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Energy management system application program interface (EMS-API) – Part 302: Common information model (CIM) dynamics

Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 302: Régimes dynamiques de modèle d'information commun (CIM)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 302: Common information model (CIM) dynamics

FOREWORD

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International Standard IEC 61970-302 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/1954/FDIS	57/1977/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61970 series, under the general title: *Energy management system application program interface (EMS-API)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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INTRODUCTION

This International Standard is one of the IEC 61970 series which defines an application program interface (API) for an energy management system (EMS).

The principal objective of the IEC 61970 series is to produce standards that facilitate the integration of EMS applications developed independently by different vendors, between entire EMSs developed independently, or between an EMS and other systems concerned with different aspects of power system operations, such as generation or distribution management systems (DMS). This is accomplished by defining application program interfaces to enable these applications or systems access to public data and exchange information independent of how such information is represented internally.

The common information model (CIM) specifies the semantics for this API. The component interface specifications (CIS), which are contained in other parts of the IEC 61970 standards, specify the content of the messages exchanged.

The CIM is an abstract model that represents all the major objects in an electric utility enterprise typically needed to model the operational aspects of a utility. This model includes public classes and attributes for these objects, as well as the relationships between them.

IEC 61970-301 defines the CIM Base set of packages which provide a logical view of the functional aspects of an energy management system.

This part of the standard, IEC 61970-302, builds on IEC 61970-301 and provides the specifications for the exchange models representing dynamic behaviour of the majority of power system components in common use today by utilities to perform system simulation studies for system dynamic assessment and for planning purposes.

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ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 302: Common information model (CIM) dynamics

1 Scope

The common information model (CIM) is an abstract model that represents all the major objects in an electric utility enterprise typically involved in utility operations. By providing a standard way of representing power system resources as object classes and attributes, along with their relationships, the CIM facilitates the integration of energy management system (EMS) applications developed independently by different vendors, between entire EMSs developed independently, or between an EMS and other systems concerned with different aspects of power system operations, such as generation or distribution management. SCADA is modelled to the extent necessary to support power system simulation and communication between control centres. The CIM facilitates integration by defining a common language (i.e. semantics) based on the CIM to enable these applications or systems to access public data and exchange information independent of how such information is represented internally.

Due to the size of the complete CIM, the object classes contained in the CIM are grouped into a number of logical packages, each of which represents a certain part of the overall power system being modelled. Collections of these packages are being developed as separate International Standards.

This particular document specifies a Dynamics package which contains extensions to the CIM to support the exchange of models between software applications that perform analysis of the steady-state stability (small-signal stability) or transient stability of a power system as defined by IEEE / CIGRE *Definition and classification of power system stability IEEE/CIGRE joint task force on stability terms and definitions*.

The model descriptions in this standard provide specifications for each type of dynamic model as well as the information that needs to be included in dynamic case exchanges between planning/study applications.

The scope of the CIM extensions specified in this standard includes:

- standard models: a simplified approach to describing dynamic models, where models representing dynamic behaviour of elements of the power system are contained in predefined libraries of classes which are interconnected in a standard manner. Only the names of the selected elements of the models along with their attributes are needed to describe dynamic behaviour.
- proprietary user-defined models: an approach providing users the ability to define the parameters of a dynamic behaviour model representing a vendor or user proprietary device where an explicit description of the model is not provided by the standard. The same libraries and standard interconnections are used for both proprietary user-defined models and standard models. The behavioural details of the model are not documented in the standard, only the model parameters.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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IEC 60050 (all parts), *International Electrotechnical Vocabulary*

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

3 Terms and definitions

For the purposes of this document, the terms and definitions contained in IEC 60050 (for general glossary), IEC 61970-2 (for EMS-API glossary definitions) and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
application program interface
API
set of public functions provided by an executable application component for use by other executable application components

3.2
common information model
CIM
abstract model that represents all the major objects in an electric utility enterprise typically contained in an EMS information model

Note 1 to entry: By providing a standard way of representing power system resources as object classes and attributes, along with their relationships, the CIM facilitates the integration of EMS applications developed independently by different vendors, between entire EMSs developed independently, or between an EMS and other systems concerned with different aspects of power system operations, such as generation or distribution management.

3.3
CIMXML
serialisation format for exchange of XML data as defined in this document

3.4
Document Object Model
DOM
platform- and language-neutral interface defined by the World Wide Web Consortium (W3C) that allows programs and scripts to dynamically access and exchange the content, structure and style of documents

3.5
document type definition
DTD
specific document for describing the vocabulary and syntax associated with an XML document

Note 1 to entry: XML Schema and RDF are other forms that can be used.

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3.6
energy management system
EMS
computer system comprising a software platform providing basic support services and a set of applications providing the functionality needed for the effective operation of electrical generation and transmission facilities so as to assure adequate security of energy supply at minimum cost

3.7
HyperText Markup Language
HTML
mark-up language used to format and present information on the Web

3.8
model
collection of data describing objects or entities real or computed, the semantics of which is defined by profiles (3.9) in the context of CIM

Note 1 to entry: In power system analysis, a model is a set of static data describing the power system. Examples of models include the static network model, the topology solution, and the network solution produced by a power flow or state estimator application.

3.9
profile
schema that defines the structure and semantics of a model that may be exchanged and is a restricted subset of the more general CIM

3.10
profile document
collection of profiles intended to be used together for a particular business purpose

3.11
Resource Description Framework
RDF
language recommended by the W3C for expressing metadata that machines can process simply

Note 1 to entry: RDF uses XML as its encoding syntax.

3.12
RDF schema
schema specification language expressed using RDF to describe resources and their properties, including how resources are related to other resources, which is used to specify an application-specific schema

3.13
real-world objects
objects that belong to the real world problem domain as distinguished from interface objects and controller objects within the implementation

Note 1 to entry: The real-world objects for the EMS domain are defined as classes in IEC 61970-301.

Note 2 to entry: Classes and objects model what is in a power system that needs to be represented in a common way to EMS applications. A class is a description of an object found in the real world, such as a PowerTransformer, GeneratingUnit, or Load that needs to be represented as part of the overall power system model in an EMS. Other types of objects include things such as schedules and measurements that EMS applications also need to process, analyze, and store. Such objects need a common representation to achieve the purposes of the EMS-API standard for plug-compatibility and interoperability. A particular object in a power system with a unique identity is modelled as an instance of the class to which it belongs.

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3.14
Standard Generalized Markup Language
SGML
international standard for the definition of device-independent, system-independent methods of representing texts in electronic form

Note 1 to entry: HTML and XML are derived from SGML.

3.15
Unified Modeling Language
UML
object-oriented modelling language and methodology for specifying, visualizing, constructing, and documenting the artefacts of a system-intensive process

3.16
uniform resource identifier
URI
standard Web syntax and semantics for identifying (referencing) resources such as files, documents, and images

3.17
eXtensible Markup Language
XML
subset of Standard Generalized Markup Language (SGML), ISO 8879, for putting structured data in a text file

Note 1 to entry: This is an endorsed recommendation from the W3C. It is license-free, platform-independent and well-supported by many readily available software tools.

3.18
eXtensible Stylesheet Language
XSL
language for expressing style sheets for XML documents

4 Document organization

Subclause 5.1 provides general information on the scope and use of CIM dynamic models.

Subclause 5.2 describes the standard interconnection of models for various types of equipment.

Subclause 5.3 contains the standard model specifications grouped by type of equipment being modelled.

Subclause 5.4 contains user-defined model classes.

Subclause 5.5 illustrates typical CIM dynamics model usage by means of instance diagrams.

Annex A describes the Dynamics package symbol representation conventions.

Annex B contains the rationale behind the use of the per unit data type.

Annex C describes the process by which updates to Dynamics standard models can be requested and provides a form for making requests.

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5 Package dynamics

5.1 General

The CIM dynamic model definitions reflect the most common IEEE or, in the case of wind models, IEC, representations of models as well as models included in some of the transient stability software widely used by utilities.

These dynamic models are intended to ensure interoperability between different vendors' software products currently in use by electric utility energy companies, utilities, Transmission System Operators (TSOs), Regional Transmission Organizations (RTOs), and Independent System Operators (ISOs). It is important to note that each vendor is free to select its own internal implementation of these models. Differences in vendor results, as long as they are within accepted engineering practice, caused by different internal representations, are acceptable.

Unless explicitly stated otherwise, the following modelling conventions are followed:

- limited integrators are of the non-windup type;
- it shall be possible to enter a time constant of zero (where it makes sense).

5.2 Package StandardInterconnections

5.2.1 General

This subclause describes the standard interconnections for various types of equipment. These interconnections are understood by the application programs and can be identified based on the presence of one of the key classes with a relationship to the static power flow model: SynchronousMachineDynamics, AsynchronousMachineDynamics, EnergyConsumerDynamics or WindTurbineType3or4Dynamics.

The relationships between classes expressed in the interconnection diagrams are intended to support dynamic behaviour described by either standard models or user-defined models.

In the interconnection diagrams, boxes which are black in colour represent function blocks whose functionality can be provided by one of many standard models or by a user-defined model. Blue boxes represent specific standard models. A dashed box means that the function block or specific standard model is optional.

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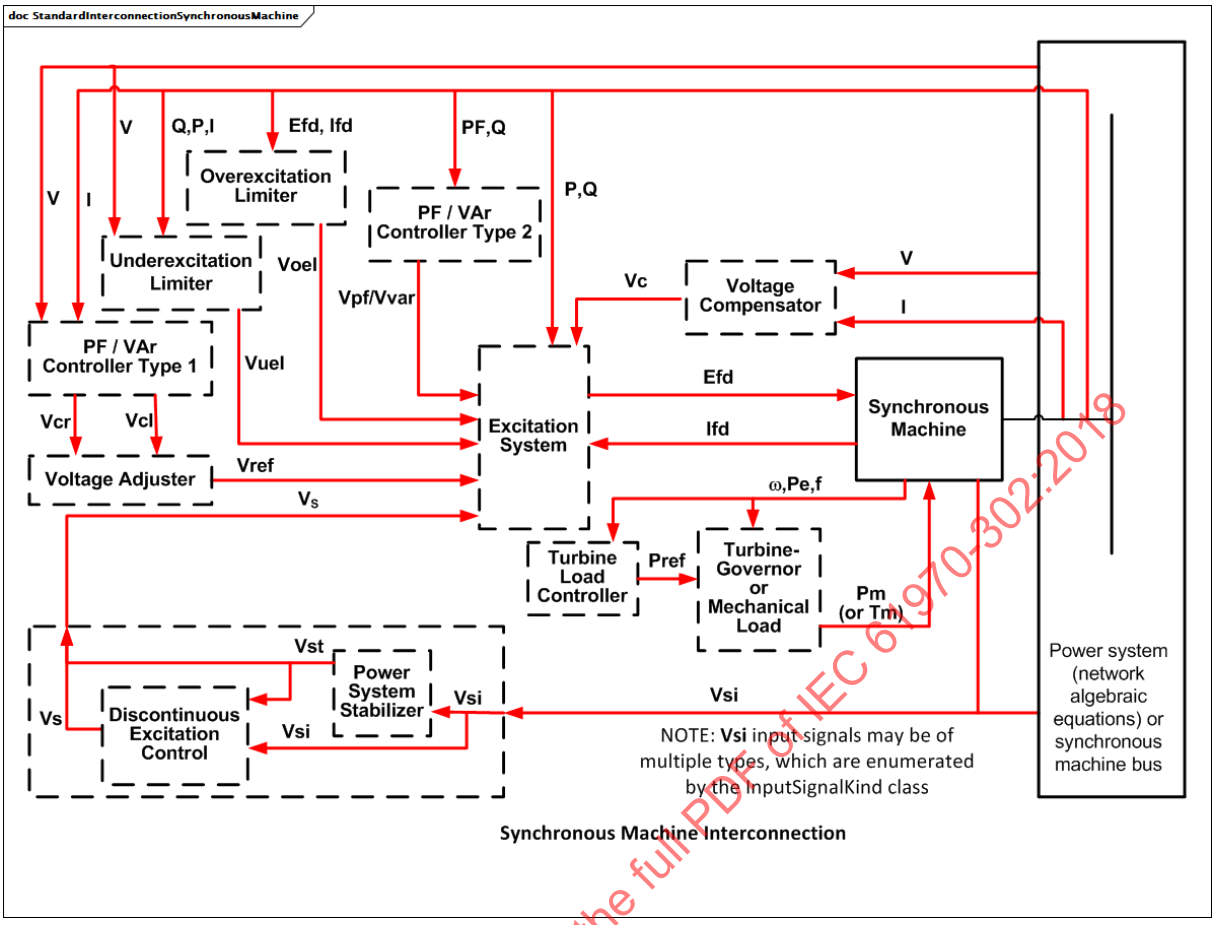

Figure 1 – StandardInterconnectionSynchronousMachine

Figure 1: A dynamic model that includes a single synchronous machine (generator, motor or condenser) and its related equipment models (function blocks) is associated with a synchronous machine in the static (power flow) model and has the standard interconnection shown above.

The interface between the dynamic synchronous machine and the network algebraic equations is application dependent. The variables used for this interface do not need to be identified since they are internal to the application program, well-defined and not necessary to be exchanged between applications.

The interfaces between different blocks in the above figure are indicative of the variety of input and output signals that are defined by the individual standard models. The figure provides information on most of the alternative interfaces, for instance, the turbine-governor (for generators) or the mechanical load (for motors) and the dynamic synchronous machine can be mechanical torque (Tm) or mechanical power (Pm).

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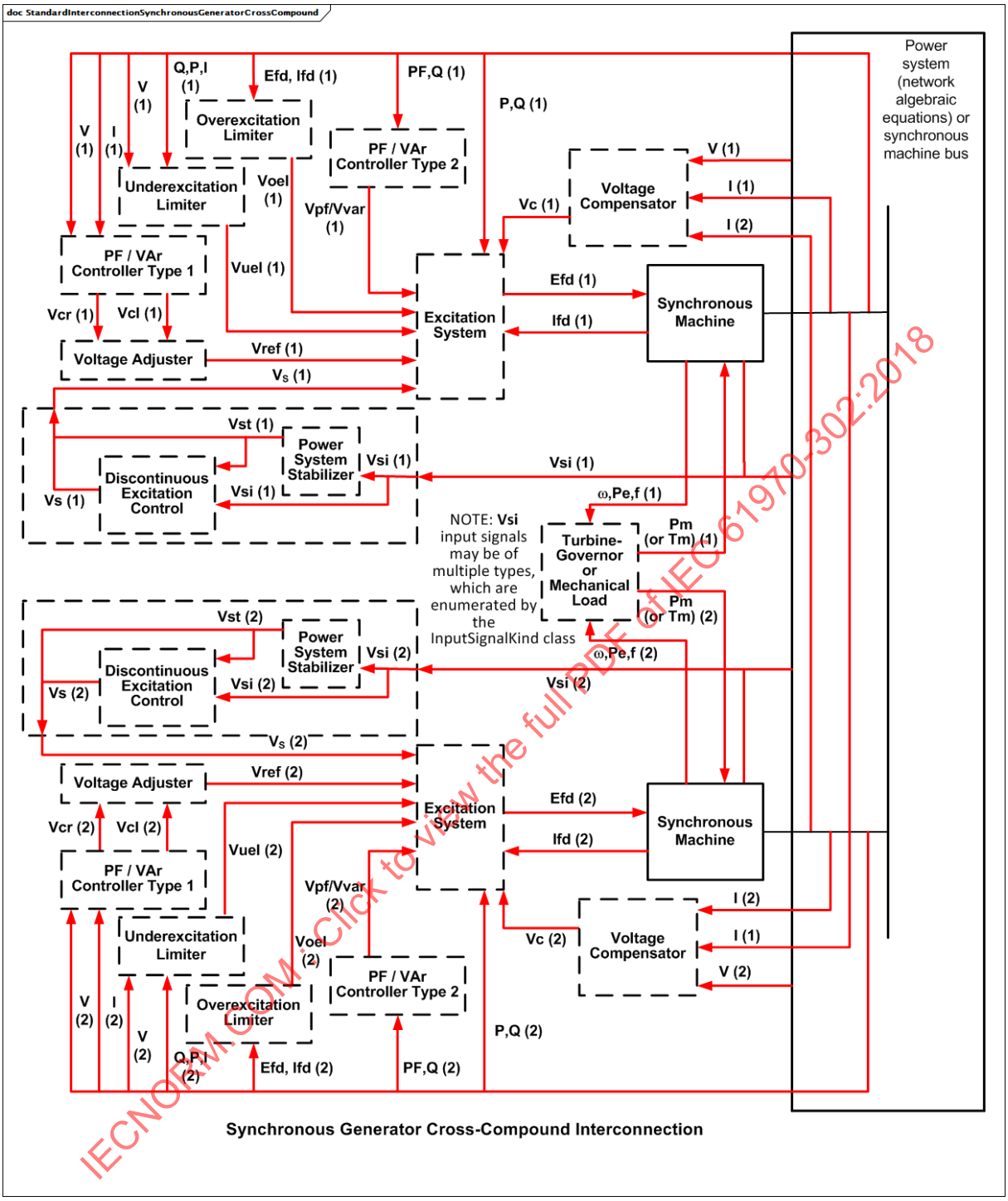

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Figure 2 – StandardInterconnectionSynchronousGeneratorCrossCompound

Figure 2: A cross-compound dynamic model that includes multiple synchronous generators and their related equipment models (function blocks), is associated with multiple synchronous machines in the static (power flow) model and has the standard interconnection shown above.

Generator 2 is the second unit of a cross-compound pair of generators and is usually connected to the same terminal bus. A single turbine-governor model determines the mechanical power for both units.

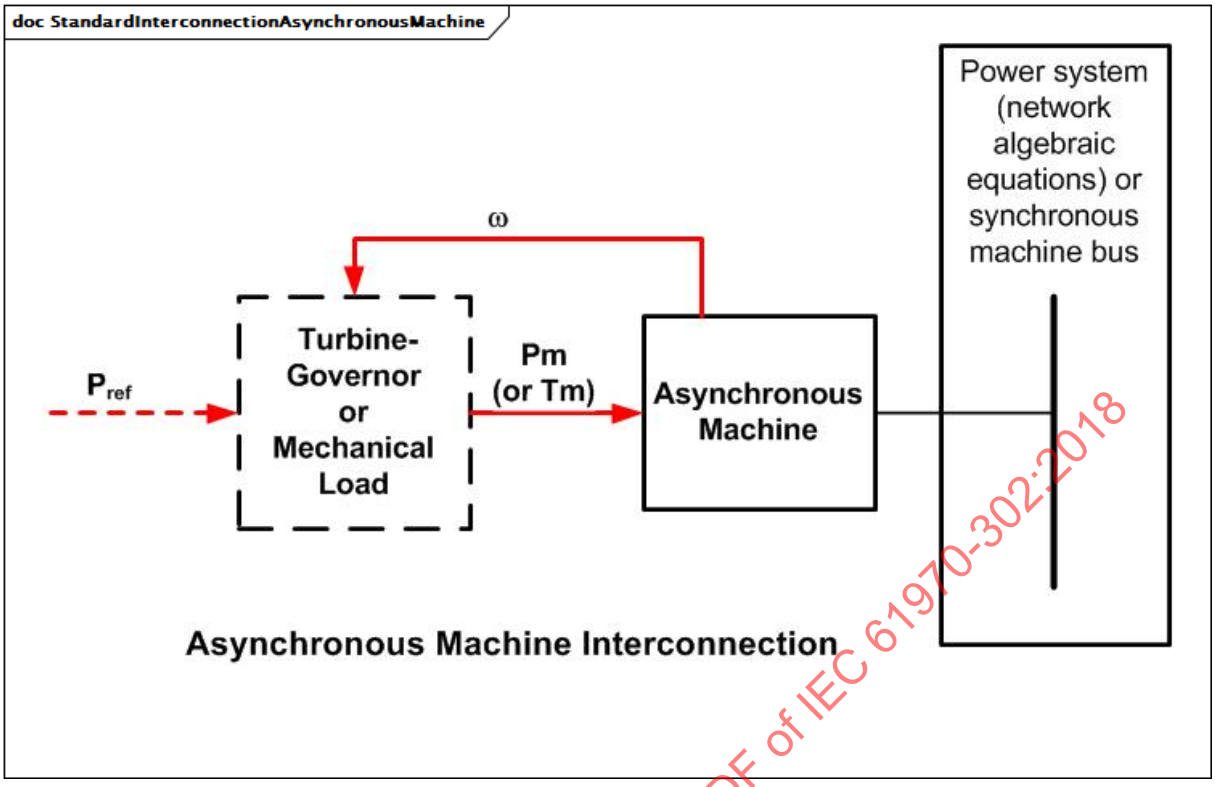

Figure 3 – StandardInterconnectionAsynchronousMachine

Figure 3: A dynamic model including an asynchronous machine (either a generator or motor) and its related equipment models (function blocks) is associated with an asynchronous machine in the static (power flow) model and has the standard interconnection shown above.

This interconnection is for a “squirrel-cage” induction machine or a wound-rotor induction machine with short-circuited field windings. Other models and a different interconnection are required for a wound-rotor machine with external connections to the field windings.

The interface between the dynamic asynchronous machine and the network algebraic equations is application-dependent.

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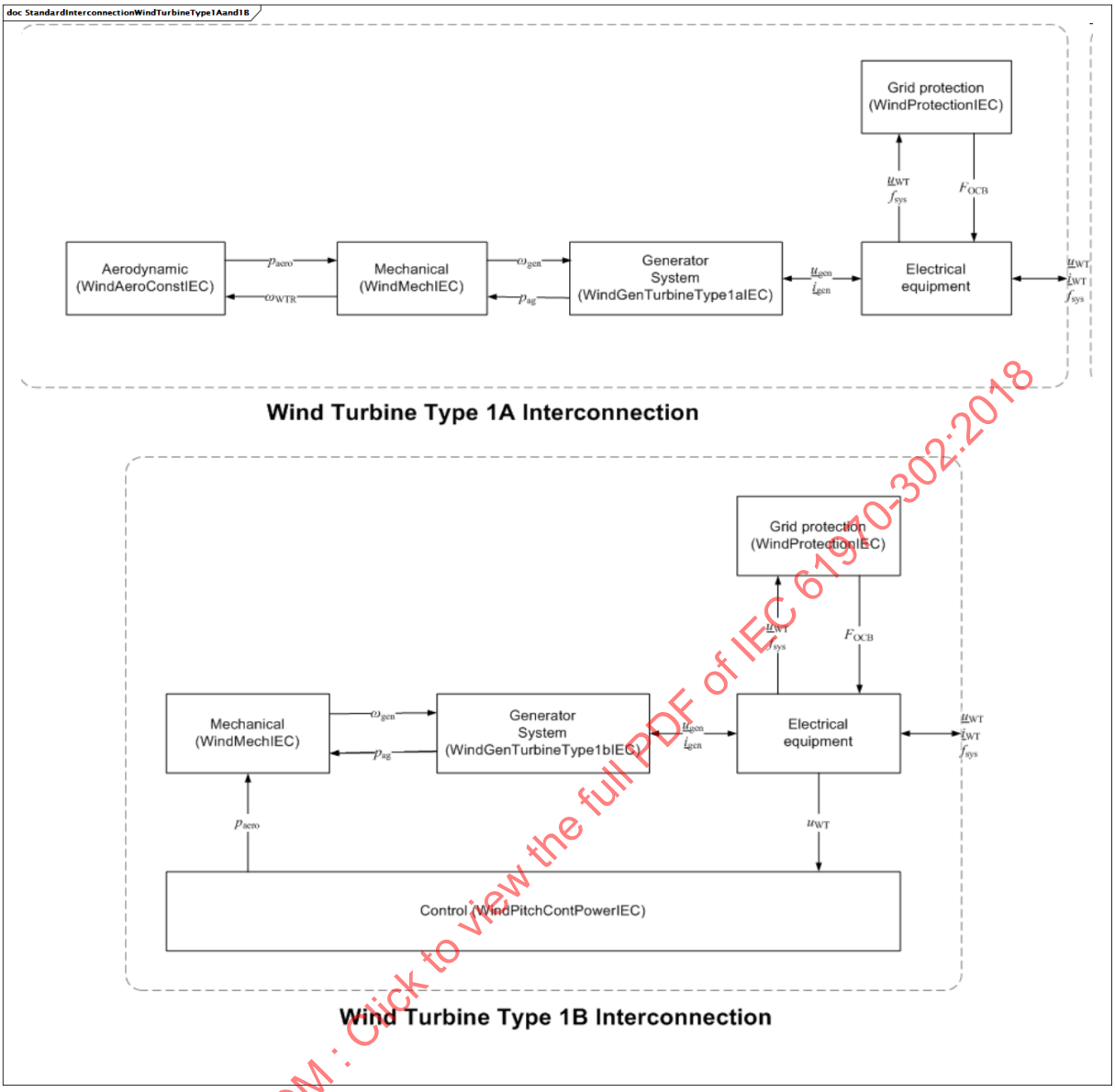

Figure 4 – StandardInterconnectionWindTurbineType1Aand1B

Figure 4: A dynamic model representing a type 1 wind turbine model uses asynchronous generators directly connected to the grid, i.e. without power converters. Most type 1 wind turbines have a soft-starter, but this is only active during start-up. There are two type 1 models:

- type 1A: wind turbines with fixed pitch angle;
- type 1B: wind turbines with under voltage ride-through pitch angle control.

The two standard interconnections are shown in the figure.

Reference: IEC 61400-27-1:2015, 5.5.2.

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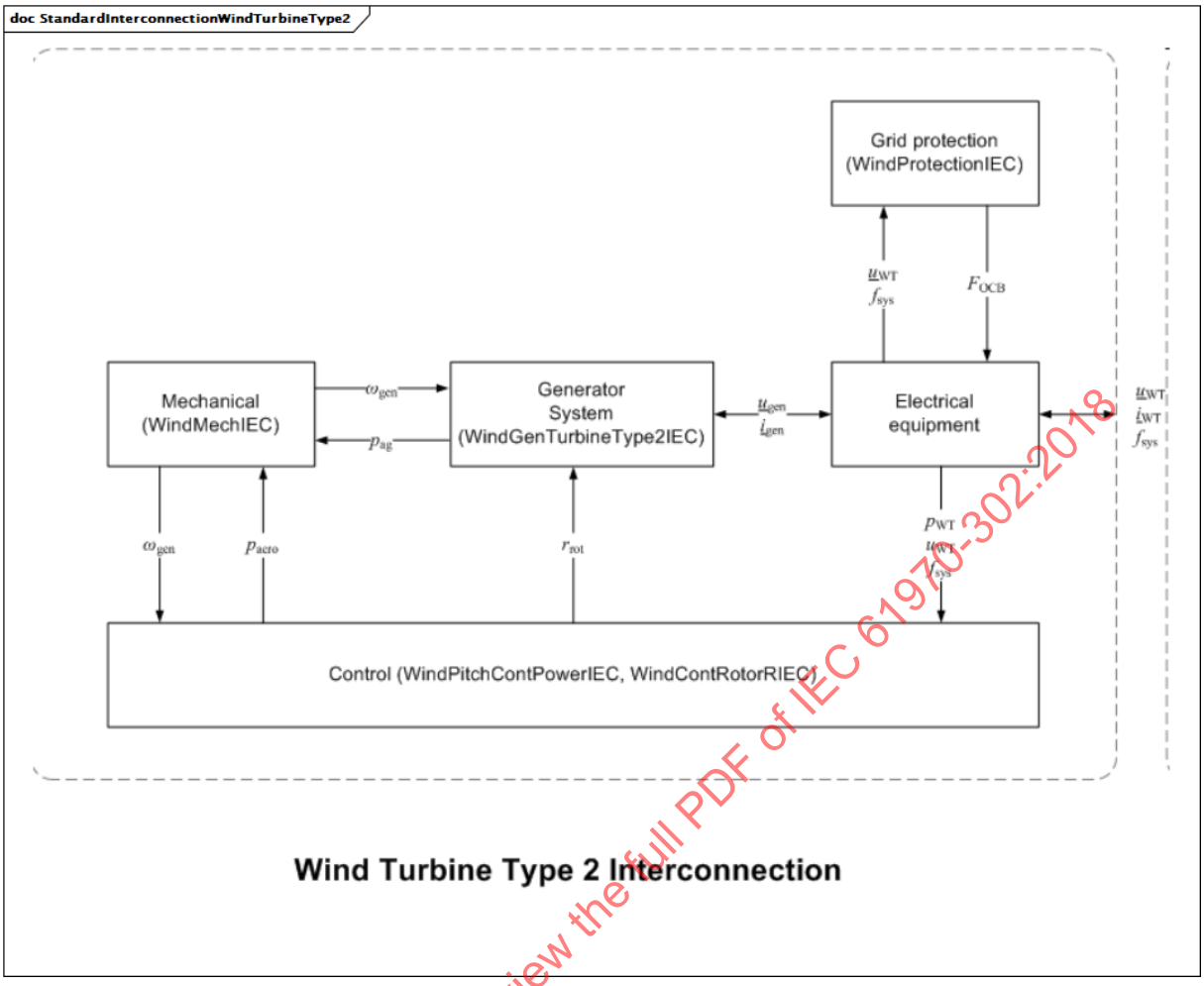

Figure 5 – StandardInterconnectionWindTurbineType2

Figure 5: A dynamic model representing a type 2 wind generator and its related standard equipment models is associated with an asynchronous machine in the static (power flow) model and has the standard interconnection shown in the figure.

The type 2 turbine is equipped with a variable rotor resistance (VRR) and therefore uses a variable rotor resistance asynchronous generator (VRRAG). Type 2 wind turbines are also normally equipped with blade angle control.

Reference: IEC 61400-27-1:2015, 5.5.3.

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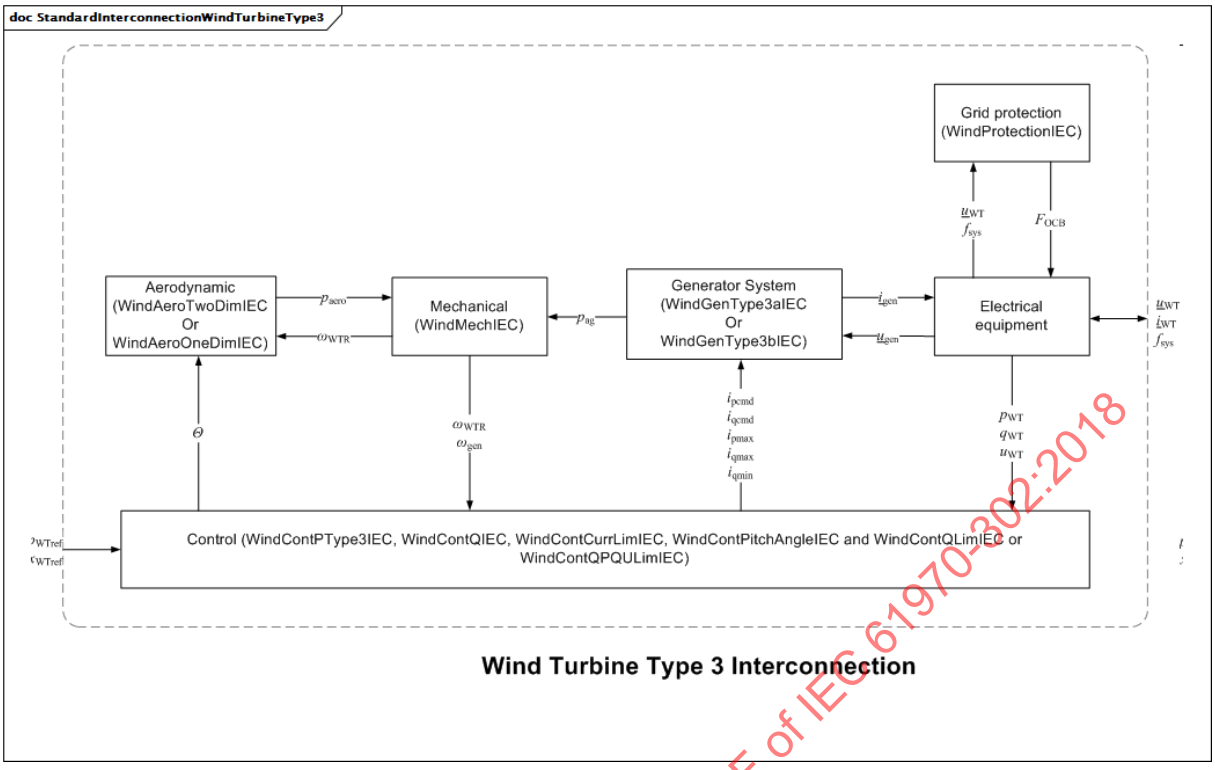

Figure 6 – StandardInterconnectionWindTurbineType3

Figure 6: A dynamic model representing a type 3 wind turbine which uses a doubly fed asynchronous generator (DFAG), where the stator is directly connected to the grid and the rotor is connected through a back-to-back power converter. It has the standard interconnection shown in the figure.

Reference: IEC 61400-27-1:2015, 5.5.4.

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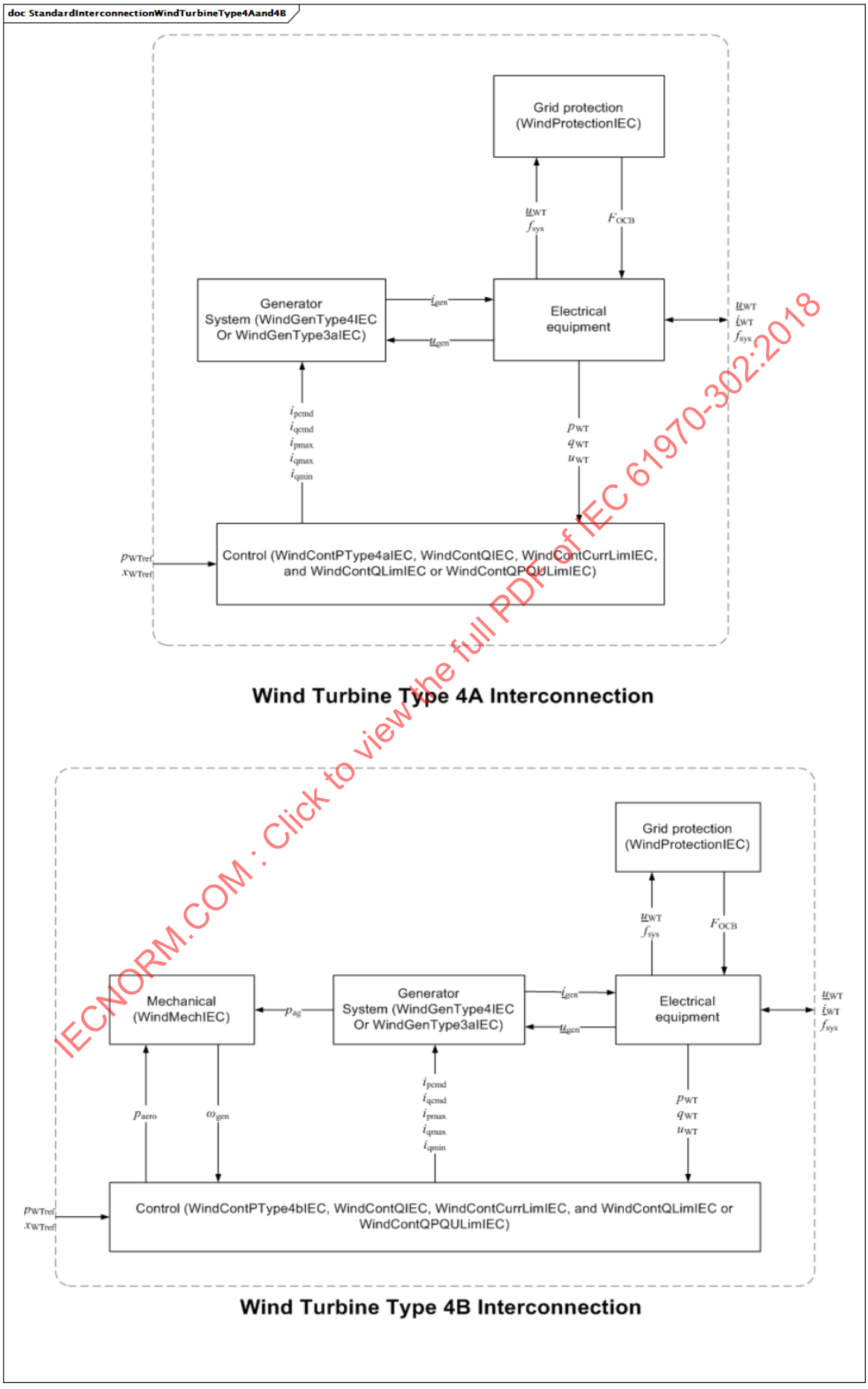

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Figure 7 – StandardInterconnectionWindTurbineType4Aand4B

Figure 7: A dynamic model representing a type 4 wind turbine which uses either synchronous generators (SG) or asynchronous generators (AG). Some type 4 wind turbines use direct drive synchronous generators, and therefore have no gearbox.

There are two type 4 models as follows:

- type 4A: a model neglecting the aerodynamic and mechanical parts and thus not simulating any power oscillations;
- type 4B: a model including a 2-mass mechanical model to replicate the power oscillations but assuming constant aerodynamic torque.

The standard interconnections for the two models are shown in the figure.

Reference: IEC 61400-27-1:2015, 5.5.5.

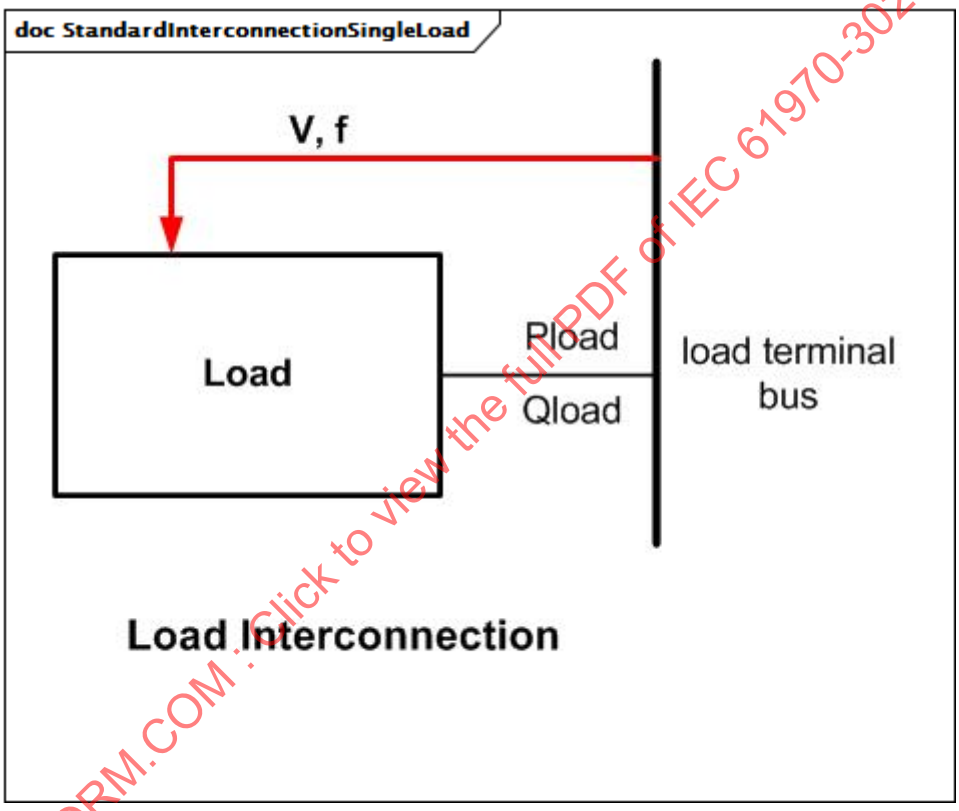

Figure 8 – StandardInterconnectionSingleLoad

Figure 8: A load model is associated with an energy consumer in the power flow data and has no standard interconnection with other models.

The P and Q consumption of the load are determined as a function of the magnitude and frequency of the voltage at the terminal bus as shown above.

The interface between the model and the network algebraic equations is application-dependent. Dynamic (motor) load models generally interface with the network equations in a similar manner to motor models.

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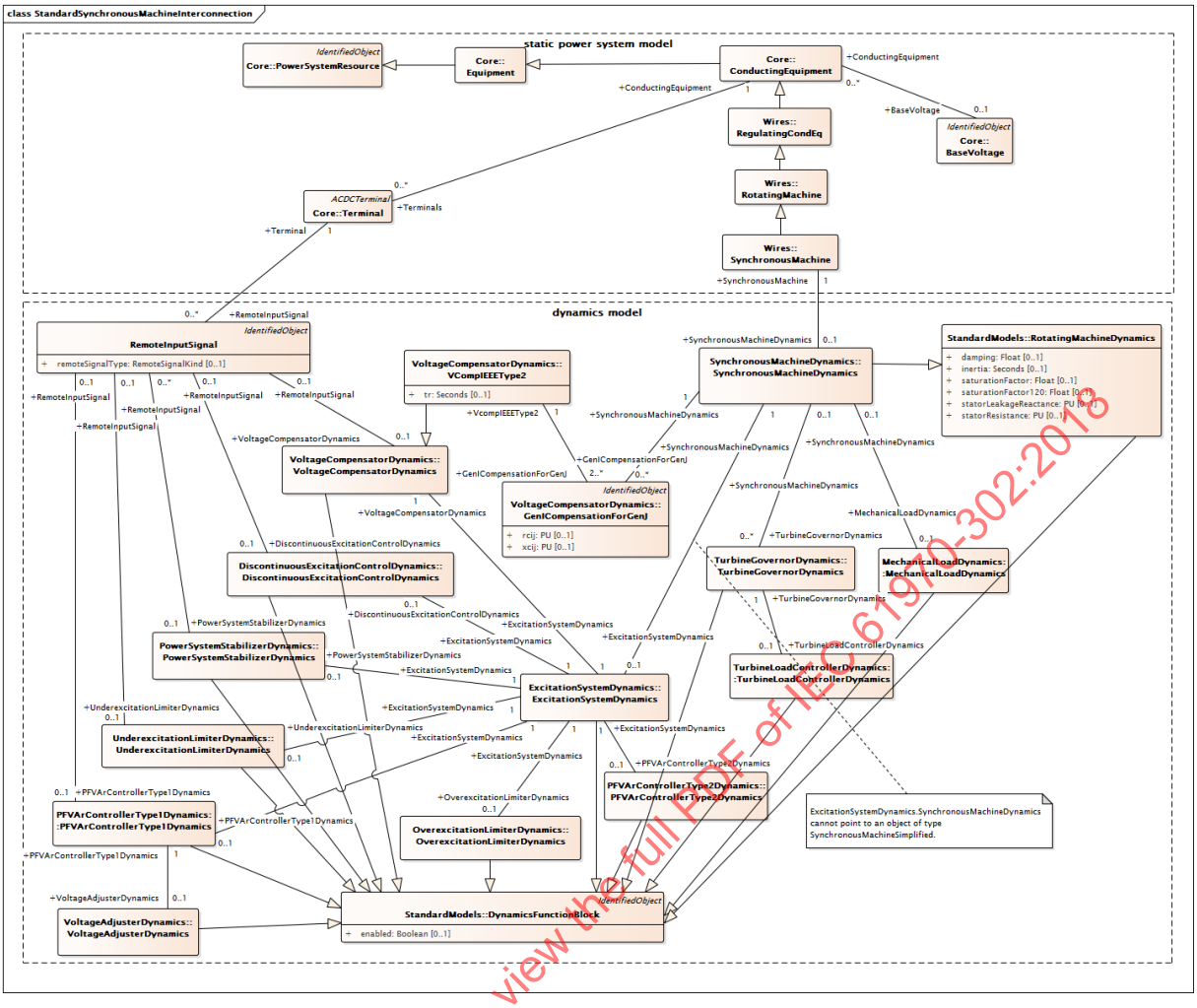

Figure 9 – Class diagram
StandardInterconnections::StandardSynchronousMachineInterconnection

Figure 9: This diagram shows the classes necessary for both of the two types of synchronous machine interconnection models: standard synchronous machine and standard synchronous generator cross-compound.

A standard synchronous machine interconnection has a single instance of a SynchronousMachineDynamics child class whereas a generator cross-compound connection has multiple instances of SynchronousMachineDynamics child classes related by a single instance of a TurbineGovernorDynamics child class.

A valid standard synchronous machine interconnection model reflects the following rules.

- It can have:
  - one instance of TurbineGovernorDynamics child class, but only if SynchronousMachine.operatingMode = generator;
  - one instance of MechanicalLoadDynamics child class, but only if SynchronousMachine.operatingMode = motor or SynchronousMachine.operatingMode = condenser.
- It cannot have any instance of GenICompensationForGenJ.

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A generator cross-compound interconnection model reflects the following rules.

- It can have:
  - + multiple instances of SynchronousMachineDynamics child classes, each of which has its related SynchronousMachine.operatingMode = generator;
  - + one instance of TurbineGovernorDynamics child class.
- It shall have two or more instances of GenICompensationForGenJ associated with each instance of a SynchronousMachineDynamics child class.

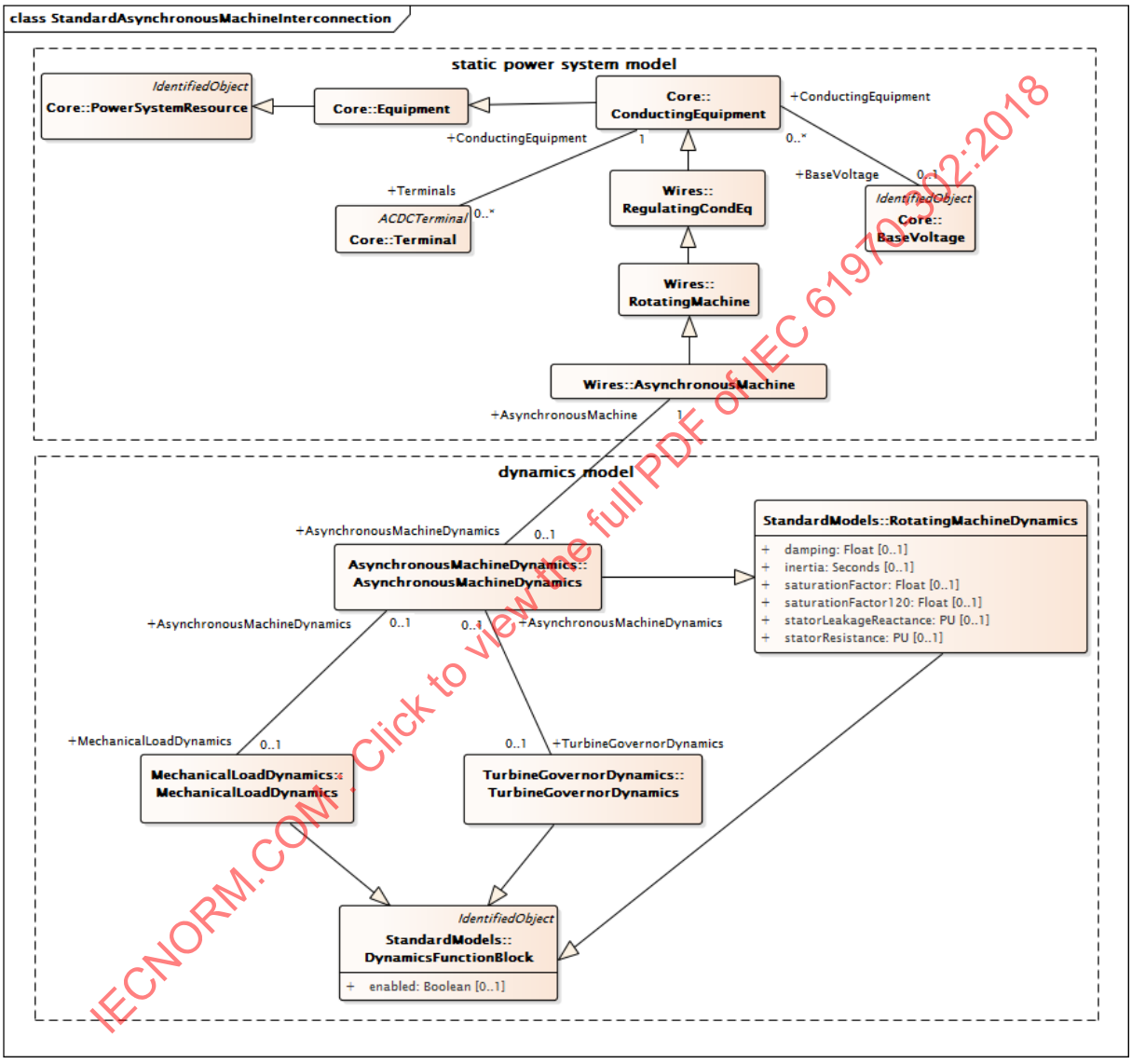

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Figure 10 – Class diagram StandardInterconnections::StandardAsynchronousMachineInterconnection

Figure 10: This diagram shows the classes necessary for the asynchronous machine interconnection model.

A standard asynchronous machine interconnection has a single instance of an AsynchronousMachineDynamics child class.

A valid standard asynchronous machine interconnection model also reflects the following rules. It can have:

- one instance of TurbineGovernorDynamics child class, but only if AsynchronousMachine.asynchronousMachineType = generator;
- one instance of MechanicalLoadDynamics child class, but only if AsynchronousMachine.asynchronousMachineType = motor.

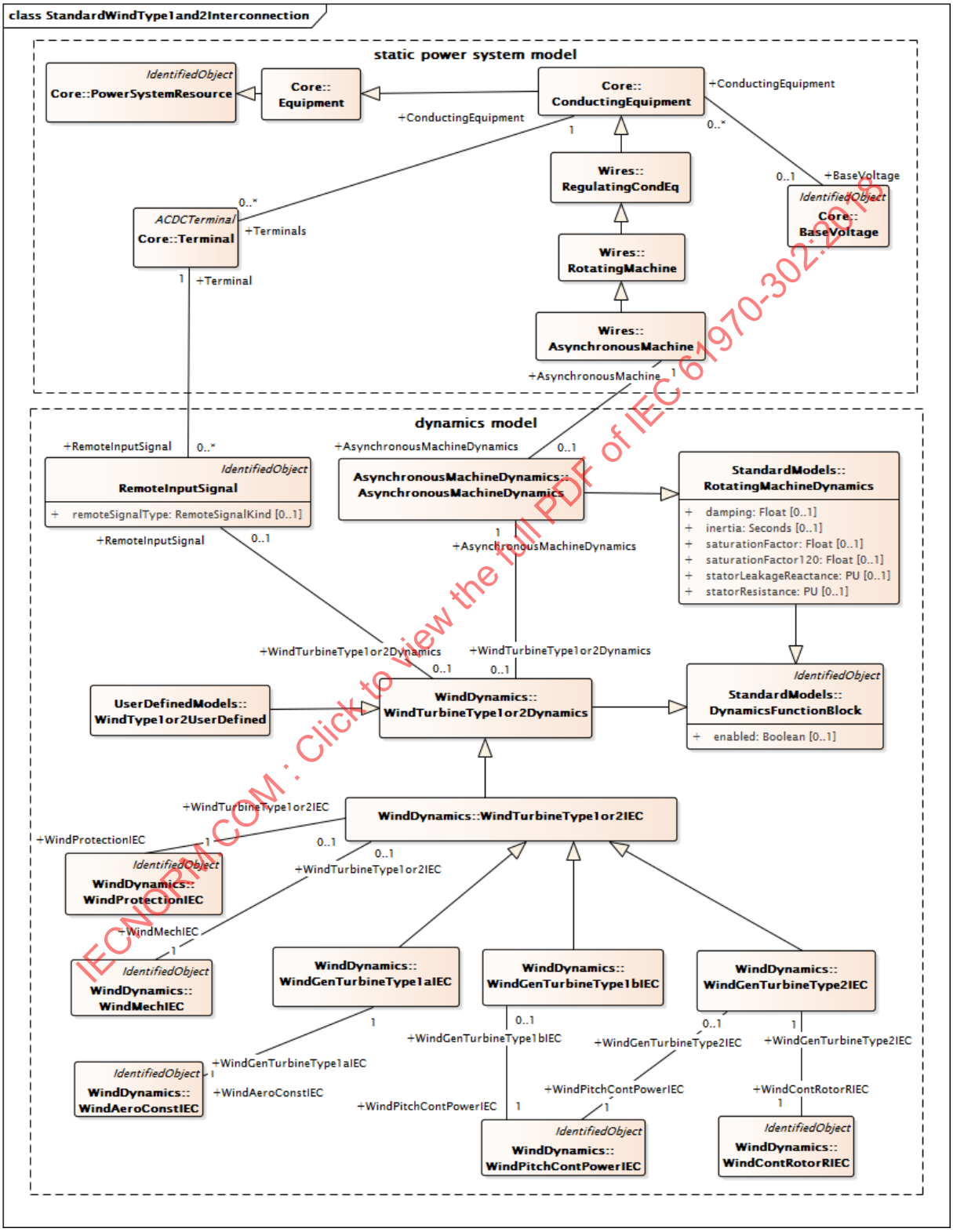

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Figure 11 – Class diagram StandardInterconnections::StandardWindType1and2Interconnection

Figure 11: This diagram shows the classes necessary for wind type 1 and type 2 interconnection models.

Standard IEC wind turbines type 1 and 2 interconnection models all have a single instance of an AsynchronousMachineDynamics child class and a single instance of the WindGenTurbineType1aIEC class, the WindGenTurbineType1bIEC class, or the WindGenTurbineType2IEC class as appropriate.

A valid IEC wind type 1A interconnection model also shall have one instance of each of the following classes (and no others):

- WindMechIEC;
- WindAeroConstIEC;
- WindProtectionIEC.

A valid IEC wind type 1B interconnection model also shall have one instance of each of the following classes (and no others):

- WindMechIEC;
- WindProtectionIEC;
- WindPitchContPowerIEC.

A valid IEC wind type 2 interconnection model also shall have one instance of each of the following classes (and no others):

- WindMechIEC;
- WindContRotorRIEC;
- WindProtectionIEC;
- WindPitchContPowerIEC.

The WindProtectionIEC class and the WindContRotorRIEC class use the WindDynamicsLookupTable class.

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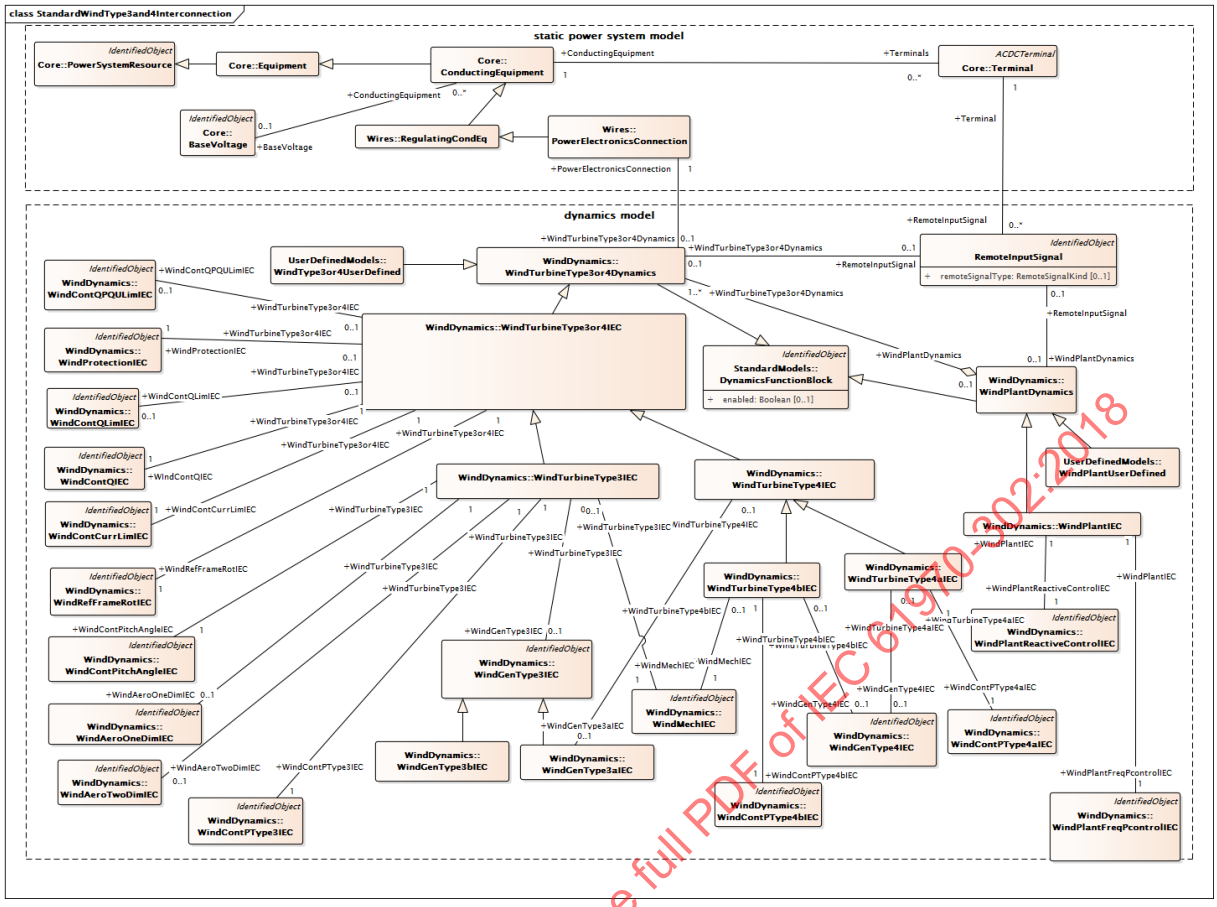

Figure 12 – Class diagram StandardInterconnections::StandardWindType3and4Interconnection

Figure 12: This diagram shows the classes necessary for wind type 3 and type 4 interconnection models, including the wind plant model.

Standard IEC wind types 3, 4A, 4B and plant interconnection models all have a single instances as follows:

IEC wind type 3:

- WindTurbineType3IEC;
- WindAeroOneDimIEC or WindAeroTwoDimIEC;
- WindMechIEC;
- WindGenType3aIEC or WindGenType3bIEC;
- WindContPType3IEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC or WindContQPQULimIEC;
- WindContPitchAngleIEC;
- WindProtectionIEC.

IEC wind type 4A:

- WindTurbineType4aIEC;
- WindGenType4IEC or WindGenType3aIEC;

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- WindContPType4aIEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC or WindContQPQULimIEC;
- WindProtectionIEC.

IEC wind type 4B:

- WindTurbineType4bIEC;
- WindMechIEC;
- WindGenType4IEC or WindGenType3aIEC;
- WindContPType4bIEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC or WindContQPQULimIEC;
- WindProtectionIEC.

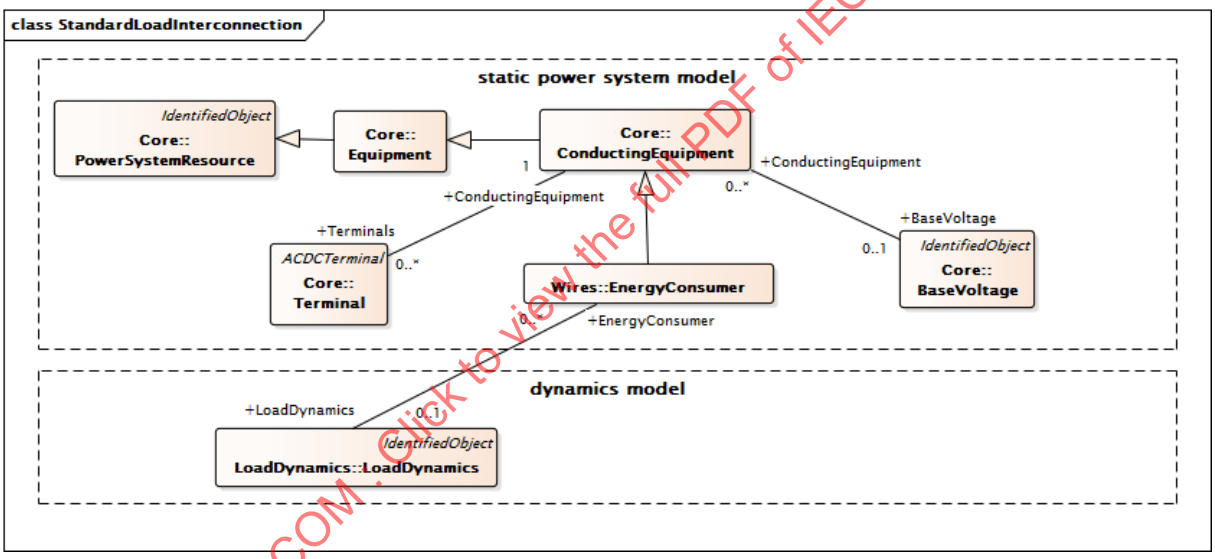

Figure 13 – Class diagram StandardInterconnections::StandardLoadInterconnection

Figure 13: This diagram shows the classes necessary for a load interconnection model.

A standard load interconnection model has a single instance of an EnergyConsumerDynamics child class plus a related instance of a LoadDynamics child class.

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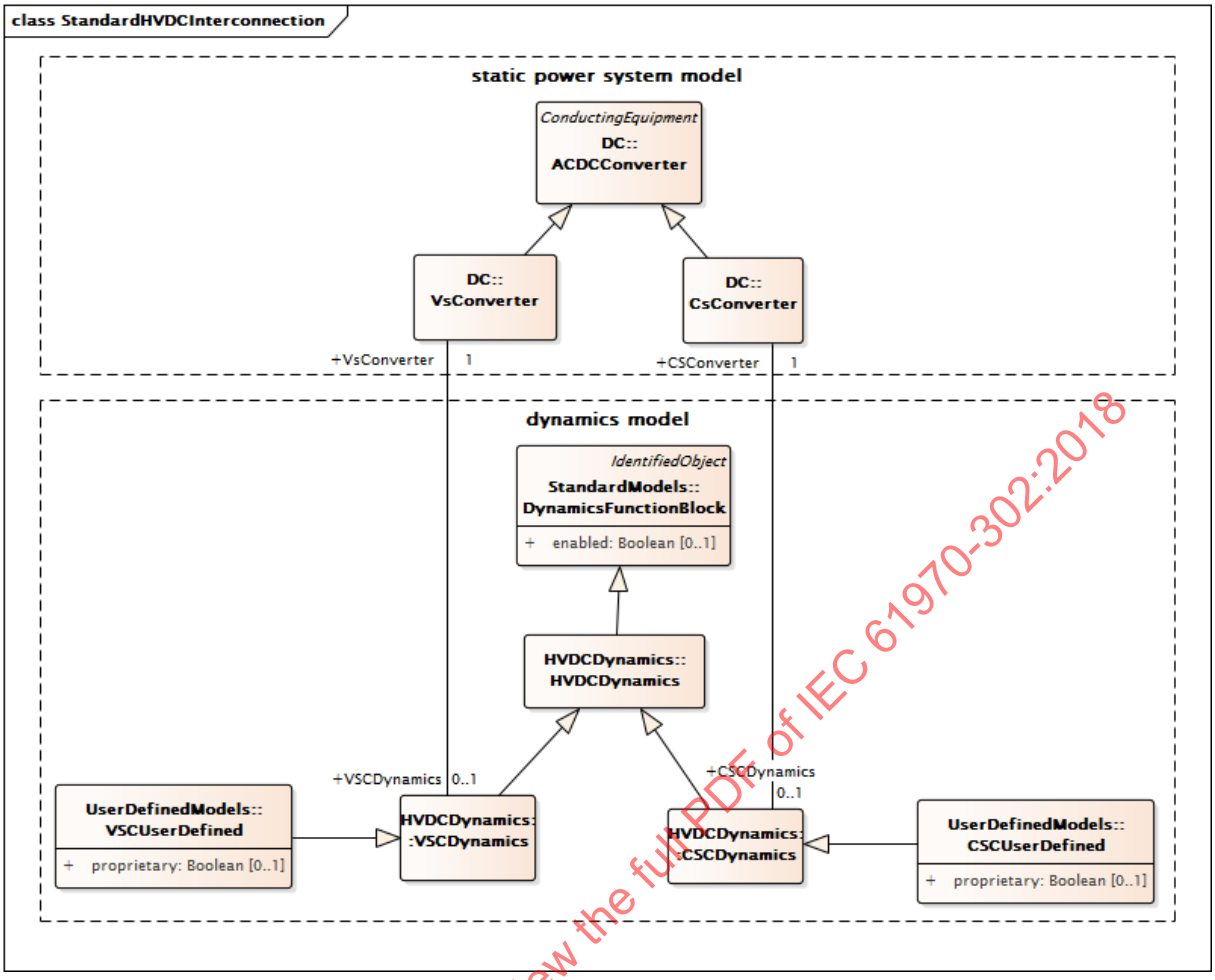

Figure 14 – Class diagram StandardInterconnections::StandardHVDCInterconnection

Figure 14: This diagram shows the classes necessary for a HVDC interconnection model.

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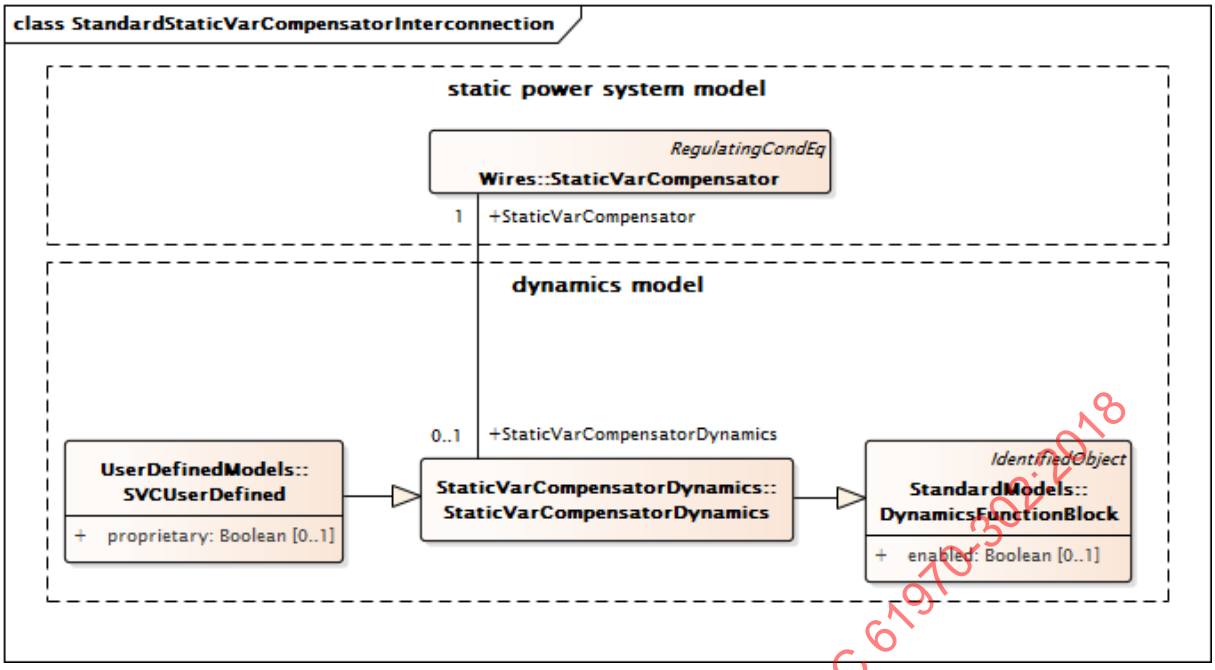

Figure 15 – Class diagram StandardInterconnections::StandardStaticVarCompensatorInterconnection

Figure 15: This diagram shows the classes necessary for a static var compensator (SVC) interconnection model.

5.2.2 RemoteInputSignal

Supports connection to a terminal associated with a remote bus from which an input signal of a specific type is coming.

Table 1 shows all attributes of RemoteInputSignal.

Table 1 – Attributes of StandardInterconnections::RemoteInputSignal

name	mult	type	description
remoteSignalType	0..1	RemoteSignalKind	Type of input signal.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 2 shows all association ends of RemoteInputSignal with other classes.

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Table 2 – Association ends of StandardInterconnections::RemoteInputSignal with other classes

mult from	name	mult to	type	description
0..*	Terminal	1..1	Terminal	Remote terminal with which this input signal is associated.
0..1	VoltageCompensatorDynamics	0..1	VoltageCompensatorDynamics	Voltage compensator model using this remote input signal.
0..1	WindPlantDynamics	0..1	WindPlantDynamics	The wind plant using the remote signal.
0..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	Underexcitation limiter model using this remote input signal.
0..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	Discontinuous excitation control model using this remote input signal.
0..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	Wind generator type 1 or type 2 model using this remote input signal.
0..1	WindTurbineType3or4Dynamics	0..1	WindTurbineType3or4Dynamics	Wind turbine type 3 or type 4 models using this remote input signal.
0..*	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	Power system stabilizer model using this remote input signal.
0..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	Power factor or VAr controller type 1 model using this remote input signal.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.2.3 RemoteSignalKind enumeration

Type of input signal coming from remote bus.

Table 3 shows all literals of RemoteSignalKind.

Table 3 – Literals of StandardInterconnections::RemoteSignalKind

literal	value	description
remoteBusVoltageFrequency		Input is voltage frequency from remote terminal bus.
remoteBusVoltageFrequencyDeviation		Input is voltage frequency deviation from remote terminal bus.
remoteBusFrequency		Input is frequency from remote terminal bus.
remoteBusFrequencyDeviation		Input is frequency deviation from remote terminal bus.
remoteBusVoltageAmplitude		Input is voltage amplitude from remote terminal bus.
remoteBusVoltage		Input is voltage from remote terminal bus.
remoteBranchCurrentAmplitude		Input is branch current amplitude from remote terminal bus.
remoteBusVoltageAmplitudeDerivative		Input is branch current amplitude derivative from remote terminal bus.
remotePuBusVoltageDerivative		Input is PU voltage derivative from remote terminal bus.

5.3 Package StandardModels

5.3.1 General

This subclause contains standard dynamic model specifications grouped into packages by standard function block (type of equipment being modelled).

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In the CIM, standard dynamic models are expressed by means of a class named with the standard model name and attributes reflecting each of the parameters necessary to describe the behaviour of an instance of the standard model.

5.3.2 DynamicsFunctionBlock

Abstract parent class for all Dynamics function blocks.

Table 4 shows all attributes of DynamicsFunctionBlock.

Table 4 – Attributes of StandardModels::DynamicsFunctionBlock

name	mult	type	description
enabled	0..1	Boolean	Function block used indicator. true = use of function block is enabled false = use of function block is disabled.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 5 shows all association ends of DynamicsFunctionBlock with other classes.

Table 5 – Association ends of StandardModels::DynamicsFunctionBlock with other classes

mult from	name	mult to	type	description
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.3 RotatingMachineDynamics

Abstract parent class for all synchronous and asynchronous machine standard models.

Table 6 shows all attributes of RotatingMachineDynamics.

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Table 6 – Attributes of StandardModels::RotatingMachineDynamics

name	mult	type	description
damping	0..1	Float	Damping torque coefficient (D) (>= 0). A proportionality constant that, when multiplied by the angular velocity of the rotor poles with respect to the magnetic field (frequency), results in the damping torque. This value is often zero when the sources of damping torques (generator damper windings, load damping effects, etc.) are modelled in detail. Typical value = 0.
inertia	0..1	Seconds	Inertia constant of generator or motor and mechanical load (H) (> 0). This is the specification for the stored energy in the rotating mass when operating at rated speed. For a generator, this includes the generator plus all other elements (turbine, exciter) on the same shaft and has units of MW x s. For a motor, it includes the motor plus its mechanical load. Conventional units are PU on the generator MVA base, usually expressed as MW x s / MVA or just s. This value is used in the accelerating power reference frame for operator training simulator solutions. Typical value = 3.
saturationFactor	0..1	Float	Saturation factor at rated terminal voltage (S1) (>= 0). Not used by simplified model. Defined by defined by S(E1) in the SynchronousMachineSaturationParameters diagram. Typical value = 0,02.
saturationFactor120	0..1	Float	Saturation factor at 120% of rated terminal voltage (S12) (>= RotatingMachineDynamics.saturationFactor). Not used by the simplified model, defined by S(E2) in the SynchronousMachineSaturationParameters diagram. Typical value = 0,12.
statorLeakageReactance	0..1	PU	Stator leakage reactance (Xl) (>= 0). Typical value = 0,15.
statorResistance	0..1	PU	Stator (armature) resistance (Rs) (>= 0). Typical value = 0,005.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 7 shows all association ends of RotatingMachineDynamics with other classes.

Table 7 – Association ends of StandardModels::RotatingMachineDynamics with other classes

mult from	name	mult to	type	description
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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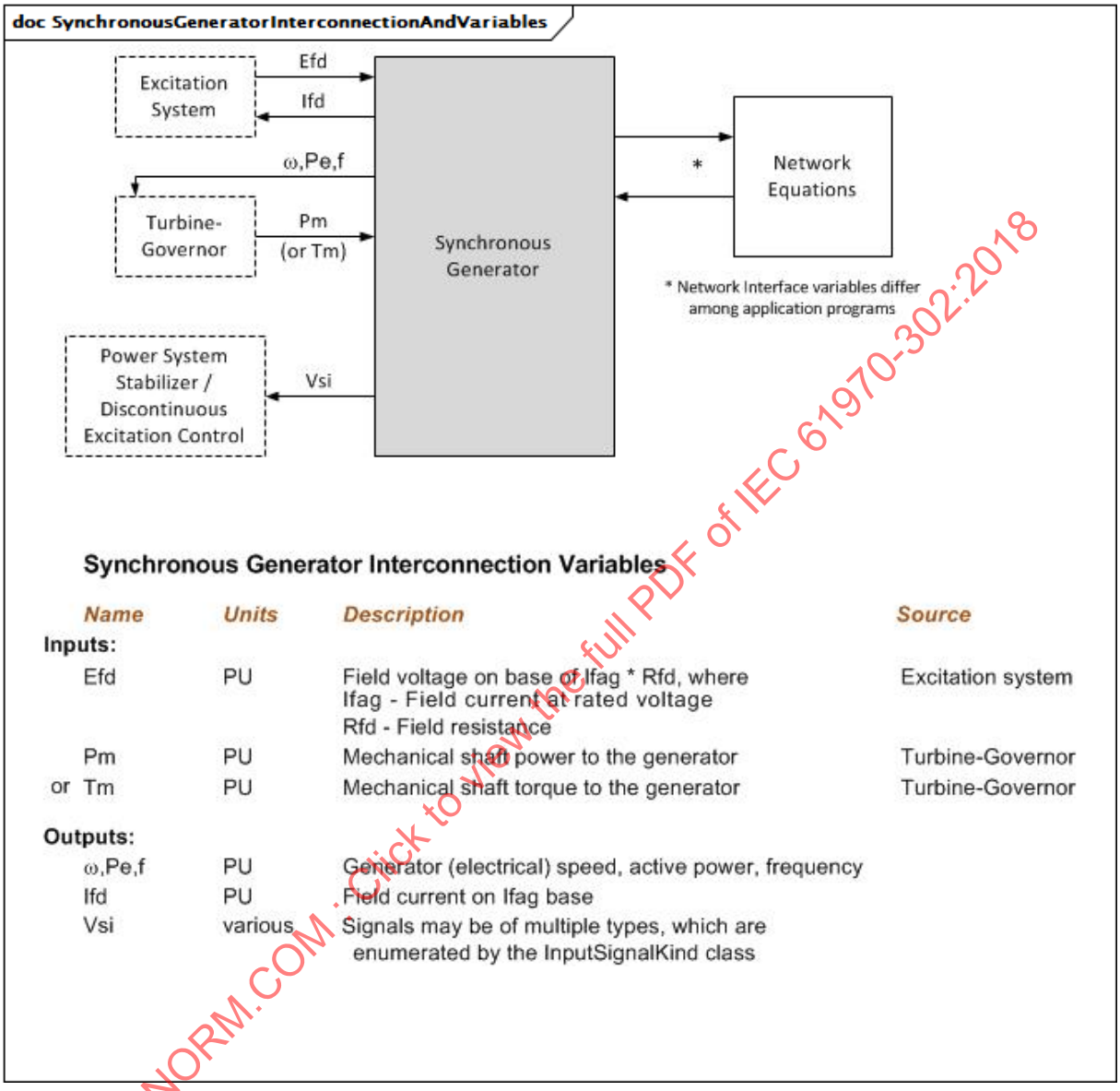
5.3.4 Package SynchronousMachineDynamics

5.3.4.1 General

For conventional power generating units (e.g., thermal, hydro, combustion turbine), a synchronous machine model represents the electrical characteristics of the generator and the mechanical characteristics of the turbine-generator rotational inertia. Large industrial motors or groups of similar motors can be represented by individual motor models which are represented as generators with negative active power in the static (power flow) data.

The interconnection with the electrical network equations can differ among simulation tools. The tool only needs to know the synchronous machine to establish the correct interconnection. The interconnection with the motor's equipment could also differ due to input and output signals required by standard models.



Synchronous Generator Interconnection Variables

	Name	*Units*	*Description*	*Source*
Inputs:				
	Efd	PU	Field voltage on base of Ifag * Rfd, where Ifag - Field current at rated voltage Rfd - Field resistance	Excitation system
	Pm	PU	Mechanical shaft power to the generator	Turbine-Governor
or	Tm	PU	Mechanical shaft torque to the generator	Turbine-Governor
Outputs:				
	ω,Pe,f	PU	Generator (electrical) speed, active power, frequency	
	Ifd	PU	Field current on Ifag base	
	Vsi	various	Signals may be of multiple types, which are enumerated by the InputSignalKind class	

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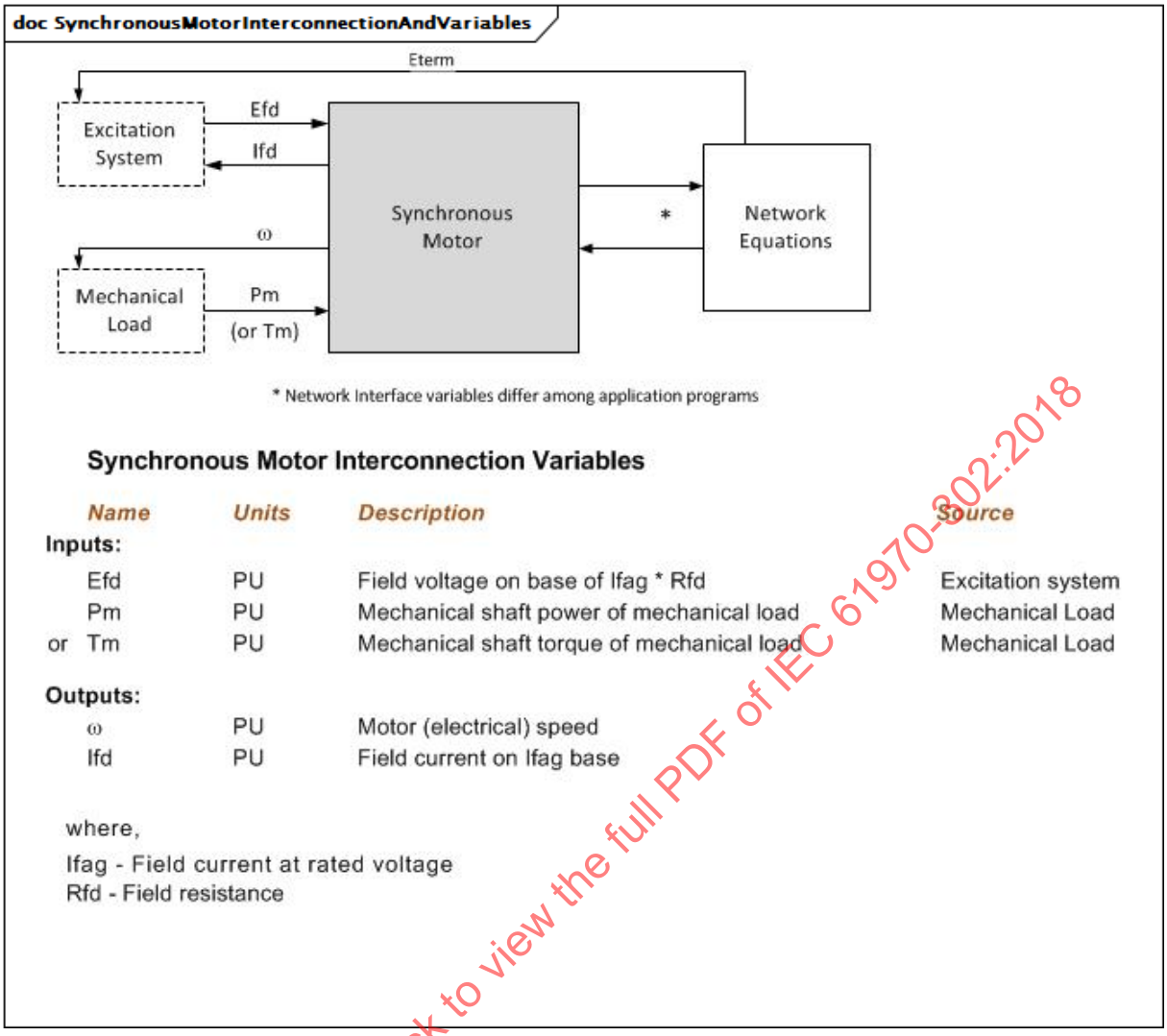
Figure 16 – SynchronousGeneratorInterconnectionAndVariables

Figure 16: This diagram illustrates the inputs and outputs for a synchronous generator.



Synchronous Motor Interconnection Variables

	Name	Units	Description	Source
Inputs:				
	Efd	PU	Field voltage on base of Ifag * Rfd	Excitation system
	Pm	PU	Mechanical shaft power of mechanical load	Mechanical Load
or	Tm	PU	Mechanical shaft torque of mechanical load	Mechanical Load
Outputs:				
	ω	PU	Motor (electrical) speed	
	Ifd	PU	Field current on Ifag base	

where,

Ifag - Field current at rated voltage
Rfd - Field resistance

Figure 17 – SynchronousMotorInterconnectionAndVariables

Figure 17: This diagram illustrates the inputs and outputs for a synchronous motor.

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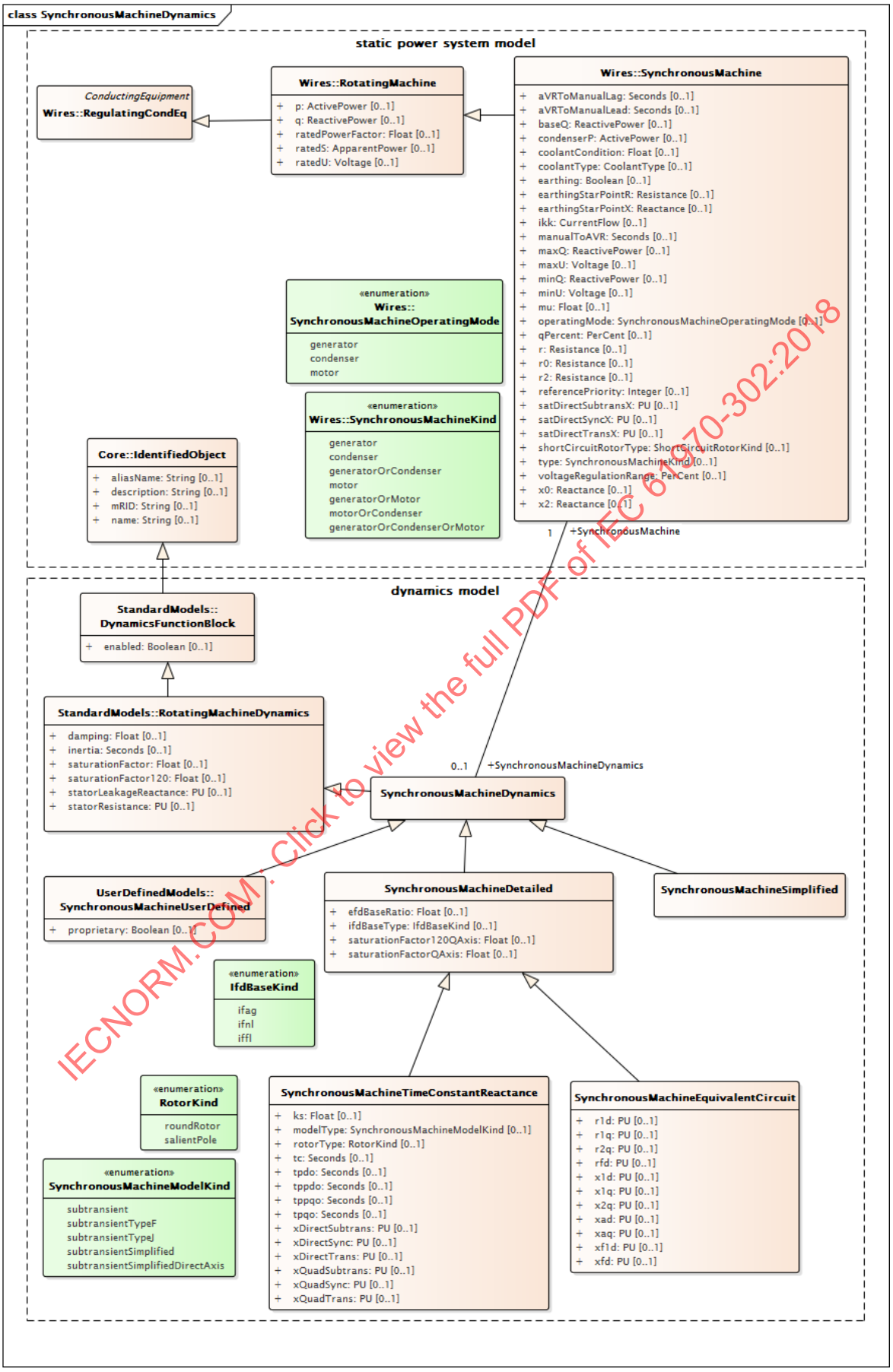

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Figure 18 – Class diagram
SynchronousMachineDynamics::SynchronousMachineDynamics

Figure 18: This diagram shows static power system model classes and dynamics model classes related to the synchronous machine dynamics model. An association between the SynchronousMachineDynamics class and the SynchronousMachine class provides a means for relating the dynamics model to the static model.

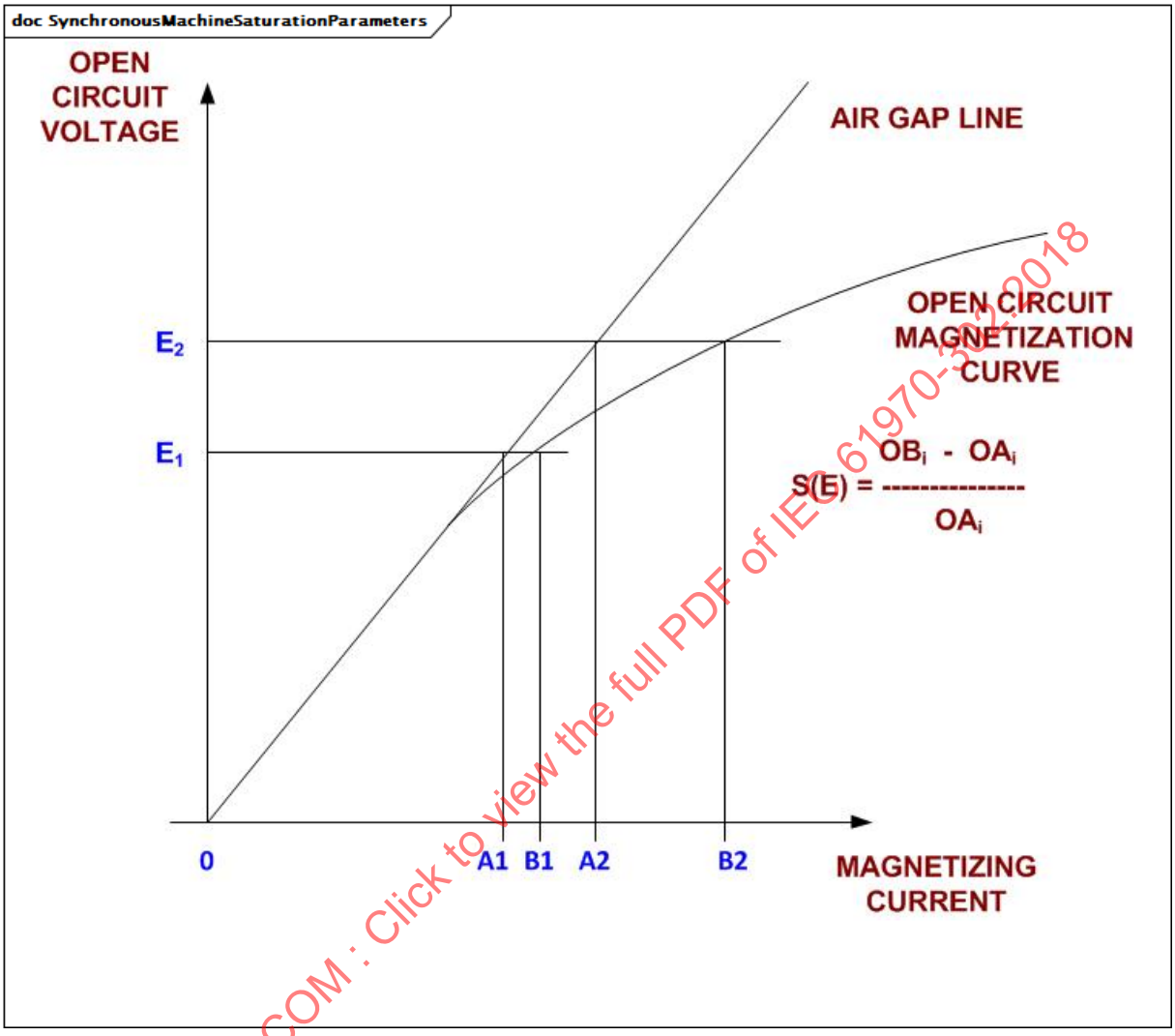

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Figure 19 – SynchronousMachineSaturationParameters

Figure 19: This diagram shows the synchronous machine saturation parameters.

Parameter details:

1) The quantity OAi in amperes is normally called Ifag (which means field current at rated voltage, open circuit on the air gap (no saturation) line). OBi in amperes isnormally called Ifn (which means field current at rated voltage with no load on the machine).
2) Saturation factors for generators are given by RotatingMachineDynamics.saturationFactor and RotatingMachineDynamics.saturationFactor120.
3) For exciters, the values are given in the attributes for each standard excitation system model.

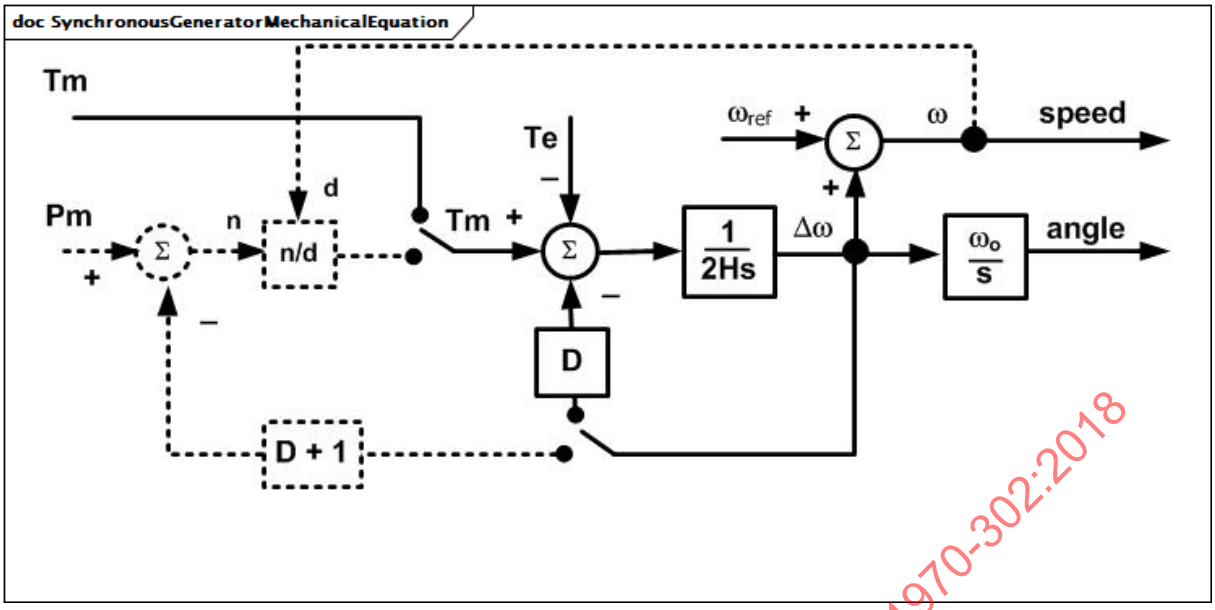

Figure 20 – SynchronousGeneratorMechanicalEquation

Figure 20: The mechanical equations for all the variations of the synchronous generator model are the same and can be represented by the SynchronousGeneratorMechanicalEquation block diagram.

Parameter details:

1) All variables are PU on generator MVA base except angle, which is in radians.
2) omega0 is the system synchronous frequency in radians per s. omegaref is the PU system frequency (or isolated area frequency), which can be constant at the initial frequency or vary during a simulation depending on the application program.
3) The input to the mechanical equations can be either Pm or Tm depending on the application program. Application programs using Pm as the input with the damping feedback subtracted from Pm will need to increase D by 1 as shown. In that case, the damping feedback to the torque summing point is not used.

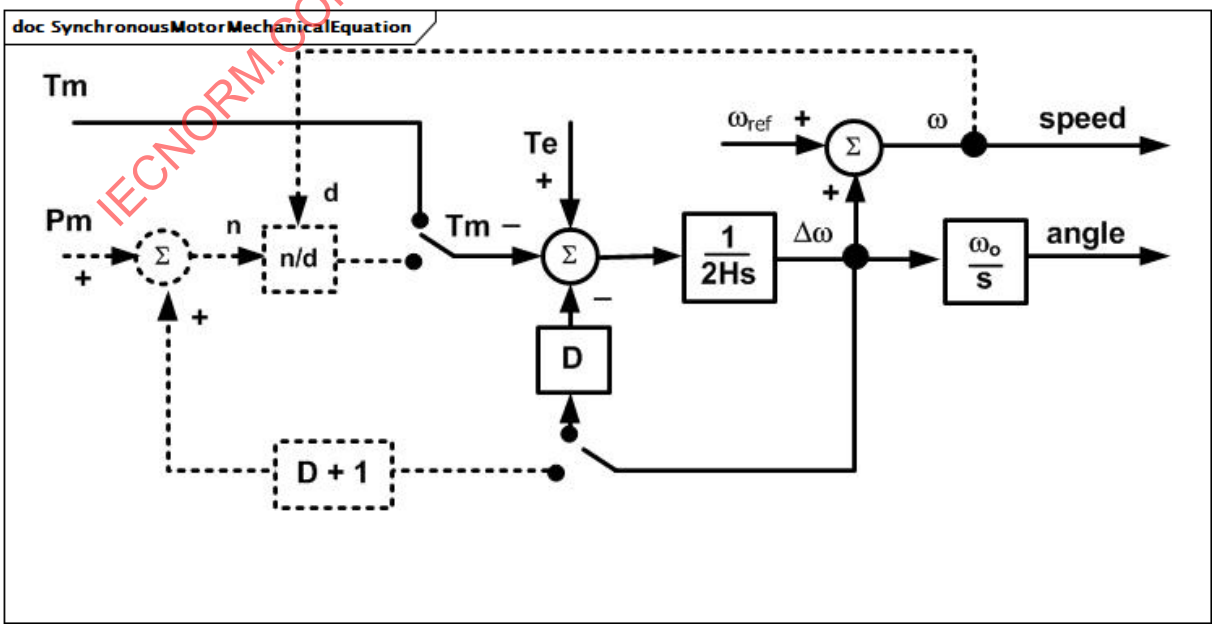

Figure 21 – SynchronousMotorMechanicalEquation

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Figure 21: The mechanical equations for all variations of the synchronous motor model are the same and can be represented by the SynchronousMotorMechanicalEquation diagram.

Parameter details:

1) All variables are PU on motor MVA base except angle, which is in radians.
2) omega0 is the system synchronous frequency in radians per s. omegaref is the PU system frequency (or isolated area frequency), which can be constant at the initial frequency or vary during a simulation depending on the application program.

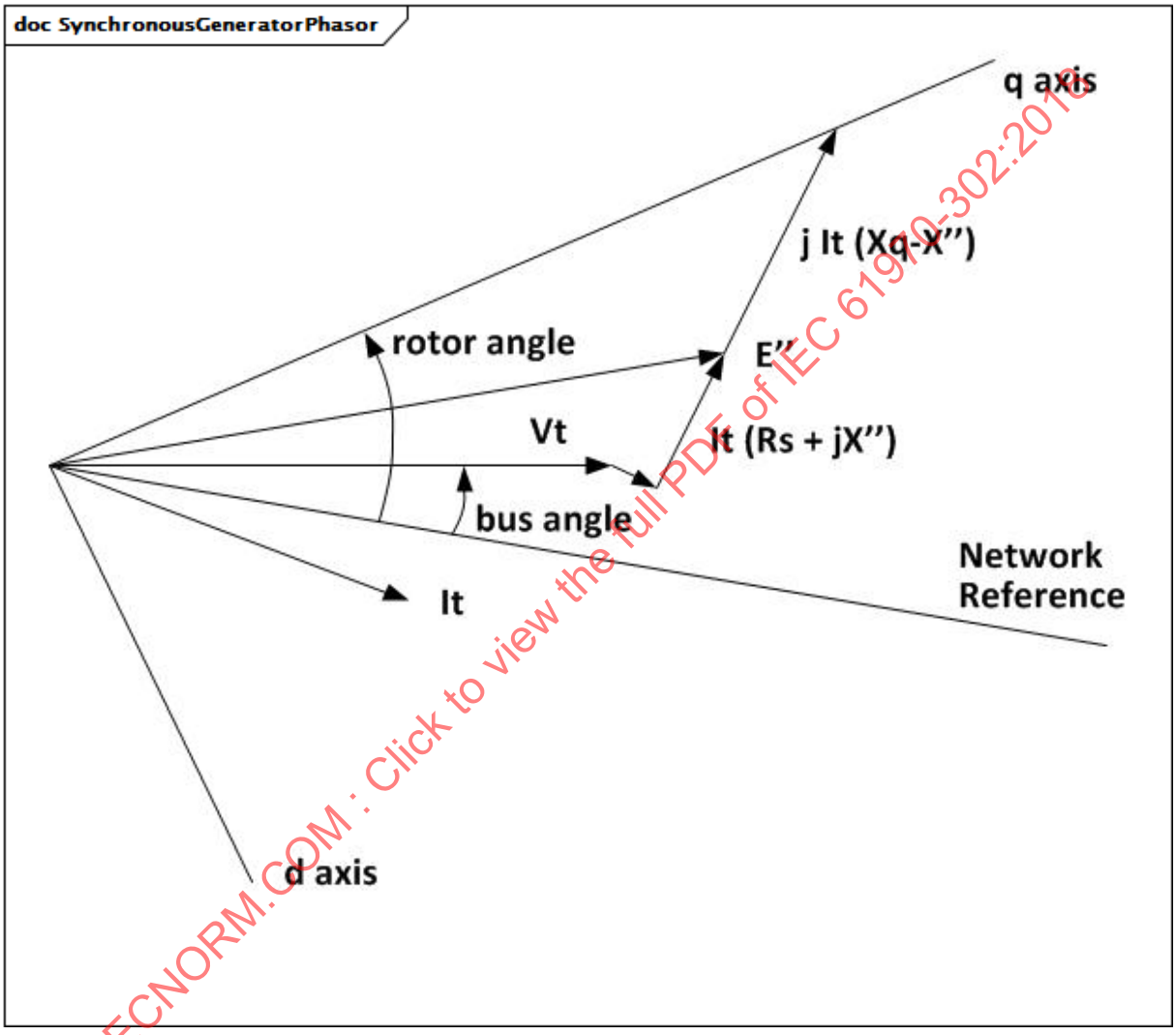

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Figure 22 – SynchronousGeneratorPhasor

Figure 22: Diagram details:

1) The definition of d- and q-axis variables is based on the SynchronousGeneratorPhasor diagram (counter-clockwise rotation) for the case of an overexcited generator (generating reactive power).

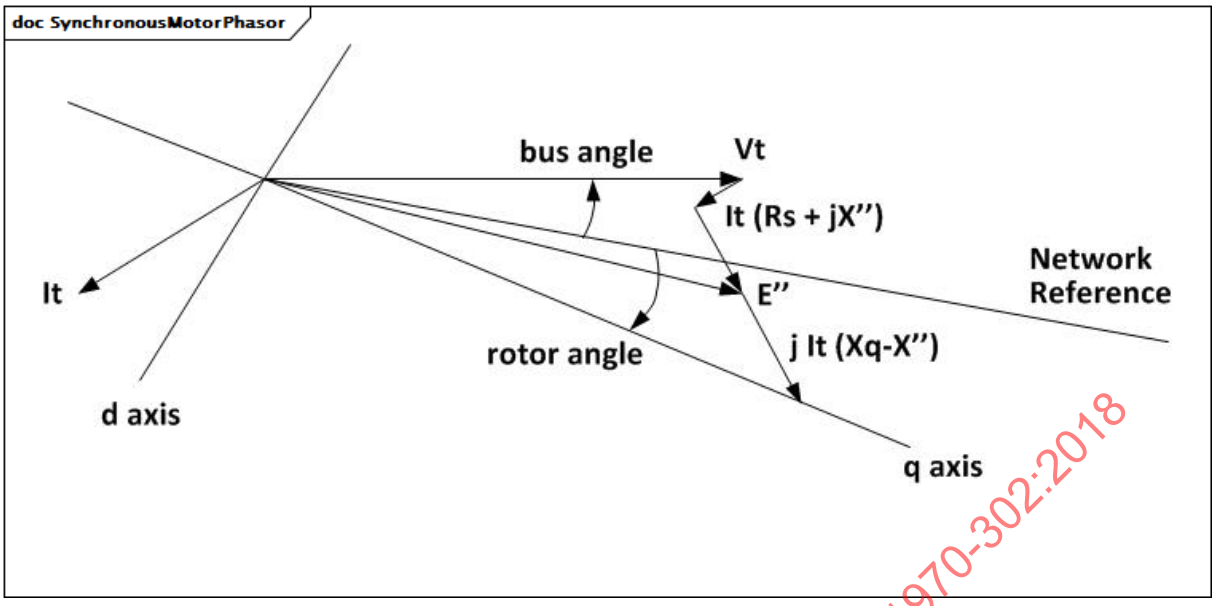

Figure 23 – SynchronousMotorPhasor

Figure 23: Diagram details:

1) The definition of d- and q-axis variables is based on the SynchronousMotorPhasor diagram (counter-clockwise rotation) for the case of a motor consuming active power and overexcited (generating reactive power).

5.3.4.2 SynchronousMachineDynamics

Synchronous machine whose behaviour is described by reference to a standard model expressed in one of the following forms:

- simplified (or classical), where a group of generators or motors is not modelled in detail;
- detailed, in equivalent circuit form;
- detailed, in time constant reactance form; or
- by definition of a user-defined model.

It is a common practice to represent small generators by a negative load rather than by a dynamic generator model when performing dynamics simulations. In this case, a SynchronousMachine in the static model is not represented by anything in the dynamics model, instead it is treated as an ordinary load.

Parameter details:

1) Synchronous machine parameters such as Xl, Xd, Xp etc. are actually used as inductances in the models, but are commonly referred to as reactances since, at nominal frequency, the PU values are the same. However, some references use the symbol L instead of X.

Table 8 shows all attributes of SynchronousMachineDynamics.

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Table 8 – Attributes of SynchronousMachineDynamics::SynchronousMachineDynamics

name	mult	type	description
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 9 shows all association ends of SynchronousMachineDynamics with other classes.

Table 9 – Association ends of SynchronousMachineDynamics::SynchronousMachineDynamics with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	Synchronous machine to which synchronous machine dynamics model applies.
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	Turbine-governor model associated with this synchronous machine model. Multiplicity of greater than one is intended to support hydro units that have multiple turbines on one generator.
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	Compensation of voltage compensator's generator for current flow out of this generator.
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	Excitation system model associated with this synchronous machine model.
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	The cross-compound turbine governor with which this low-pressure synchronous machine is associated.
1..1	CrossCompoundTurbineGovernorDyanmics	0..1	CrossCompoundTurbineGovernorDyanmics	The cross-compound turbine governor with which this high-pressure synchronous machine is associated.
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	Mechanical load model associated with this synchronous machine model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.4.3 SynchronousMachineSimplified

The simplified model represents a synchronous generator as a constant internal voltage behind an impedance (Rs + jXp) as shown in the Simplified diagram.

Since internal voltage is held constant, there is no Efd input and any excitation system model will be ignored. There is also no Ifd output.

This model should not be used for representing a real generator except, perhaps, small generators whose response is insignificant.

The parameters used for the simplified model include:

- RotatingMachineDynamics.damping (D);
- RotatingMachineDynamics.inertia (H);
- RotatingMachineDynamics.statorLeakageReactance (used to exchange jXp for SynchronousMachineSimplified);
- RotatingMachineDynamics.statorResistance (Rs).

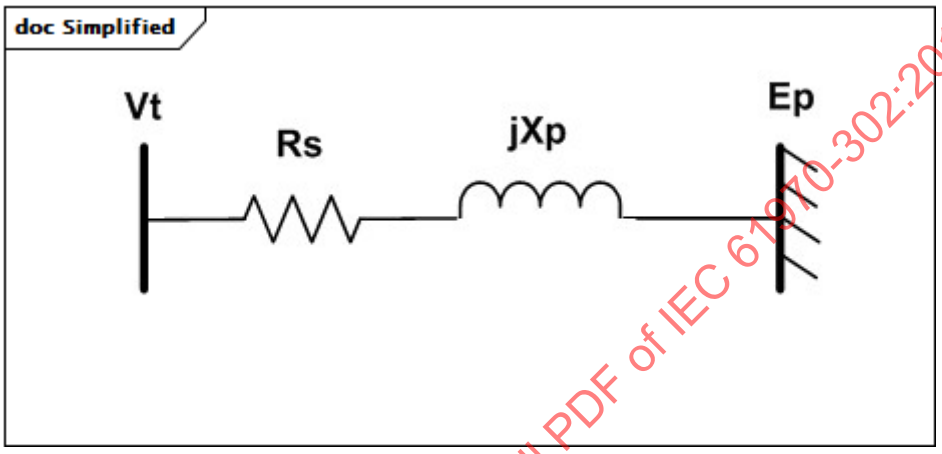

Figure 24 – Simplified

Figure 24: This diagram describes the simplified synchronous generator model.

Parameter details:

1) The model is often used for gross equivalents of parts of a system that are not represented in detail. In this case the MVA rating would be the combined rating of all generators in the equivalenced area.
2) Rs + jXp would be the short-circuit equivalent impedance at the location of the equivalent generator on the generator MVA rating base. Inertia constant (H) would be typical or average values for the generators in the equivalenced area.
3) The internal reactance (Xp) can be labelled in different ways (X', X", X'd, X"d) by different simulation tools.

Table 10 shows all attributes of SynchronousMachineSimplified.

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Table 10 – Attributes of SynchronousMachineDynamics::SynchronousMachineSimplified

name	mult	type	description
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 11 shows all association ends of SynchronousMachineSimplified with other classes.

Table 11 – Association ends of SynchronousMachineDynamics::SynchronousMachineSimplified with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	inherited from: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	inherited from: SynchronousMachineDynamics
1..1	GenICompensationForGen J	0..*	GenICompensationForGen J	inherited from: SynchronousMachineDynamics
1..1	ExcitationSystemDynamic s	0..1	ExcitationSystemDynamic s	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineG overnorDynamics	0..1	CrossCompoundTurbineG overnorDyanmics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineG overnorDyanmics	0..1	CrossCompoundTurbineG overnorDyanmics	inherited from: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.4.4 SynchronousMachineDetailed

All synchronous machine detailed types use a subset of the same data parameters and input/output variables.

The several variations differ in the following ways:

- the number of equivalent windings that are included;
- the way in which saturation is incorporated into the model;
- whether or not “subtransient saliency” (X''q not = X''d) is represented.

It is not necessary for each simulation tool to have separate models for each of the model types. The same model can often be used for several types by alternative logic within the model. Also, differences in saturation representation might not result in significant model performance differences so model substitutions are often acceptable.

Table 12 shows all attributes of SynchronousMachineDetailed.

Table 12 – Attributes of SynchronousMachineDynamics::SynchronousMachineDetailed

name	mult	type	description
efdBaseRatio	0..1	Float	Ratio (exciter voltage/generator voltage) of Efd bases of exciter and generator models (> 0). Typical value = 1.
ifdBaseType	0..1	IfdBaseKind	Excitation base system mode. It should be equal to the value of WLMDV given by the user. WLMDV is the PU ratio between the field voltage and the excitation current: Efd = WLMDV x Ifd. Typical value = ifag.
saturationFactor120QAxis	0..1	Float	Quadrature-axis saturation factor at 120% of rated terminal voltage (S12q) (>= SynchonousMachineDetailed.saturationFactorQAxis). Typical value = 0,12.
saturationFactorQAxis	0..1	Float	Quadrature-axis saturation factor at rated terminal voltage (S1q) (>= 0). Typical value = 0,02.
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 13 shows all association ends of SynchronousMachineDetailed with other classes.

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Table 13 – Association ends of SynchronousMachineDynamics::SynchronousMachineDetailed with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	inherited from: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	inherited from: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	inherited from: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDyanmics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.4.5 SynchronousMachineTimeConstantReactance

Synchronous machine detailed modelling types are defined by the combination of the attributes SynchronousMachineTimeConstantReactance.modelType and SynchronousMachineTimeConstantReactance.rotorType.

Parameter details:

1) The “p” in the time-related attribute names is a substitution for a “prime” in the usual parameter notation, e.g. tpdo refers to T'do.
2) The parameters used for models expressed in time constant reactance form include:
   – RotatingMachine.ratedS (MVAbase);
   – RotatingMachineDynamics.damping (D);
   – RotatingMachineDynamics.inertia (H);
   – RotatingMachineDynamics.saturationFactor (S1);
   – RotatingMachineDynamics.saturationFactor120 (S12);
   – RotatingMachineDynamics.statorLeakageReactance (Xl);
   – RotatingMachineDynamics.statorResistance (Rs);
   – SynchronousMachineTimeConstantReactance.ks (Ks);
   – SynchronousMachineDetailed.saturationFactorQAxis (S1q);
   – SynchronousMachineDetailed.saturationFactor120QAxis (S12q);
   – SynchronousMachineDetailed.efdBaseRatio;
   – SynchronousMachineDetailed.ifdBaseType;
   – .xDirectSync (Xd);
   – .xDirectTrans (X'd);
   – .xDirectSubtrans (X''d);
   – .xQuadSync (Xq);
   – .xQuadTrans (X'q);

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– .xQuadSubtrans (X''q);
– .tpdo (T'do);
– .tppdo (T''do);
– .tpqo (T'qo);
– .tppqo (T''qo);
– .tc.

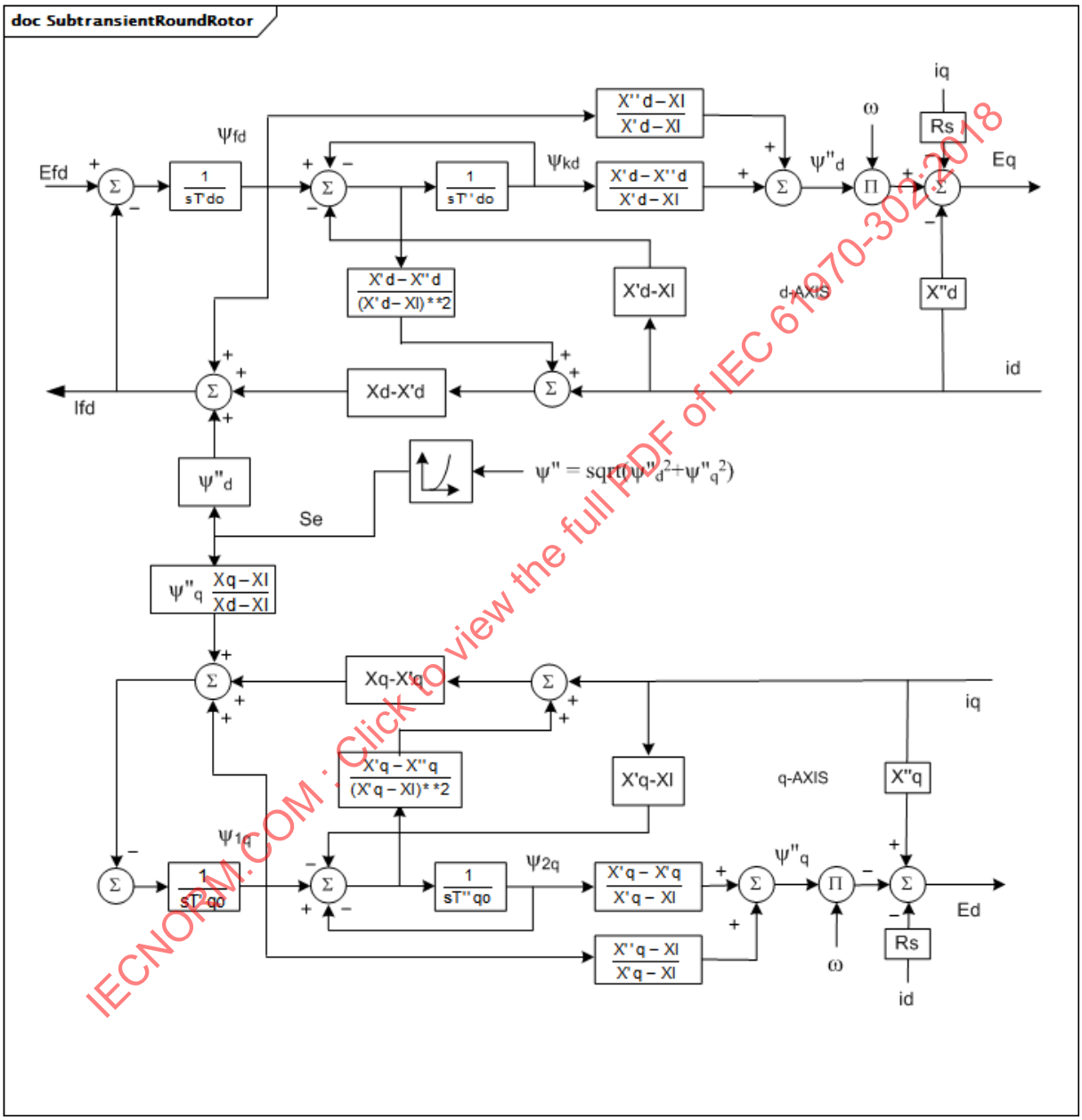

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Figure 25 – SubtransientRoundRotor

Figure 25: The subtransient round rotor type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransient and .rotorType = roundRotor.

The complete equivalent circuit is used with two rotor windings in each axis.

Ifd represents LadIfd (XadIfd) and is a voltage proportional to field current in PU (IEEE 421.5-2005, Annex B). It is equal to Efd in steady-state.

Parameter details:

1) X''q can be assumed to be equal to X''d (no subtransient saliency).
2) Saturation is modelled in both the direct- and quadrature- axes.
3) For generators, the following parameters can be omitted with defaults shown: X''q (= X''d), Ks (= 0), S1q (= S1), S12q (= S12), Tc (= 0).
4) For motors, the following parameter is not used: X''q.

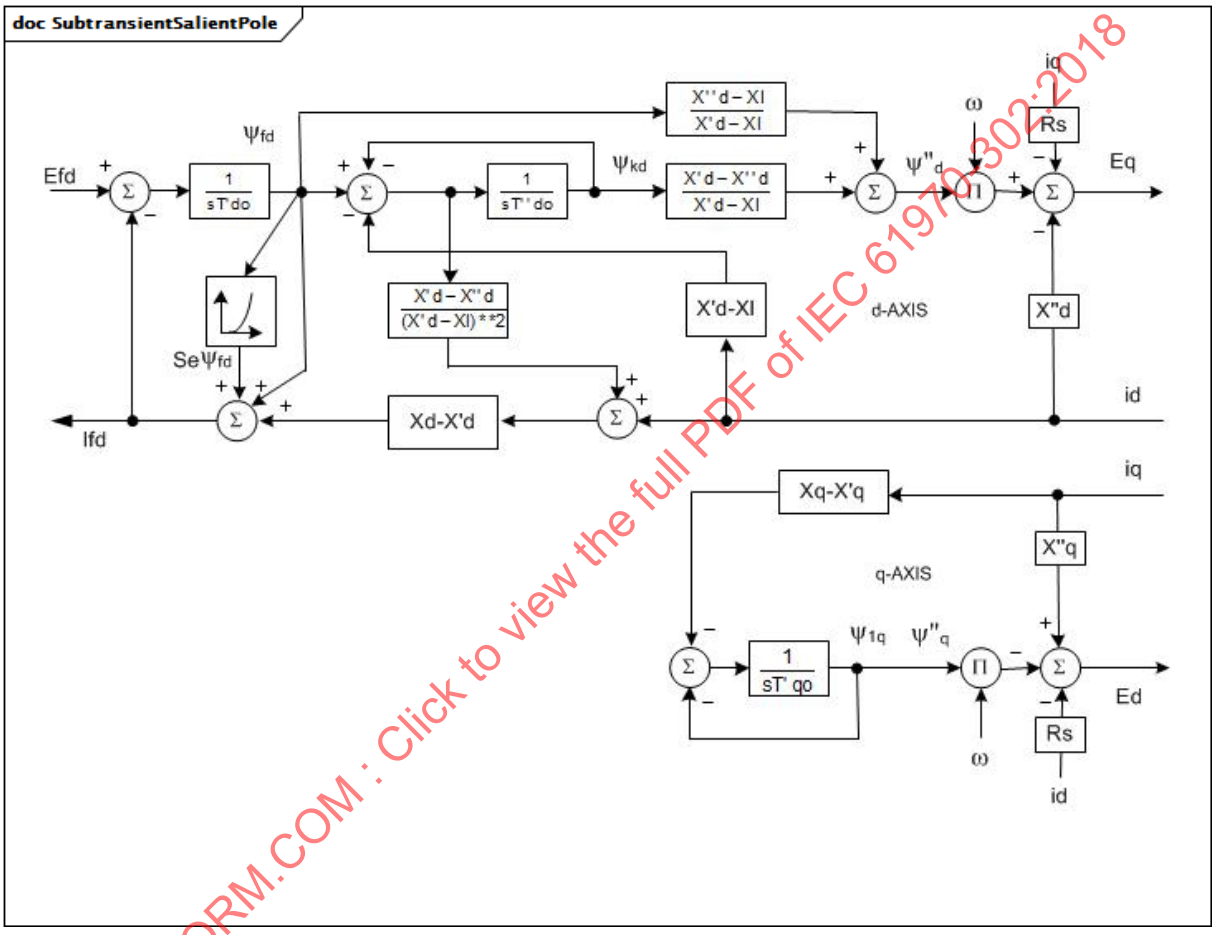

Figure 26 – SubtransientSalientPole

Figure 26: The subtransient salient pole type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransient and .rotorKind = salientPole.

The d-axis equivalent circuit is the same as for the subtransient round rotor type. The q-axis has only one equivalent rotor winding, which can be labelled as transient (X'q) or subtransient (X''q); X'q is used for the CIM description.

Ifd represents LadIfd (XadIfd) and is a voltage proportional to field current in PU (IEEE 421.5-2005, Annex B). It is equal to Efd in steady-state.

Parameter details:

1) X''q (=X'q) is assumed to be equal to X''d (no subtransient saliency).

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2) Saturation is modelled in the d-axis only.

3) For generators, the following input parameters can be omitted with default shown: X'q (=X''d), X''q (=X''d), T''qo, Ks (=0), S1q (=0), S12q (=0), Tc (=0).

4) For motors, the following input parameters are not used: X'q, X''q, T''qo.

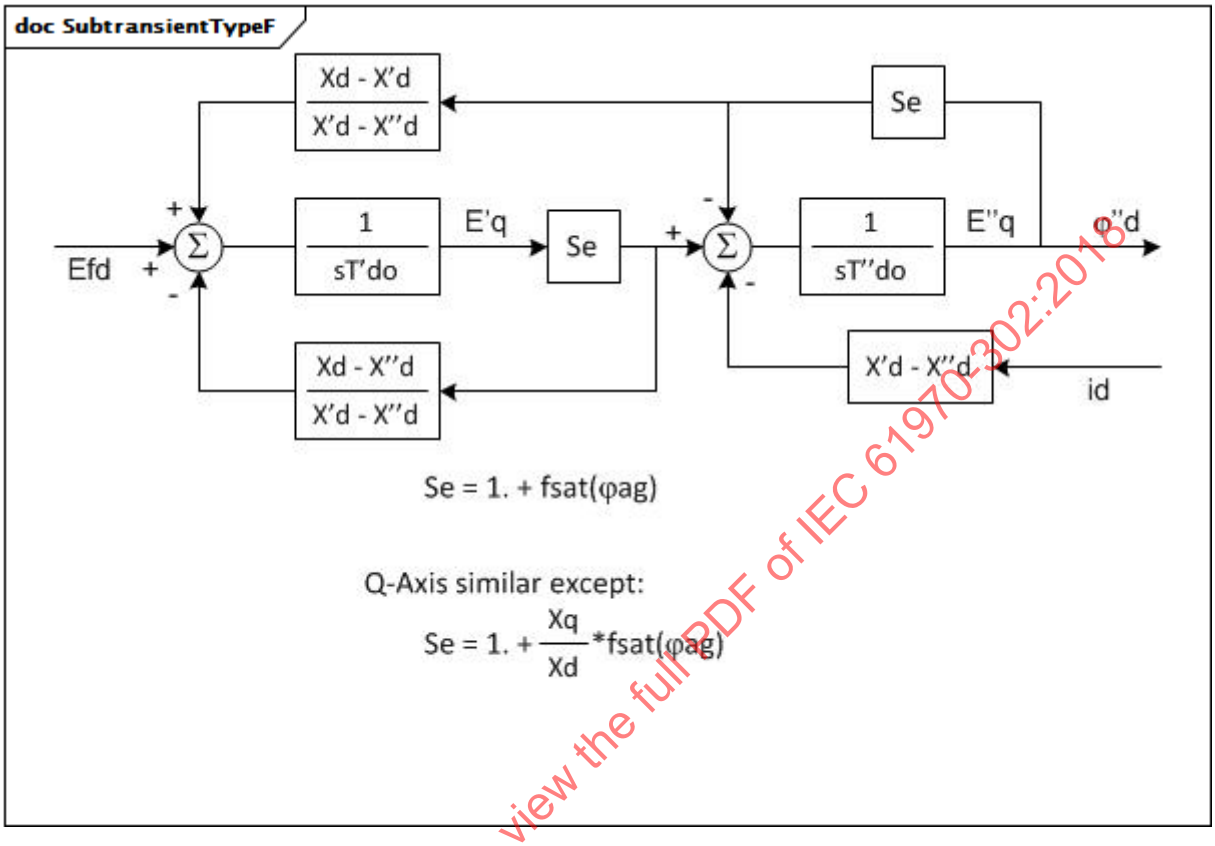

Figure 27 – SubtransientTypeF

Figure 27: The subtransient type F is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientTypeF.

This model is the WECC type F model with uniform inductance rotor modelling; shaft speed effects are neglected. It has a similar level of detail to the subtransient round rotor type but permits subtransient saliency (X''q not = X''d) and models saturation differently. The subtransient round rotor type can usually be substituted without significant loss of accuracy.

Saturation is modelled in both the direct- and quadrature- axes.

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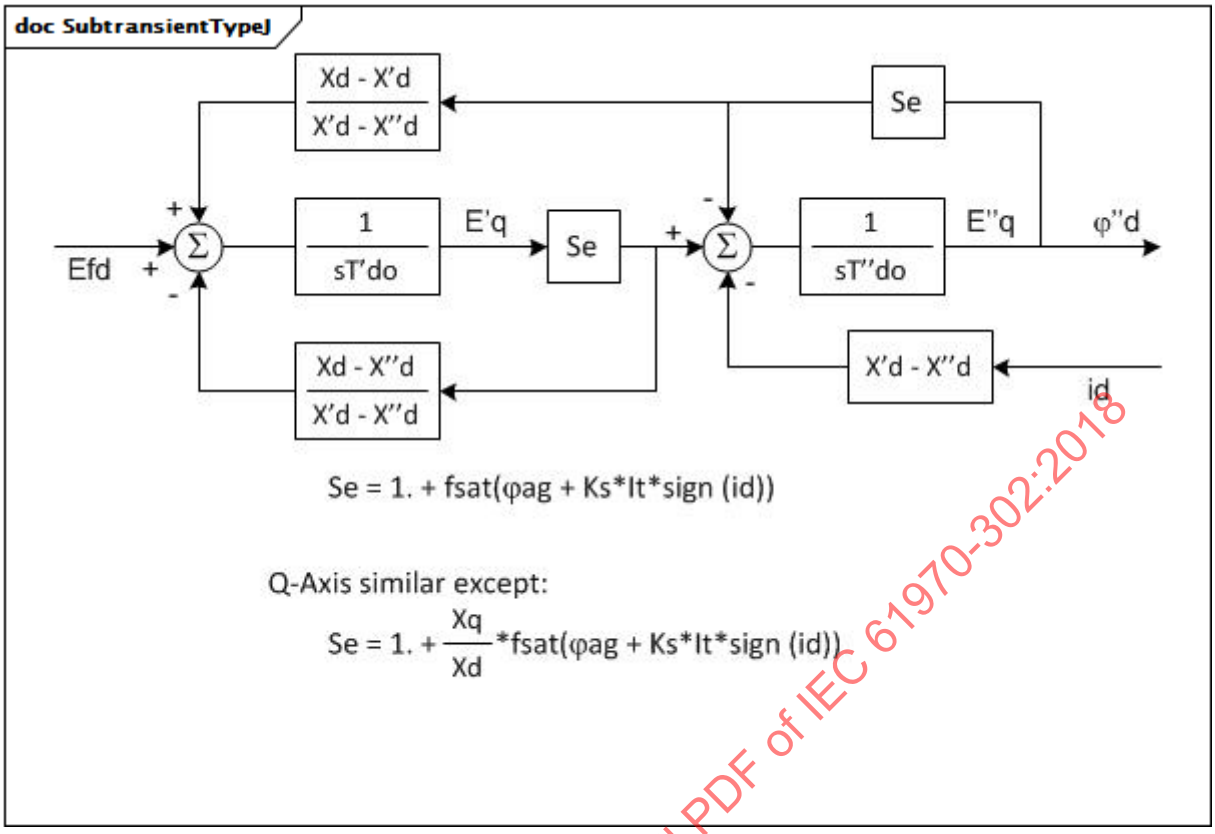

Figure 28 – SubtransientTypeJ

Figure 28: The subtransient type J is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientTypeJ.

This model is the WECC type J model with uniform inductance ratios rotor modelling with modified saturation model; shaft speed effects are neglected. This model is the same as subtransient type F but includes the effect of generator loading on saturation. With the usage of the saturation constant (Ks) parameter, it allows reproduction of the measured "V curves" over the whole range of reactive power, particularly on some hydro (salient pole) machines.

Saturation is modelled in both the direct- and quadrature- axes.

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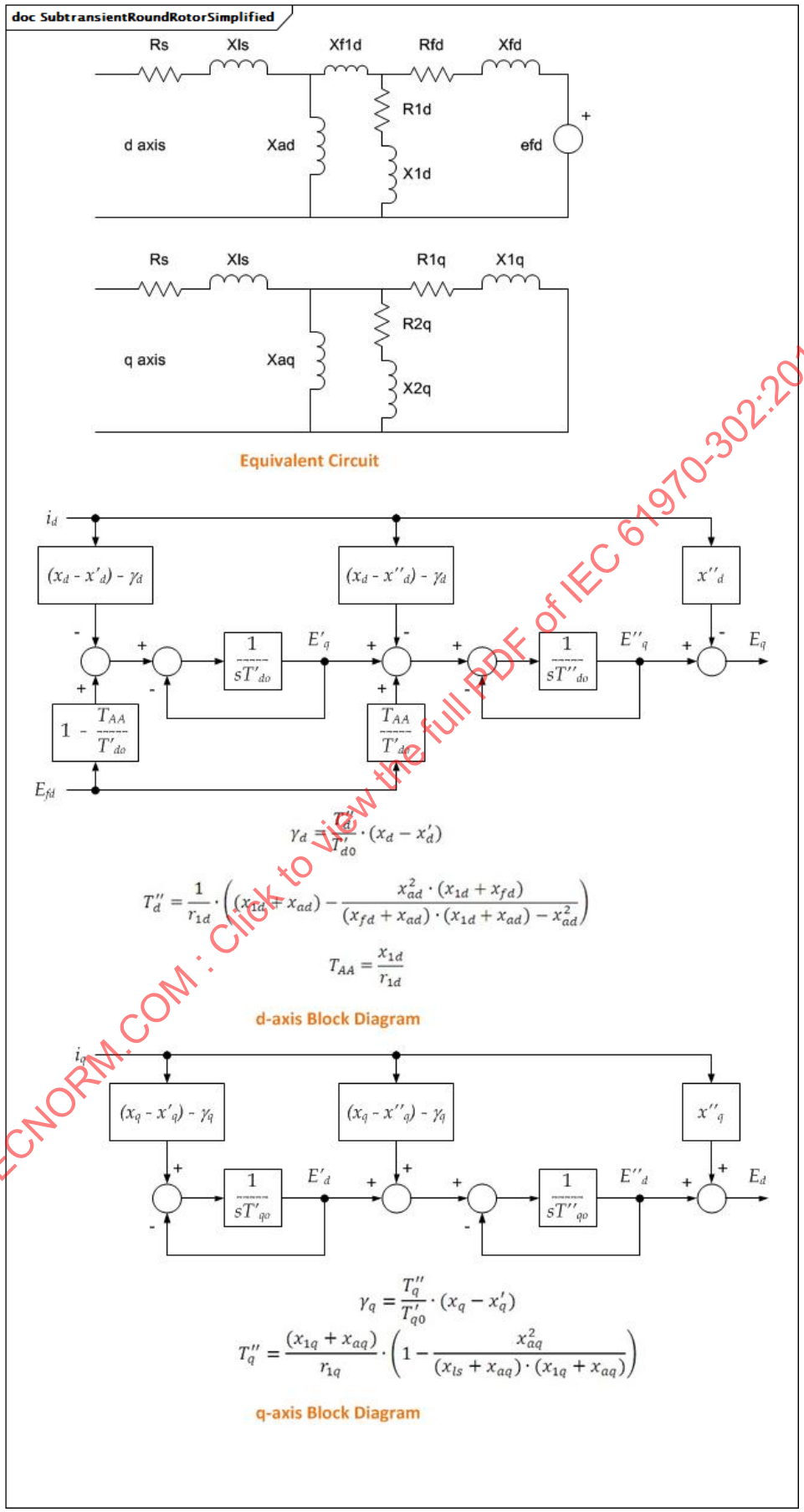

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Figure 29 – SubtransientRoundRotorSimplified

Figure 29: The subtransient round rotor simplified type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientSimplified and .rotorKind = roundRotor.

It is a simplified version of subtransient round rotor type, magnetic coupling between the direct- and quadrature- axes is ignored.

Parameter details:

1) The effects of speed variation are neglected.
2) No armature resistance.
3) No saturation effects.
4) No subtransient saliency.
5) Direct-axis with field circuit and one equivalent damper circuit, X'd not = X''d.
6) Quadrature-axis with two equivalent damper circuit, X''q not = X'q.
7) For generators and motors the following input parameters are needed: Xd, X'd, X''d, T'do, T''do and Xq, X'q, X''q, T'qo, T''qo.

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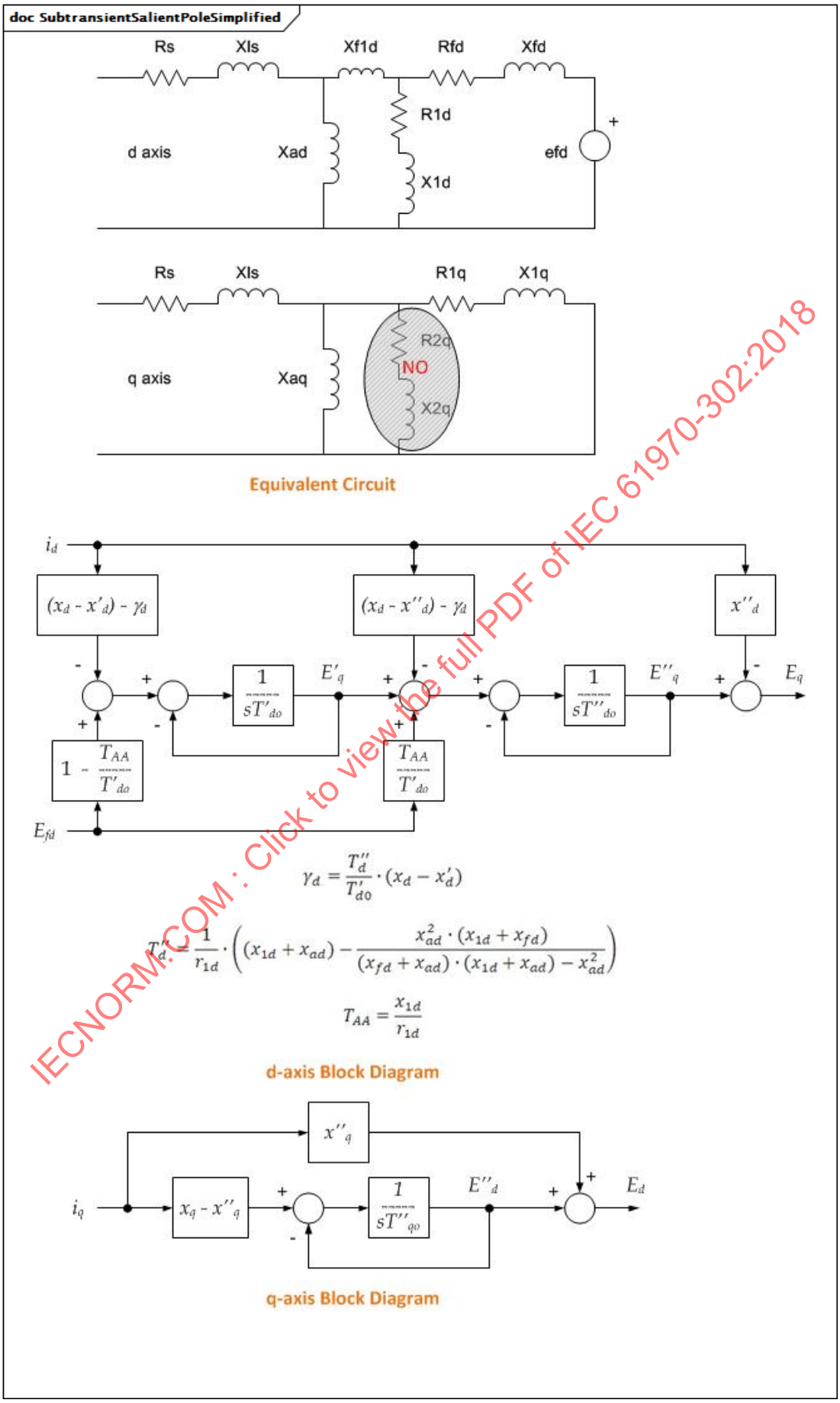

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Figure 30 – SubtransientSalientPoleSimplified

Figure 30: The subtransient salient pole simplified type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientSimplified and .rotorKind = salientPole.

It is a simplified version of subtransient salient pole type, magnetic coupling between the direct- and quadrature- axes is ignored.

Parameter details:

1) The effects of speed variation are neglected.
2) No armature resistance.
3) No saturation effects.
4) No subtransient saliency.
5) Direct-axis with field circuit and one equivalent damper circuit, X'd not = X''d.
6) Quadrature-axis with only one equivalent damper circuit, which is labeled as subtransient (X''q), X''q =X'q.
7) For generators and motors the following input parameters are needed: Xd, X'd, X''d, T'do, T''do and Xq, X''q, T''qo.

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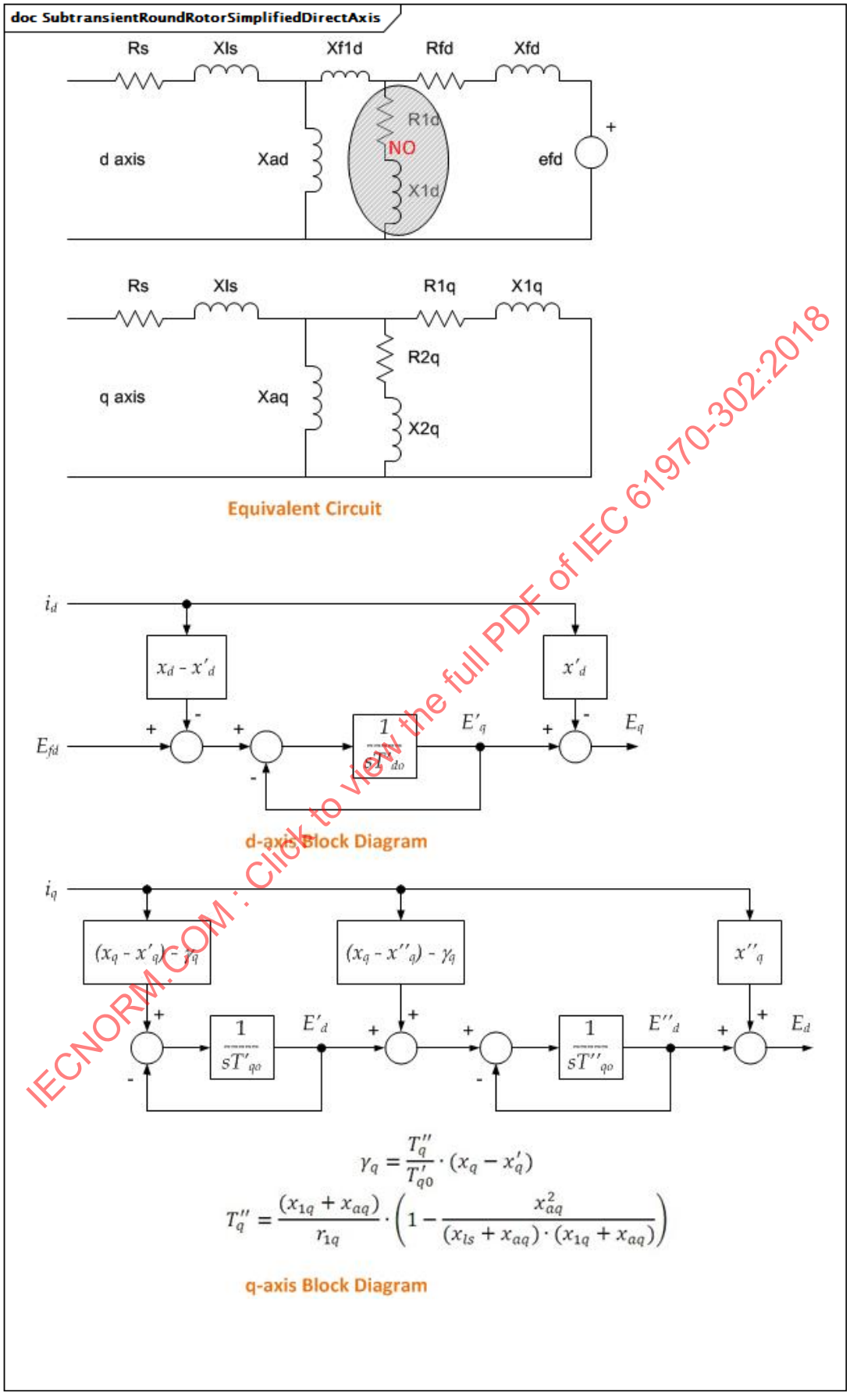

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Figure 31 – SubtransientRoundRotorSimplifiedDirectAxis

Figure 31: The subtransient round rotor simplified direct-axis type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientSimplifiedDirectAxis and .rotorKind = roundRotor.

It is a simplified version of a subtransient round rotor type with no damper circuit on the d-axis. This simplification contributes to a reduction in computational effort by reducing the order of the differential equation system. The q-axis has two equivalent rotor windings. Magnetic coupling between the direct- and quadrature- axes is ignored.

Parameter details:

1) The effects of speed variation are neglected.
2) No armature resistance.
3) No saturation effects.
4) No subtransient saliency.
5) Direct-axis with field circuit only, no equivalent damper circuit. Approximation: X'd = X''d.
6) Quadrature-axis with two equivalent damper circuit, X''q not = X'q.
7) For generators and motors the following input parameters are needed: Xd, X'd, T'do and Xq, X'q, X''q, T'qo, T''qo.

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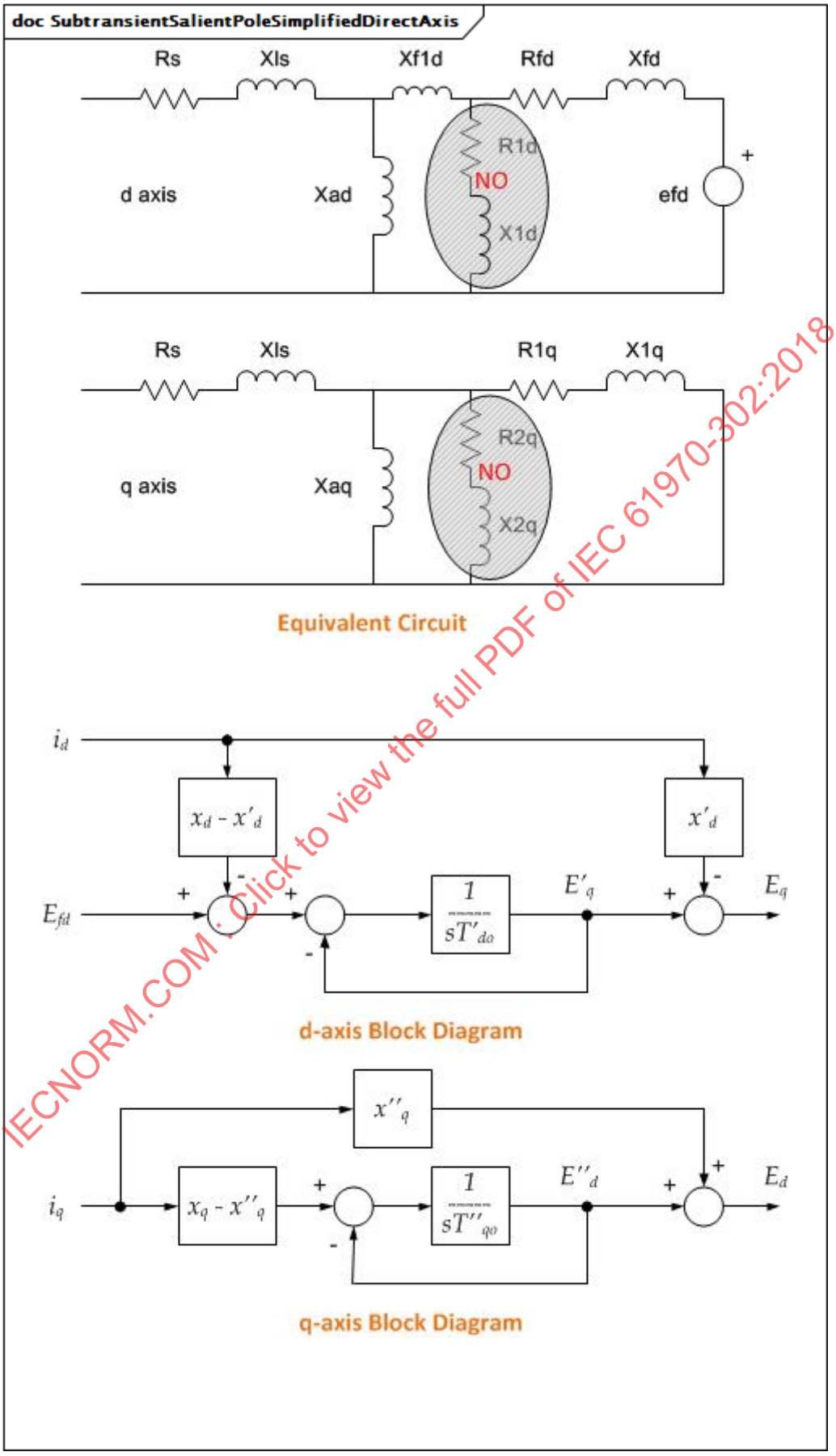

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Figure 32 – SubtransientSalientPoleSimplifiedDirectAxis

Figure 32: The subtransient salient pole simplified direct-axis type is modelled using one of the concrete child classes of the SynchronousMachineDetailed class. If the SynchronousMachineTimeConstantReactance class is used, .modelType = subtransientSimplifiedDirectAxis and .rotorKind = salientPole. It is a simplified version of a subtransient salient pole type with no damper circuit on the d-axis. This simplification contributes to a reduction in computational effort by reducing the order of the differential equation system. The q-axis has only one equivalent rotor winding. Magnetic coupling between the direct- and quadrature- axes is ignored.

Parameter details:

1) The effects of speed variation are neglected.
2) No armature resistance.
3) No saturation effects.
4) No subtransient saliency.
5) Direct-axis with field circuit only, no equivalent damper circuit. Approximation: X'd = X''d.
6) Quadrature-axis with only one equivalent damper circuit, which is labelled as subtransient (X''q), X''q =X'q.
7) For generators and motors the following input parameters are needed: Xd, X'd, T'do and Xq, X''q, T''qo.

Table 14 shows all attributes of SynchronousMachineTimeConstantReactance.

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Table 14 – Attributes of SynchronousMachineDynamics::SynchronousMachineTimeConstantReactance

name	mult	type	description
rotorType	0..1	RotorKind	Type of rotor on physical machine.
modelType	0..1	SynchronousMachineModelKind	Type of synchronous machine model used in dynamic simulation applications.
ks	0..1	Float	Saturation loading correction factor (Ks) (>= 0). Used only by type J model. Typical value = 0.
xDirectSync	0..1	PU	Direct-axis synchronous reactance (Xd) (>= SynchronousMachineTimeConstantReactance.xDirectTrans). The quotient of a sustained value of that AC component of armature voltage that is produced by the total direct-axis flux due to direct-axis armature current and the value of the AC component of this current, the machine running at rated speed. Typical value = 1,8.
xDirectTrans	0..1	PU	Direct-axis transient reactance (unsaturated) (X'd) (>= SynchronousMachineTimeConstantReactance.xDirectSubtrans). Typical value = 0,5.
xDirectSubtrans	0..1	PU	Direct-axis subtransient reactance (unsaturated) (X''d) (> RotatingMachineDynamics.statorLeakageReactance). Typical value = 0,2.
xQuadSync	0..1	PU	Quadrature-axis synchronous reactance (Xq) (>= SynchronousMachineTimeConstantReactance.xQuadTrans). The ratio of the component of reactive armature voltage, due to the quadrature-axis component of armature current, to this component of current, under steady state conditions and at rated frequency. Typical value = 1,6.
xQuadTrans	0..1	PU	Quadrature-axis transient reactance (X'q) (>= SynchronousMachineTimeConstantReactance.xQuadSubtrans). Typical value = 0,3.
xQuadSubtrans	0..1	PU	Quadrature-axis subtransient reactance (X''q) (> RotatingMachineDynamics.statorLeakageReactance). Typical value = 0,2.
tpdo	0..1	Seconds	Direct-axis transient rotor time constant (T'do) (> SynchronousMachineTimeConstantReactance.tppdo). Typical value = 5.
tppdo	0..1	Seconds	Direct-axis subtransient rotor time constant (T''do) (> 0). Typical value = 0,03.
tpqo	0..1	Seconds	Quadrature-axis transient rotor time constant (T'qo) (> SynchronousMachineTimeConstantReactance.tppqo). Typical value = 0,5.
tppqo	0..1	Seconds	Quadrature-axis subtransient rotor time constant (T''qo) (> 0). Typical value = 0,03.
tc	0..1	Seconds	Damping time constant for “Canay” reactance (>= 0). Typical value = 0.
efdBaseRatio	0..1	Float	inherited from: SynchronousMachineDetailed
ifdBaseType	0..1	IfdBaseKind	inherited from: SynchronousMachineDetailed
saturationFactor120QAxis	0..1	Float	inherited from: SynchronousMachineDetailed
saturationFactorQAxis	0..1	Float	inherited from: SynchronousMachineDetailed
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics

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name	mult	type	description
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 15 shows all association ends of SynchronousMachineTimeConstantReactance with other classes.

Table 15 – Association ends of SynchronousMachineDynamics::SynchronousMachineTimeConstantReactance with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	inherited from: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	inherited from: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	inherited from: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.4.6 SynchronousMachineEquivalentCircuit

The electrical equations for all variations of the synchronous models are based on the SynchronousEquivalentCircuit diagram for the direct- and quadrature- axes.

Equations for conversion between equivalent circuit and time constant reactance forms:

Xd = Xad + Xl

X'd = Xl + Xad x Xfd / (Xad + Xfd)

X"d = Xl + Xad x Xfd x X1d / (Xad x Xfd + Xad x X1d + Xfd x X1d)

Xq = Xaq + Xl

X'q = Xl + Xaq x X1q / (Xaq + X1q)

X”q = Xl + Xaq x X1q x X2q / (Xaq x X1q + Xaq x X2q + X1q x X2q)

T’do = (Xad + Xfd) / (omega0 x Rfd)

T”do = (Xad x Xfd + Xad x X1d + Xfd x X1d) / (omega0 x R1d x (Xad + Xfd)

T’qo = (Xaq + X1q) / (omega0 x R1q)

T”qo = (Xaq x X1q + Xaq x X2q + X1q x X2q) / (omega0 x R2q x (Xaq + X1q)

Same equations using CIM attributes from SynchronousMachineTimeConstantReactance class on left of "=" and SynchronousMachineEquivalentCircuit class on right (except as noted):

xDirectSync = xad + RotatingMachineDynamics.statorLeakageReactance

xDirectTrans = RotatingMachineDynamics.statorLeakageReactance + xad x xfd / (xad + xfd)

xDirectSubtrans = RotatingMachineDynamics.statorLeakageReactance + xad x xfd x x1d / (xad x xfd + xad x x1d + xfd x x1d)

xQuadSync = xaq + RotatingMachineDynamics.statorLeakageReactance

xQuadTrans = RotatingMachineDynamics.statorLeakageReactance + xaq x x1q / (xaq+ x1q)

xQuadSubtrans = RotatingMachineDynamics.statorLeakageReactance + xaq x x1q x x2q / (xaq x x1q + xaq x x2q + x1q x x2q)

tpdo = (xad + xfd) / (2 x pi x nominal frequency x rfd)

tppdo = (xad x xfd + xad x x1d + xfd x x1d) / (2 x pi x nominal frequency x r1d x (xad + xfd)

tpqo = (xaq + x1q) / (2 x pi x nominal frequency x r1q)

tppqo = (xaq x x1q + xaq x x2q + x1q x x2q) / (2 x pi x nominal frequency x r2q x (xaq + x1q)

These are only valid for a simplified model where "Canay" reactance is zero.

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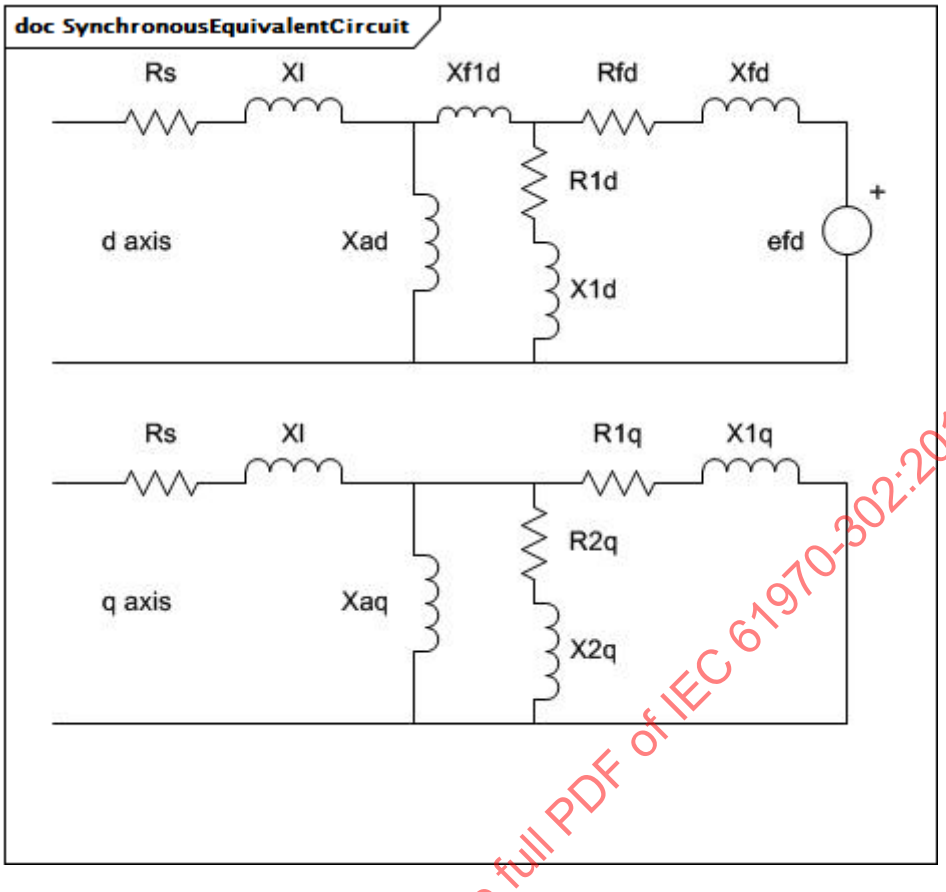

Figure 33 – SynchronousEquivalentCircuit

Figure 33: In each axis, the branches represent the stator leakage reactance (Xl) and resistance (Rs), the magnetizing reactance (Xad, Xaq), the physical field winding (Rfd, Xfd) on the rotor, and equivalent windings for eddy current flow in the rotor iron.

Table 16 shows all attributes of SynchronousMachineEquivalentCircuit.

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Table 16 – Attributes of SynchronousMachineDynamics::SynchronousMachineEquivalentCircuit

name	mult	type	description
xad	0..1	PU	Direct-axis mutual reactance.
rfd	0..1	PU	Field winding resistance.
xfd	0..1	PU	Field winding leakage reactance.
r1d	0..1	PU	Direct-axis damper 1 winding resistance.
x1d	0..1	PU	Direct-axis damper 1 winding leakage reactance.
xf1d	0..1	PU	Differential mutual (“Canay”) reactance.
xaq	0..1	PU	Quadrature-axis mutual reactance.
r1q	0..1	PU	Quadrature-axis damper 1 winding resistance.
x1q	0..1	PU	Quadrature-axis damper 1 winding leakage reactance.
r2q	0..1	PU	Quadrature-axis damper 2 winding resistance.
x2q	0..1	PU	Quadrature-axis damper 2 winding leakage reactance.
efdBaseRatio	0..1	Float	inherited from: SynchronousMachineDetailed
ifdBaseType	0..1	IfdBaseKind	inherited from: SynchronousMachineDetailed
saturationFactor120QAxis	0..1	Float	inherited from: SynchronousMachineDetailed
saturationFactorQAxis	0..1	Float	inherited from: SynchronousMachineDetailed
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 17 shows all association ends of SynchronousMachineEquivalentCircuit with other classes.

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Table 17 – Association ends of SynchronousMachineDynamics::SynchronousMachineEquivalentCircuit with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	inherited from: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	inherited from: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	inherited from: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDyanmics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.4.7 IfdBaseKind enumeration

Excitation base system mode.

Table 18 shows all literals of IfdBaseKind.

Table 18 – Literals of SynchronousMachineDynamics::IfdBaseKind

literal	value	description
ifag		Air gap line mode.
ifnl		No load system with saturation mode.
iffl		Full load system mode.

5.3.4.8 SynchronousMachineModelKind enumeration

Type of synchronous machine model used in dynamic simulation applications.

Table 19 shows all literals of SynchronousMachineModelKind.

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Table 19 – Literals of SynchronousMachineDynamics::SynchronousMachineModelKind

literal	value	description
subtransient		Subtransient synchronous machine model.
subtransientTypeF		WECC type F variant of subtransient synchronous machine model.
subtransientTypeJ		WECC type J variant of subtransient synchronous machine model.
subtransientSimplified		Simplified version of subtransient synchronous machine model where magnetic coupling between the direct- and quadrature- axes is ignored.
subtransientSimplifiedDirectAxis		Simplified version of a subtransient synchronous machine model with no damper circuit on the direct-axis.

5.3.4.9 RotorKind enumeration

Type of rotor on physical machine.

Table 20 shows all literals of RotorKind.

Table 20 – Literals of SynchronousMachineDynamics::RotorKind

literal	value	description
roundRotor		Round rotor type of synchronous machine.
salientPole		Salient pole type of synchronous machine.

5.3.5 Package AsynchronousMachineDynamics

5.3.5.1 General

An asynchronous machine model represents a (induction) generator or motor with no external connection to the rotor windings, e.g. a squirrel-cage induction machine.

The interconnection with the electrical network equations can differ among simulation tools. The program only needs to know the terminal to which this asynchronous machine is connected in order to establish the correct interconnection. The interconnection with the motor's equipment could also differ due to input and output signals required by standard models.

The asynchronous machine model is used to model wind generators type 1 and type 2. For these, normal practice is to include the rotor flux transients and neglect the stator flux transients.

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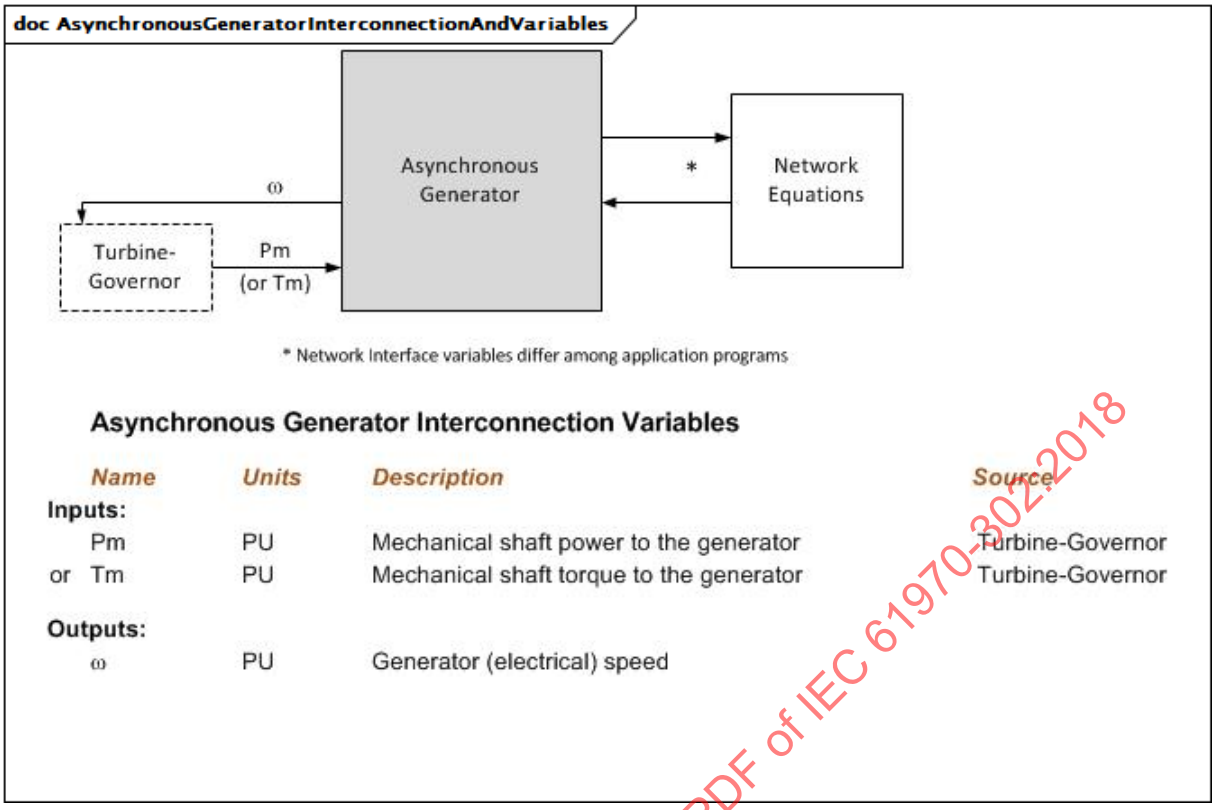
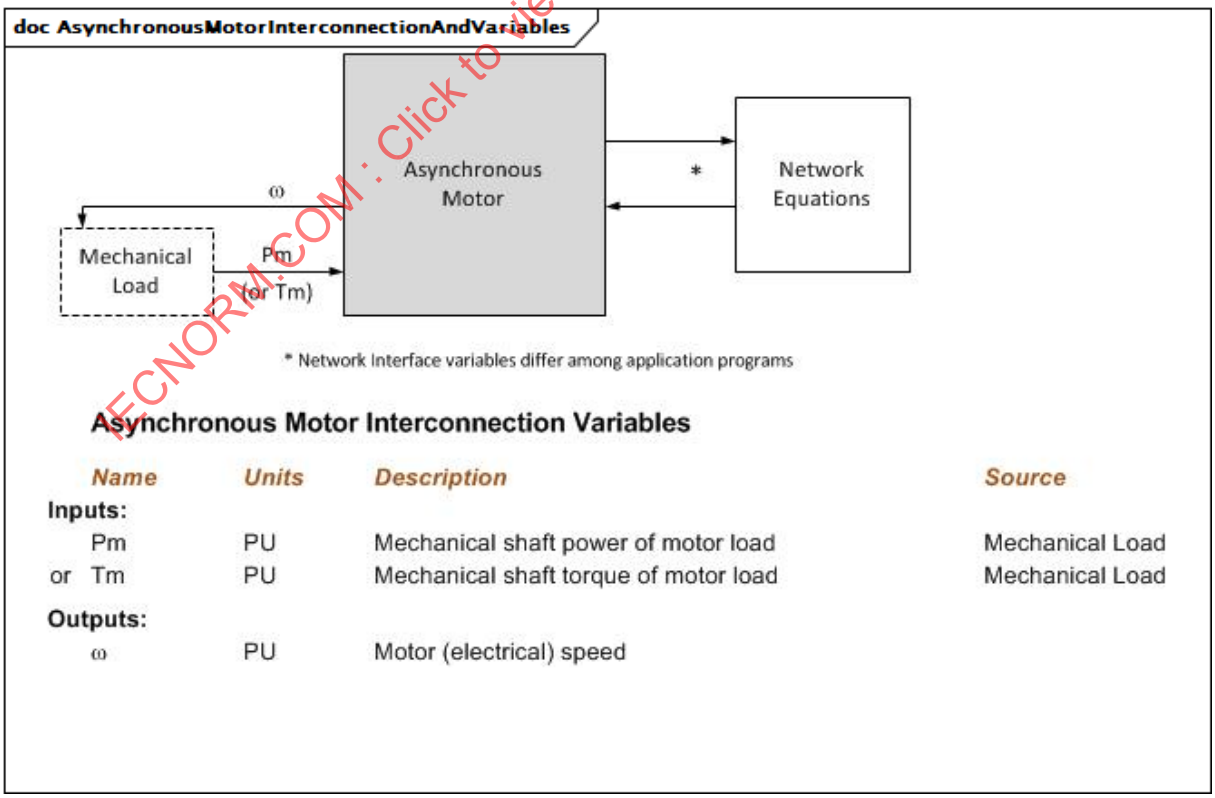


Asynchronous Generator Interconnection Variables

	Name	Units	Description	Source
Inputs:				
	Pm	PU	Mechanical shaft power to the generator	Turbine-Governor
or	Tm	PU	Mechanical shaft torque to the generator	Turbine-Governor
Outputs:				
	ω	PU	Generator (electrical) speed	

Figure 34 – AsynchronousGeneratorInterconnectionAndVariables

Figure 34: This diagram illustrates the inputs and outputs for an asynchronous generator.



Asynchronous Motor Interconnection Variables

	Name	Units	Description	Source
Inputs:				
	Pm	PU	Mechanical shaft power of motor load	Mechanical Load
or	Tm	PU	Mechanical shaft torque of motor load	Mechanical Load
Outputs:				
	ω	PU	Motor (electrical) speed	

Figure 35 – AsynchronousMotorInterconnectionAndVariables

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Figure 35: This diagram illustrates the inputs and outputs for an asynchronous motor.

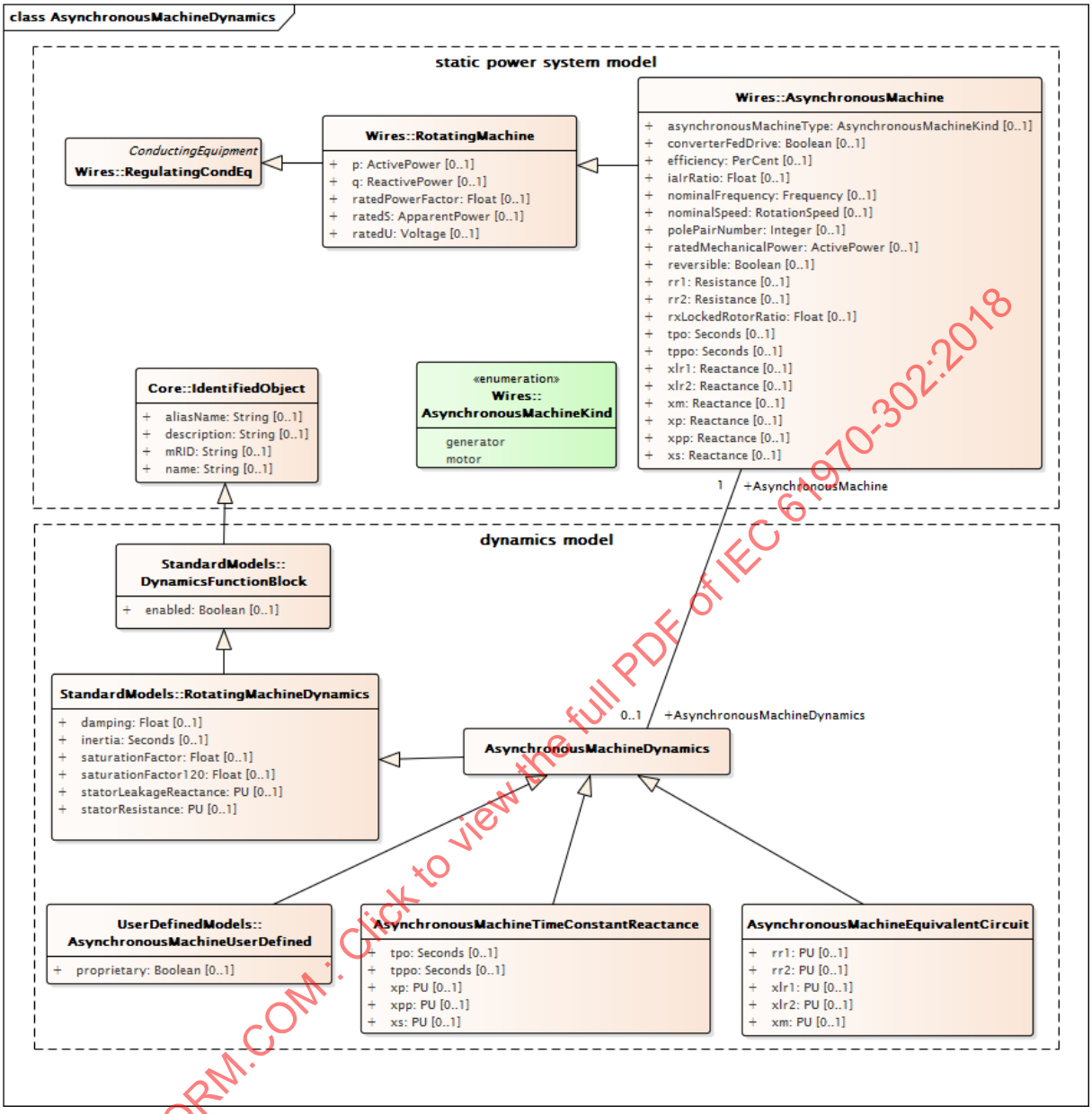

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Figure 36 – Class diagram AsynchronousMachineDynamics::AsynchronousMachineDynamics

Figure 36: This diagram shows static power system model classes and dynamics model classes related to the asynchronous machine dynamics model. An association between the AsynchronousMachineDynamics class and the AsynchronousMachine class provides a means for relating the dynamics model to the static model.

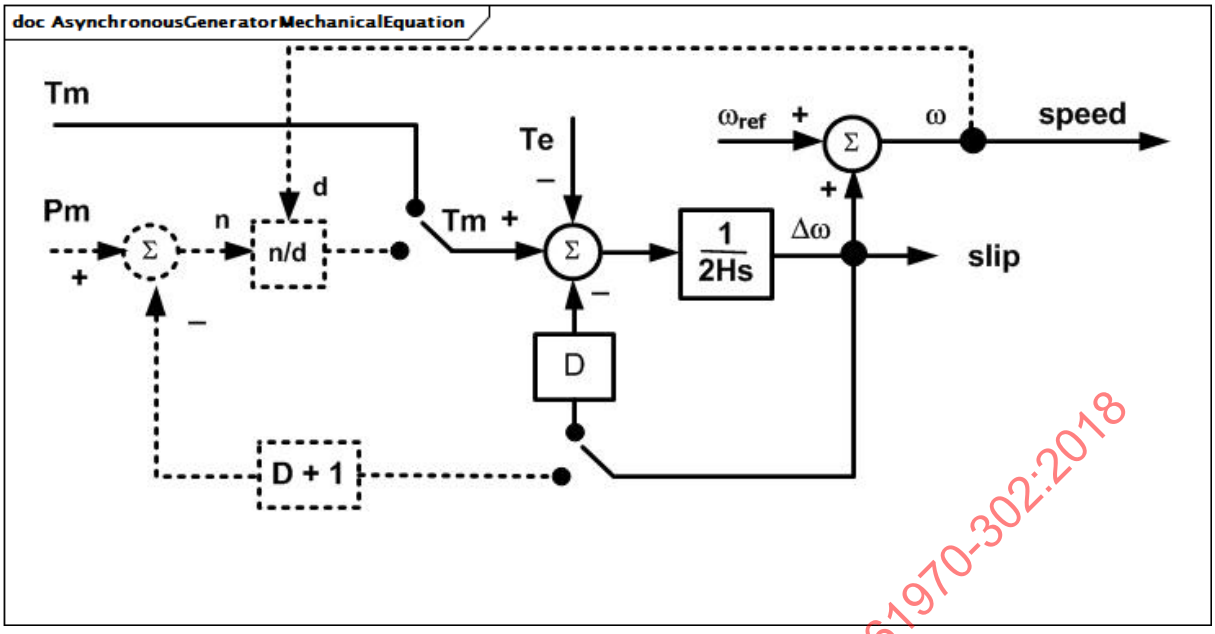

Figure 37 – AsynchronousGeneratorMechanicalEquation

Figure 37: The mechanical equations for all the variations of the asynchronous generator model are the same and can be represented by the AsynchronousGeneratorMechanicalEquation block diagram.

Parameter details:

1) All variables are PU on motor MVA base except angle, which is in radians.
2) omega0 is the system synchronous frequency in radians per s. omegaref is the PU system frequency (or isolated area frequency), which can be constant at the initial frequency or vary during a simulation depending on the application program.

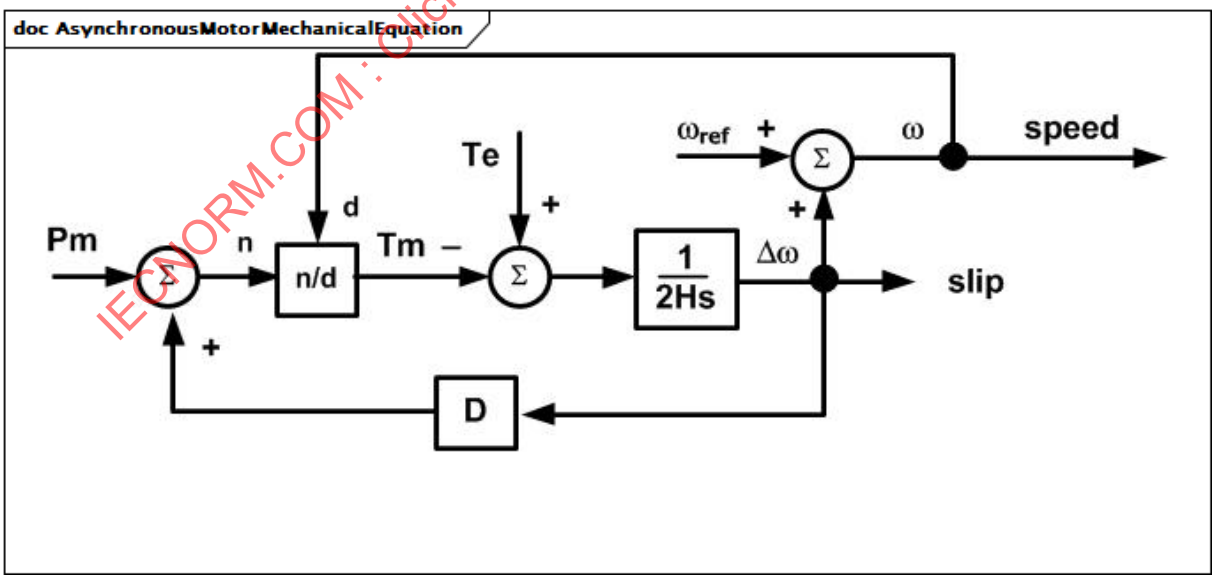

Figure 38 – AsynchronousMotorMechanicalEquation

Figure 38: The mechanical equations for all variations of the asynchronous motor model are the same and can be represented by the AsynchronousMotorMechanicalEquation diagram.

Parameter details:

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1) All variables are PU on motor MVA base except angle, which is in radians.
2) omega0 is the system synchronous frequency in radians per s. omegaref is the PU system frequency (or isolated area frequency), which can be constant at the initial frequency or vary during a simulation depending on the application program.

5.3.5.2 AsynchronousMachineDynamics

Asynchronous machine whose behaviour is described by reference to a standard model expressed in either time constant reactance form or equivalent circuit form or by definition of a user-defined model.

Parameter details:

1) Asynchronous machine parameters such as Xl, Xs, etc. are actually used as inductances in the model, but are commonly referred to as reactances since, at nominal frequency, the PU values are the same. However, some references use the symbol L instead of X.

Table 21 shows all attributes of AsynchronousMachineDynamics.

Table 21 – Attributes of AsynchronousMachineDynamics::AsynchronousMachineDynamics

name	mult	type	description
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 22 shows all association ends of AsynchronousMachineDynamics with other classes.

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Table 22 – Association ends of AsynchronousMachineDynamics::AsynchronousMachineDynamics with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	Asynchronous machine to which this asynchronous machine dynamics model applies.
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	Turbine-governor model associated with this asynchronous machine model.
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	Mechanical load model associated with this asynchronous machine model.
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	Wind generator type 1 or type 2 model associated with this asynchronous machine model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.5.3 AsynchronousMachineTimeConstantReactance

Parameter details:

1) If X'' = X', a single cage (one equivalent rotor winding per axis) is modelled.
2) The “p” in the attribute names is a substitution for a “prime” in the usual parameter notation, e.g. tpo refers to T'o.

   The parameters used for models expressed in time constant reactance form include:

   – RotatingMachine.ratedS (MVAbase);
   – RotatingMachineDynamics.damping (D);
   – RotatingMachineDynamics.inertia (H);
   – RotatingMachineDynamics.saturationFactor (S1);
   – RotatingMachineDynamics.saturationFactor120 (S12);
   – RotatingMachineDynamics.statorLeakageReactance (Xl);
   – RotatingMachineDynamics.statorResistance (Rs);
   – .xs (Xs);
   – .xp (X');
   – .xpp (X'');
   – .tpo (T'o);
   – .tppo (T''o).

Table 23 shows all attributes of AsynchronousMachineTimeConstantReactance.

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Table 23 – Attributes of AsynchronousMachineDynamics::AsynchronousMachineTimeConstantReactance

name	mult	type	description
xs	0..1	PU	Synchronous reactance (Xs) (>= AsynchronousMachineTimeConstantReactance.xp). Typical value = 1,8.
xp	0..1	PU	Transient reactance (unsaturated) (X') (>= AsynchronousMachineTimeConstantReactance.xpp). Typical value = 0,5.
xpp	0..1	PU	Subtransient reactance (unsaturated) (X'') (> RotatingMachineDynamics.statorLeakageReactance). Typical value = 0,2.
tpo	0..1	Seconds	Transient rotor time constant (T'o) (> AsynchronousMachineTimeConstantReactance.tppo). Typical value = 5.
tppo	0..1	Seconds	Subtransient rotor time constant (T''o) (> 0). Typical value = 0,03.
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 24 shows all association ends of AsynchronousMachineTimeConstantReactance with other classes.

Table 24 – Association ends of AsynchronousMachineDynamics::AsynchronousMachineTimeConstantReactance with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	inherited from: AsynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	inherited from: AsynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: AsynchronousMachineDynamics
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	inherited from: AsynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.5.4 AsynchronousMachineEquivalentCircuit

The electrical equations of all variations of the asynchronous model are based on the AsynchronousEquivalentCircuit diagram for the direct- and quadrature- axes, with two equivalent rotor windings in each axis.

Equations for conversion between equivalent circuit and time constant reactance forms:

Xs = Xm + Xl

X' = Xl + Xm x Xlr1 / (Xm + Xlr1)

X'' = Xl + Xm x Xlr1 x Xlr2 / (Xm x Xlr1 + Xm x Xlr2 + Xlr1 x Xlr2)

T'o = (Xm + Xlr1) / (omega0 x Rr1)

T''o = (Xm x Xlr1 + Xm x Xlr2 + Xlr1 x Xlr2) / (omega0 x Rr2 x (Xm + Xlr1)

Same equations using CIM attributes from AsynchronousMachineTimeConstantReactance class on left of "=" and AsynchronousMachineEquivalentCircuit class on right (except as noted):

xs = xm + RotatingMachineDynamics.statorLeakageReactance

xp = RotatingMachineDynamics.statorLeakageReactance + xm x xlr1 / (xm + xlr1)

xpp = RotatingMachineDynamics.statorLeakageReactance + xm x xlr1 x xlr2 / (xm x xlr1 + xm x xlr2 + xlr1 x xlr2)

tpo = (xm + xlr1) / (2 x pi x nominal frequency x rr1)

tppo = (xm x xlr1 + xm x xlr2 + xlr1 x xlr2) / (2 x pi x nominal frequency x rr2 x (xm + xlr1).

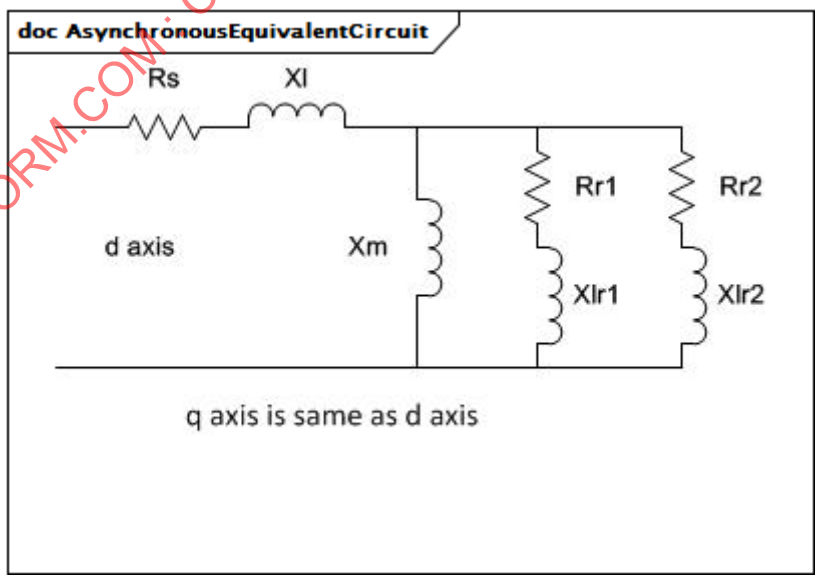

Figure 39 – AsynchronousEquivalentCircuit

Figure 39: In each axis, the branches represent the stator leakage reactance (Xl) and resistance (Rs), the magnetizing reactance (Xm), and the resistance and leakage reactance of equivalent windings (Rr1, Xlr1, etc.) on the rotor.

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Table 25 shows all attributes of AsynchronousMachineEquivalentCircuit.

Table 25 – Attributes of AsynchronousMachineDynamics::AsynchronousMachineEquivalentCircuit

name	mult	type	description
xm	0..1	PU	Magnetizing reactance.
rr1	0..1	PU	Damper 1 winding resistance.
xlr1	0..1	PU	Damper 1 winding leakage reactance.
rr2	0..1	PU	Damper 2 winding resistance.
xlr2	0..1	PU	Damper 2 winding leakage reactance.
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 26 shows all association ends of AsynchronousMachineEquivalentCircuit with other classes.

Table 26 – Association ends of AsynchronousMachineDynamics::AsynchronousMachineEquivalentCircuit with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	inherited from: AsynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	inherited from: AsynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: AsynchronousMachineDynamics
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	inherited from: AsynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6 Package TurbineGovernorDynamics

5.3.6.1 General

The turbine-governor model is linked to one or two synchronous generators and determines the shaft mechanical power (Pm) or torque (Tm) for the generator model.

Unlike IEEE standard models for other function blocks, the three IEEE turbine-governor standard models (GovHydroIEEE0, GovHydroIEEE2, and GovSteamIEEE1) are documented in IEEE Transactions, not in IEEE standards. For that reason, diagrams are supplied for those models.

A 2012 IEEE report, Dynamic Models for Turbine-Governors in Power System Studies, provides updated information on a variety of models including IEEE, vendor and reliability authority models. Fully incorporating the results of that report into the CIM dynamics model is a future effort.

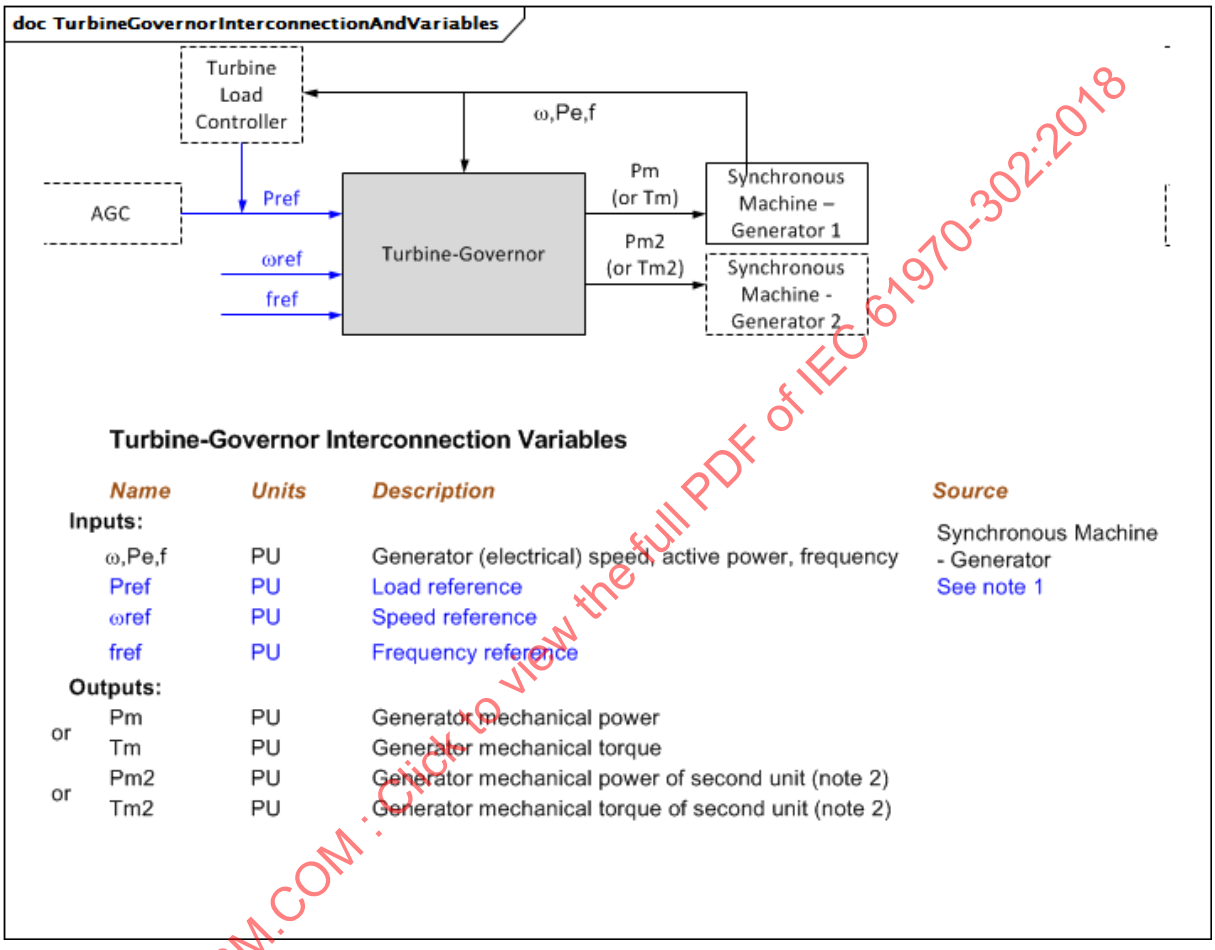

Figure 40 – TurbineGovernorInterconnectionAndVariables

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Figure 40: This diagram illustrates the inputs and outputs for a turbine-governor. Some turbine-governor models are used in cross-compound interconnections, e.g. GovSteam1, where they are connected to two generators (synchronous machines).

Diagram details:

1) Pref is usually held constant for stability analysis, but can be determined by a user-defined model or, for long-term dynamics, an area-wide automatic generation control (AGC) model. For some models, Pref has units of PU speed instead of PU power.
2) The vast majority of turbine-governor models have MWbase as a parameter. This parameter corresponds to GeneratingUnit.ratedGrossMaxP from the Production package, but is specified explicitly in the Dynamics package to support use of a different value by transient analysis tools, if needed.

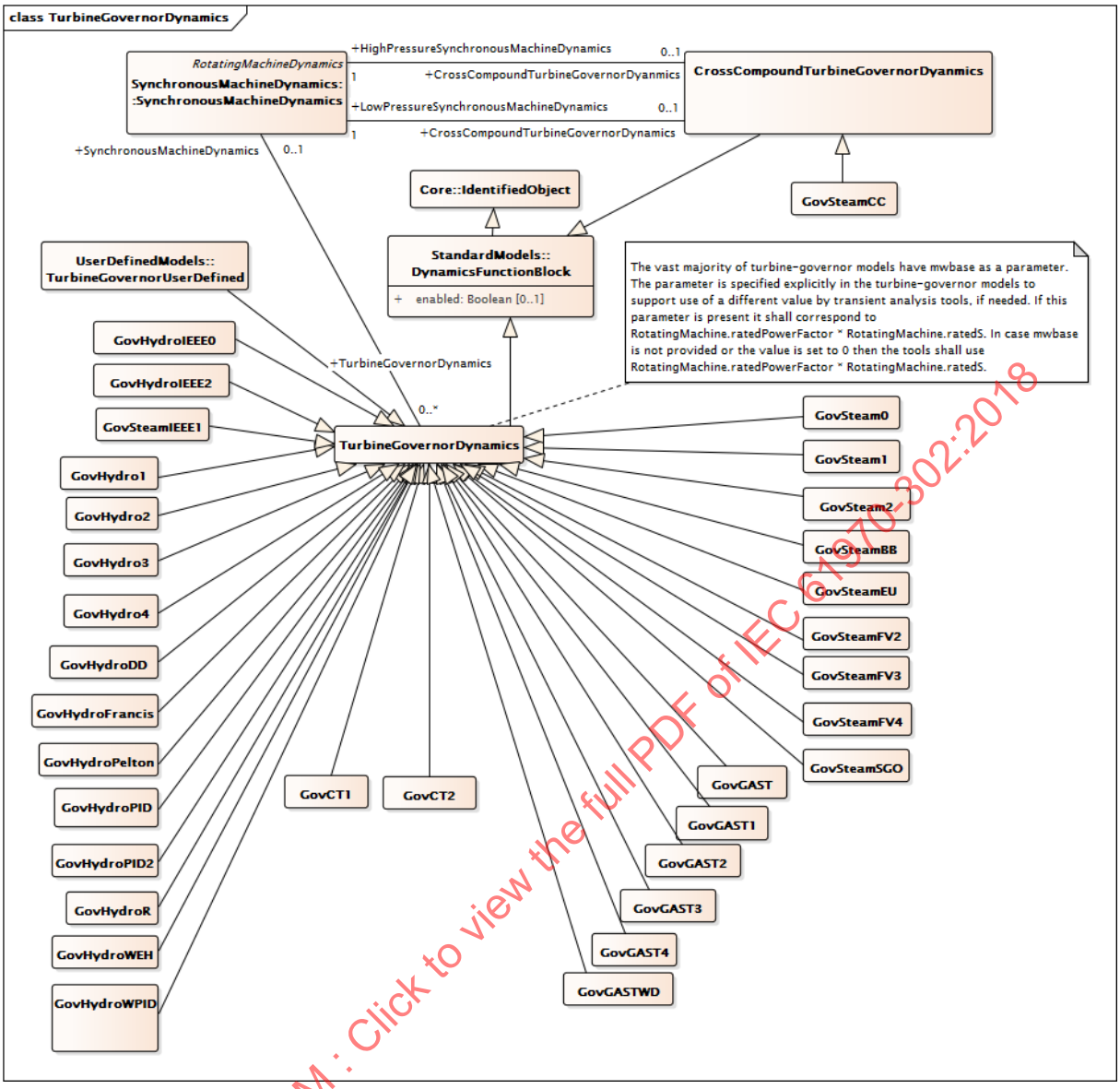

Figure 41 – Class diagram TurbineGovernorDynamics::TurbineGovernorDynamics

Figure 41: This diagram shows dynamic standard model turbine-governor classes and their inheritance from the TurbineGovernorDynamics class.

5.3.6.2 CrossCompoundTurbineGovernorDyanmics

Turbine-governor cross-compound function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 27 shows all attributes of CrossCompoundTurbineGovernorDyanmics.

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Table 27 – Attributes of TurbineGovernorDynamics::CrossCompoundTurbineGovernorDyanmics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 28 shows all association ends of CrossCompoundTurbineGovernorDyanmics with other classes.

Table 28 – Association ends of TurbineGovernorDynamics::CrossCompoundTurbineGovernorDyanmics with other classes

mult from	name	mult to	type	description
0..1	LowPressureSynchronous MachineDynamics	1..1	SynchronousMachineDynamics	Low-pressure synchronous machine with which this cross-compound turbine governor is associated.
0..1	HighPressureSynchronous MachineDynamics	1..1	SynchronousMachineDynamics	High-pressure synchronous machine with which this cross-compound turbine governor is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.3 TurbineGovernorDynamics

Turbine-governor function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 29 shows all attributes of TurbineGovernorDynamics.

Table 29 – Attributes of TurbineGovernorDynamics::TurbineGovernorDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 30 shows all association ends of TurbineGovernorDynamics with other classes.

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Table 30 – Association ends of TurbineGovernorDynamics::TurbineGovernorDynamics with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	Asynchronous machine model with which this turbine-governor model is associated. TurbineGovernorDynamics shall have either an association to SynchronousMachineDynamics or to AsynchronousMachineDynamics.
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	Synchronous machine model with which this turbine-governor model is associated. TurbineGovernorDynamics shall have either an association to SynchronousMachineDynamics or to AsynchronousMachineDynamics.
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	Turbine load controller providing input to this turbine-governor.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.4 GovHydroIEEE0

IEEE simplified hydro governor-turbine model. Used for mechanical-hydraulic and electro-hydraulic turbine governors, with or without steam feedback. Typical values given are for mechanical-hydraulic turbine-governor.

Reference: IEEE Transactions on Power Apparatus and Systems, November/December 1973, Volume PAS-92, Number 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

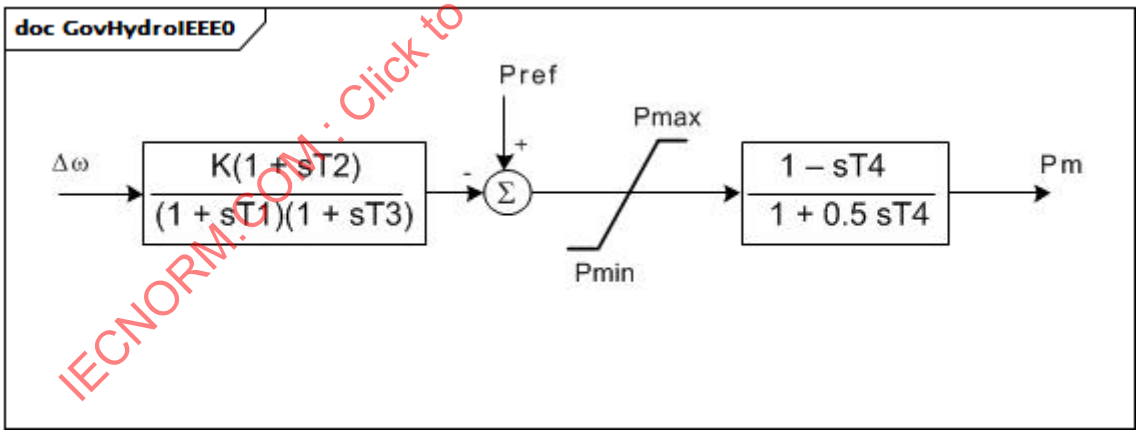

Figure 42 – GovHydroIEEE0

Figure 42: This diagram describes the CIM model interpretation of the IEEE simplified hydro governor-turbine model.

Table 31 shows all attributes of GovHydroIEEE0.

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Table 31 – Attributes of TurbineGovernorDynamics::GovHydroIEEE0

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
k	0..1	PU	Governor gain (K).
t1	0..1	Seconds	Governor lag time constant (T1) (>= 0). Typical value = 0,25.
t2	0..1	Seconds	Governor lead time constant (T2) (>= 0). Typical value = 0.
t3	0..1	Seconds	Gate actuator time constant (T3) (>= 0). Typical value = 0,1.
t4	0..1	Seconds	Water starting time (T4) (>= 0).
pmax	0..1	PU	Gate maximum (Pmax) (> GovHydroIEEE0.pmin).
pmin	0..1	PU	Gate minimum (Pmin) (< GovHydroIEEE.pmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 32 shows all association ends of GovHydroIEEE0 with other classes.

Table 32 – Association ends of TurbineGovernorDynamics::GovHydroIEEE0 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.5 GovHydroIEEE2

IEEE hydro turbine governor model represents plants with straightforward penstock configurations and hydraulic-dashpot governors.

Reference: IEEE Transactions on Power Apparatus and Systems, November/December 1973, Volume PAS-92, Number 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

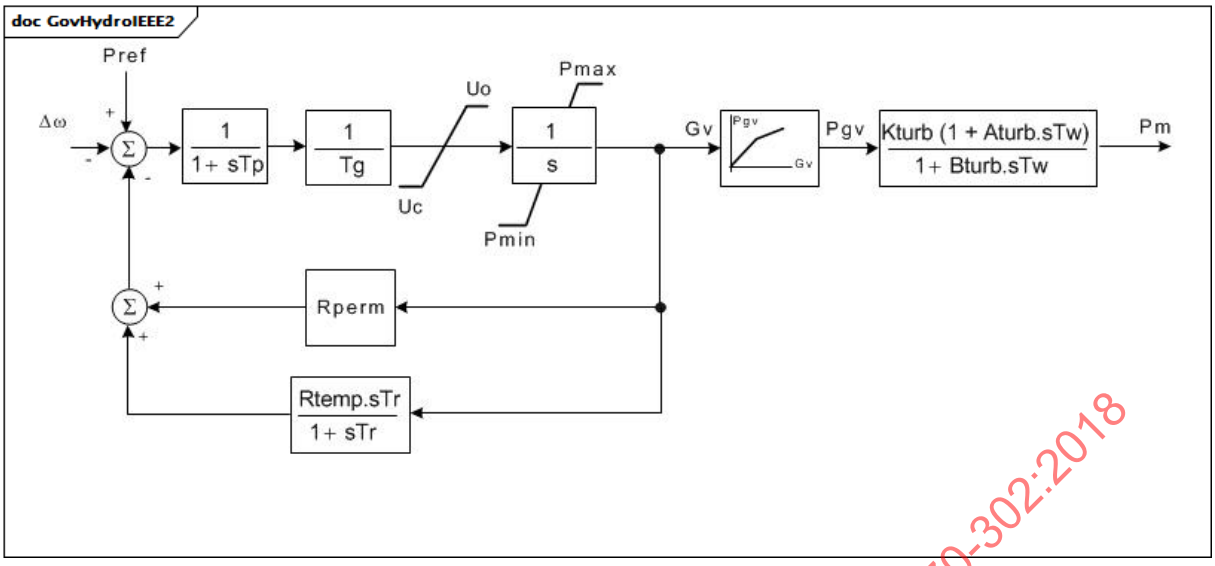

Figure 43 – GovHydroIEEE2

Figure 43: This diagram describes the CIM model interpretation of the IEEE hydro turbine governor model representing plants with straightforward penstock configurations and hydraulic-dashpot governors.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.
2) This turbine governor model is a reasonable approximation to the performance of simple hydro plants for small motions of the gates about a given load, but it represents the variation of water inertia effect with load only if the values of the turbine parameters are properly adjusted by the user as load is varied. For idealized turbine model, set Kturb = 1, Aturb = -1, Bturb = 0,5.
3) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero values, the default hydro curve (between 0,0 , 0,0 and 1,0 , 1,0) will be used.

Table 33 shows all attributes of GovHydroIEEE2.

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Table 33 – Attributes of TurbineGovernorDynamics::GovHydroIEEE2

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
tg	0..1	Seconds	Gate servo time constant (Tg) (>= 0). Typical value = 0,5.
tp	0..1	Seconds	Pilot servo valve time constant (Tp) (>= 0). Typical value = 0,03.
uo	0..1	Float	Maximum gate opening velocity (Uo). Unit = PU / s. Typical value = 0,1.
uc	0..1	Float	Maximum gate closing velocity (Uc) (<0). Typical value = -0,1.
pmax	0..1	PU	Maximum gate opening (Pmax) (> GovHydroIEEE2.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening (Pmin) (<GovHydroIEEE2.pmax). Typical value = 0.
rperm	0..1	PU	Permanent droop (Rperm). Typical value = 0,05.
rtemp	0..1	PU	Temporary droop (Rtemp). Typical value = 0,5.
tr	0..1	Seconds	Dashpot time constant (Tr) (>= 0). Typical value = 12.
tw	0..1	Seconds	Water inertia time constant (Tw) (>= 0). Typical value = 2.
kturb	0..1	PU	Turbine gain (Kturb). Typical value = 1.
aturb	0..1	PU	Turbine numerator multiplier (Aturb). Typical value = -1.
bturb	0..1	PU	Turbine denominator multiplier (Bturb) (> 0). Typical value = 0,5.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 34 shows all association ends of GovHydroIEEE2 with other classes.

Table 34 – Association ends of TurbineGovernorDynamics::GovHydroIEEE2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.6 GovSteamIEEE1

IEEE steam turbine governor model.

Reference: IEEE Transactions on Power Apparatus and Systems, November/December 1973, Volume PAS-92, Number 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

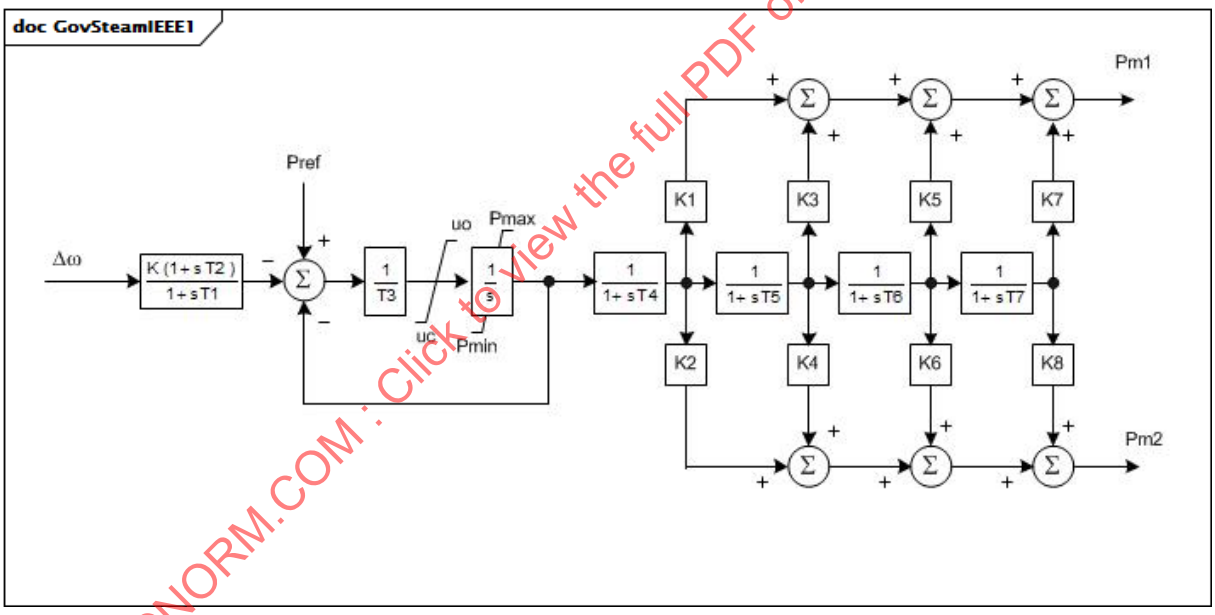

Figure 44 – GovSteamIEEE1

Figure 44: This diagram describes the CIM model interpretation of the IEEE steam turbine governor model.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.
2) For a tandem-compound turbine the parameters K2, K4, K6, and K8 are ignored. For a cross-compound turbine, two generators are connected to this turbine-governor model.
3) Each generator shall be represented in the load flow by data on its own MVA base. The values of K1, K3, K5, and K7 shall be specified to describe the proportionate development of power on the first turbine shaft. K2, K4, K6, and K8 shall describe the second turbine shaft. Normally K1 + K3 + K5 + K7 = 1,0 and K2 + K4 + K6 + K8 = 1,0 (if second generator is present).

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4) The division of power between the two shafts is in proportion to the values of MVA bases of the two generators. The initial condition load flow should, therefore, have the two generators loaded to the same fraction of each one's MVA base.

Table 35 shows all attributes of GovSteamIEEE1.

Table 35 – Attributes of TurbineGovernorDynamics::GovSteamIEEE1

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
k	0..1	PU	Governor gain (reciprocal of droop) (K) (> 0). Typical value = 25.
t1	0..1	Seconds	Governor lag time constant (T1) (>= 0). Typical value = 0.
t2	0..1	Seconds	Governor lead time constant (T2) (>= 0). Typical value = 0.
t3	0..1	Seconds	Valve positioner time constant (T3) (> 0). Typical value = 0,1.
uo	0..1	Float	Maximum valve opening velocity (Uo) (> 0). Unit = PU / s. Typical value = 1.
uc	0..1	Float	Maximum valve closing velocity (Uc) (< 0). Unit = PU / s. Typical value = -10.
pmax	0..1	PU	Maximum valve opening (Pmax) (> GovSteamIEEE1.pmin). Typical value = 1.
pmin	0..1	PU	Minimum valve opening (Pmin) (>= 0 and < GovSteamIEEE1.pmax). Typical value = 0.
t4	0..1	Seconds	Inlet piping/steam bowl time constant (T4) (>= 0). Typical value = 0,3.
k1	0..1	Float	Fraction of HP shaft power after first boiler pass (K1). Typical value = 0,2.
k2	0..1	Float	Fraction of LP shaft power after first boiler pass (K2). Typical value = 0.
t5	0..1	Seconds	Time constant of second boiler pass (T5) (>= 0). Typical value = 5.
k3	0..1	Float	Fraction of HP shaft power after second boiler pass (K3). Typical value = 0,3.
k4	0..1	Float	Fraction of LP shaft power after second boiler pass (K4). Typical value = 0.
t6	0..1	Seconds	Time constant of third boiler pass (T6) (>= 0). Typical value = 0,5.
k5	0..1	Float	Fraction of HP shaft power after third boiler pass (K5). Typical value = 0,5.
k6	0..1	Float	Fraction of LP shaft power after third boiler pass (K6). Typical value = 0.
t7	0..1	Seconds	Time constant of fourth boiler pass (T7) (>= 0). Typical value = 0.
k7	0..1	Float	Fraction of HP shaft power after fourth boiler pass (K7). Typical value = 0.
k8	0..1	Float	Fraction of LP shaft power after fourth boiler pass (K8). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 36 shows all association ends of GovSteamIEEE1 with other classes.

Table 36 – Association ends of TurbineGovernorDynamics::GovSteamIEEE1 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.7 GovCT1

General model for any prime mover with a PID governor, used primarily for combustion turbine and combined cycle units.

This model can be used to represent a variety of prime movers controlled by PID governors. It is suitable, for example, for the representation of:

- gas turbine and single shaft combined cycle turbines
- diesel engines with modern electronic or digital governors
- steam turbines where steam is supplied from a large boiler drum or a large header whose pressure is substantially constant over the period under study
- simple hydro turbines in dam configurations where the water column length is short and water inertia effects are minimal.

Additional information on this model is available in the 2012 IEEE report, Dynamic Models for Turbine-Governors in Power System Studies, 3.1.2.3 pages 3-4 (GGOV1).

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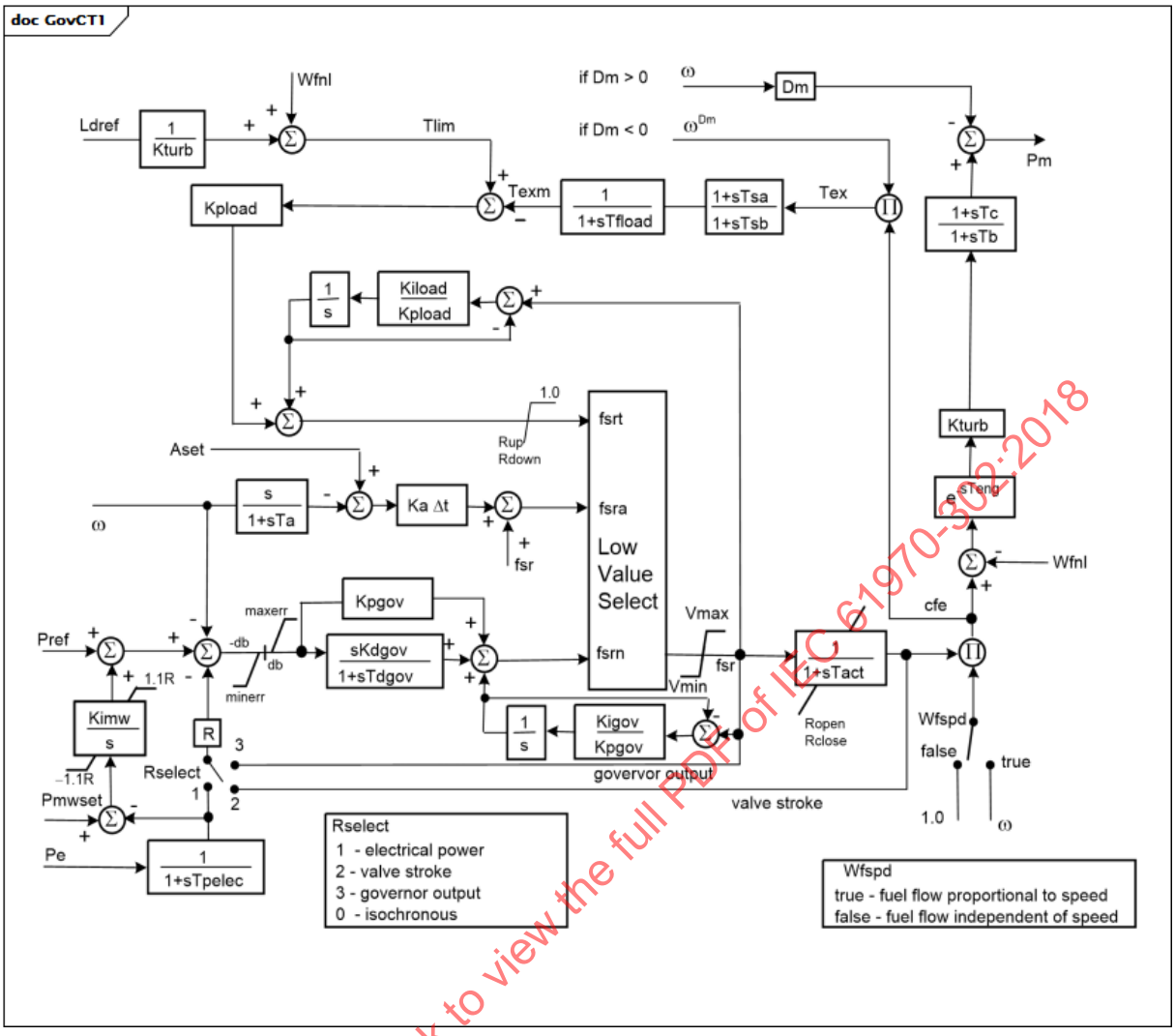

Figure 45 – GovCT1

Figure 45: This diagram describes the GovCT1 turbine governor model.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.
2) The range of fuel valve travel and of fuel flow is unity. Thus the largest possible value of Vmax is 1,0 and the smallest possible value of Vmin is zero. Vmax can, however, be reduced below unity to represent a loading limit imposed by the operator or a supervisory control system. For gas turbines Vmin should normally be greater than zero and less than Wfnl to represent a minimum firing limit. The value of the fuel flow at maximum output shall be less than, or equal to unity, depending on the value of Kturb.
3) The load limiter module can be used to impose a maximum output limit such as an exhaust temperature limit. To do this the time constant Tfload should be set to represent the time constant in the measurement of temperature (or other signal), and the gains of the limiter, Kpload and Kiload, should be set to give prompt stable control when on limit. The load limit can be deactivated by setting the parameter Ldref to a high value.

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4) This model includes a simple representation of a supervisory load controller. This controller is active if the parameter Kimw is non-zero. The load controller is a slow acting reset loop that adjusts the speed/load reference of the turbine governor to hold the electrical power output of the unit at its initial condition value. This value is stored in the parameter Pmwset (which equals Pe, initial generated power) when the model is initialized, and can be changed thereafter. The load controller shall be adjusted to respond gently relative to the speed governor.

5) The parameters Aset, Ka, and Ta describe an acceleration limiter. Ta shall be non-zero, but the acceleration limiter can be disabled by setting Aset to a large value, such as 1.

6) The parameters Tsa and Tsb are provided to augment the exhaust gas temperature measurement subsystem in gas turbines. For example, they can be set to values such as 4,0 and 5,0, to represent the 'radiation shield' element of large gas turbines.

7) The parameters Rup and Rdown specify the maximum rate of increase and decrease of the output of the load limit controller (Kpload / Kiload). These parameters should normally be set, or defaulted to 99 / -99, but can be given particular values to represent the temperature limit controls of some General ElectricTM heavy-duty engine controls. [Footnote: GE heavy-duty engine controls are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

8) The fuel flow command fsr is determined by whichever is lowest of fsrt, fsra, and fsrn. Although not explicitly shown in the GovCT1 diagram, the signals that are not in control track fsr so that they do not "windup" beyond that value. This represents GE gas turbine control practice but might not be true for other controller designs.

9) As shown in the GovCT1 diagram, when Kpgov is non-zero, the governor PI control is implemented to "track" fsr to prevent windup when fsr is limited by another signal (fsrt, fsra) or Vmax/Vmin. If Kpgov is zero, the integral path is implemented directly. The same applies to the load limiter PI control with regard to Kpload.

10) The parameter delta t in the block diagram is the simulation time step. It is not exchanged with the dataset. In cases where applications are using variable time step the results of the simulations could be different. In such situations the application applies a default value which is 0,001.

Table 37 shows all attributes of GovCT1.

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Table 37 – Attributes of TurbineGovernorDynamics::GovCT1

name	mult	type	description
aset	0..1	Float	Acceleration limiter setpoint (Aset). Unit = PU / s. Typical value = 0,01.
db	0..1	PU	Speed governor deadband in PU speed (db). In the majority of applications, it is recommended that this value be set to zero. Typical value = 0.
dm	0..1	PU	Speed sensitivity coefficient (Dm). Dm can represent either the variation of the engine power with the shaft speed or the variation of maximum power capability with shaft speed. If it is positive it describes the falling slope of the engine speed verses power characteristic as speed increases. A slightly falling characteristic is typical for reciprocating engines and some aero-derivative turbines. If it is negative the engine power is assumed to be unaffected by the shaft speed, but the maximum permissible fuel flow is taken to fall with falling shaft speed. This is characteristic of single-shaft industrial turbines due to exhaust temperature limits. Typical value = 0.
ka	0..1	PU	Acceleration limiter gain (Ka). Typical value = 10.
kdgov	0..1	PU	Governor derivative gain (Kdgov). Typical value = 0.
kigov	0..1	PU	Governor integral gain (Kigov). Typical value = 2.
kiload	0..1	PU	Load limiter integral gain for PI controller (Kiload). Typical value = 0,67.
kimw	0..1	PU	Power controller (reset) gain (Kimw). The default value of 0,01 corresponds to a reset time of 100 s. A value of 0,001 corresponds to a relatively slow-acting load controller. Typical value = 0,01.
kpgov	0..1	PU	Governor proportional gain (Kpgov). Typical value = 10.
kpload	0..1	PU	Load limiter proportional gain for PI controller (Kpload). Typical value = 2.
kturb	0..1	PU	Turbine gain (Kturb) (> 0). Typical value = 1,5.
ldref	0..1	PU	Load limiter reference value (Ldref). Typical value = 1.
maxerr	0..1	PU	Maximum value for speed error signal (maxerr) (> GovCT1.minerr). Typical value = 0,05.
minerr	0..1	PU	Minimum value for speed error signal (minerr) (< GovCT1.maxerr). Typical value = -0,05.
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
r	0..1	PU	Permanent droop (R). Typical value = 0,04.
rclose	0..1	Float	Minimum valve closing rate (Rclose). Unit = PU / s. Typical value = -0,1.
rdown	0..1	PU	Maximum rate of load limit decrease (Rdown). Typical value = -99.
ropen	0..1	Float	Maximum valve opening rate (Ropen). Unit = PU / s. Typical value = 0.10.
rselect	0..1	DroopSignalFeedbackKind	Feedback signal for droop (Rselect). Typical value = electricalPower.
rup	0..1	PU	Maximum rate of load limit increase (Rup). Typical value = 99.
ta	0..1	Seconds	Acceleration limiter time constant (Ta) (> 0). Typical value = 0,1.
tact	0..1	Seconds	Actuator time constant (Tact) (>= 0). Typical value = 0,5.

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name	mult	type	description
tb	0..1	Seconds	Turbine lag time constant (Tb) (> 0). Typical value = 0,5.
tc	0..1	Seconds	Turbine lead time constant (Tc) (>= 0). Typical value = 0.
tdgov	0..1	Seconds	Governor derivative controller time constant (Tdgov) (>= 0). Typical value = 1.
teng	0..1	Seconds	Transport time delay for diesel engine used in representing diesel engines where there is a small but measurable transport delay between a change in fuel flow setting and the development of torque (Teng) (>= 0). Teng should be zero in all but special cases where this transport delay is of particular concern. Typical value = 0.
tfload	0..1	Seconds	Load-limiter time constant (Tfload) (> 0). Typical value = 3.
tpelec	0..1	Seconds	Electrical power transducer time constant (Tpelec) (> 0). Typical value = 1.
tsa	0..1	Seconds	Temperature detection lead time constant (Tsa) (>= 0). Typical value = 4.
tsb	0..1	Seconds	Temperature detection lag time constant (Tsb) (>= 0). Typical value = 5.
vmax	0..1	PU	Maximum valve position limit (Vmax) (> GovCT1.vmin). Typical value = 1.
vmin	0..1	PU	Minimum valve position limit (Vmin) (< GovCT1.vmax). Typical value = 0,15.
wfnl	0..1	PU	No load fuel flow (Wfnl). Typical value = 0,2.
wfspd	0..1	Boolean	Switch for fuel source characteristic to recognize that fuel flow, for a given fuel valve stroke, can be proportional to engine speed (Wfspd). true = fuel flow proportional to speed (for some gas turbines and diesel engines with positive displacement fuel injectors) false = fuel control system keeps fuel flow independent of engine speed. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 38 shows all association ends of GovCT1 with other classes.

Table 38 – Association ends of TurbineGovernorDynamics::GovCT1 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.8 GovCT2

General governor with frequency-dependent fuel flow limit. This model is a modification of the GovCT1 model in order to represent the frequency-dependent fuel flow limit of a specific gas turbine manufacturer.

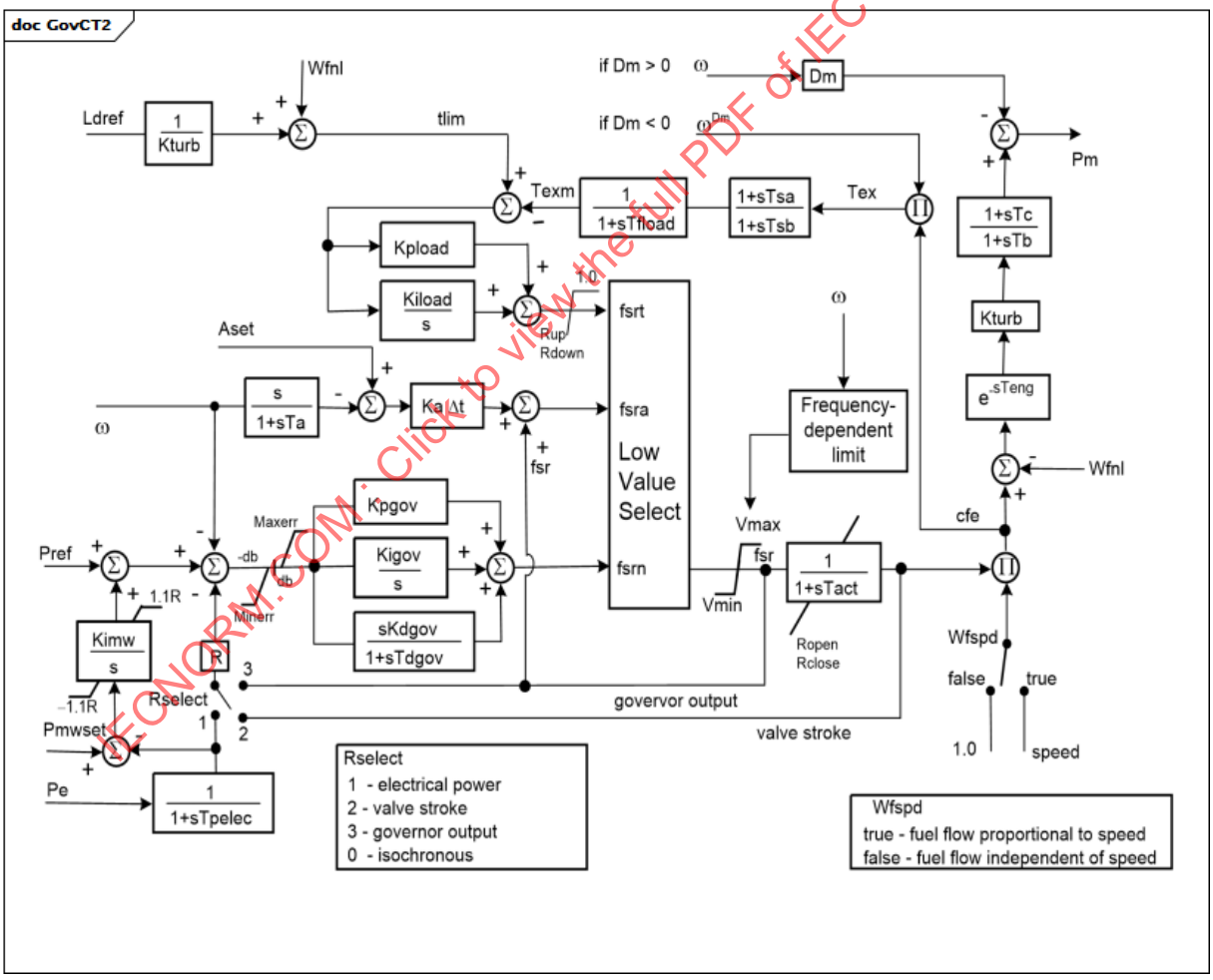

Figure 46 – GovCT2

Figure 46: This diagram describes the GovCT2 turbine governor model.

Parameter Details:

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1) The frequency-dependent limit reduces the Vmax limit on fuel flow signal (fsr). For normal operation, the limiter performs no action. When frequency (generator speed) drops below Flim1, the highest frequency data point, the desired value for the power limit (Plim) is determined by linear interpolation between associated data pairs. The maximum value of the limiter (Vmax) will ramp to the fsr value corresponding to Plim (Plim / Kturb + Wfnl) at the Prate ramp rate. Plim will be updated as the frequency changes. If the frequency subsequently rises back above Flim1, the value of the limit will ramp up at the rate Prate back to the normal value of Vmax.
2) The frequency-dependent limit is defined by a set of up to 10 pairs of points relating frequency (generator speed in Hz) and power. The points shall be monotonically decreasing in both the magnitude of frequency and power. If fewer than 10 points are needed to define the relationship, values of zero shall be entered for the remaining frequencies and power limits. The value of the last non-zero data pair is used as a lower limit, that is, the last two values are not extrapolated to calculate lower power limits. If there is only one set of frequency and power limits, those values will be used as a single limit of power applied at that frequency and below.
3) Refer to the GovCT1 model for other parameter details. Aside from the frequency-dependent limit, GovCT2 is identical to GovCT1, except that the temperature fuel command fsrt does not track fsr when it is not in control. Instead, it stays at its upper limit (1.).
4) The Kpgov/Kigov and Kpload/Kiload controllers include tracking logic to ensure smooth transfer between active controllers. This logic is not shown on the GovCT2 diagram.
5) Pmwset equals Pe, initial generated power.
6) The parameter delta t in the block diagram is the simulation time step. It is not exchanged with the dataset. In cases where applications are using variable time step the results of the simulations could be different. In such situations the application applies a default value which is 0,001.

Table 39 shows all attributes of GovCT2.

Table 39 – Attributes of TurbineGovernorDynamics::GovCT2

name	mult	type	description
aset	0..1	Float	Acceleration limiter setpoint (Aset). Unit = PU / s. Typical value = 10.
db	0..1	PU	Speed governor deadband in PU speed (db). In the majority of applications, it is recommended that this value be set to zero. Typical value = 0.
dm	0..1	PU	Speed sensitivity coefficient (Dm). Dm can represent either the variation of the engine power with the shaft speed or the variation of maximum power capability with shaft speed. If it is positive it describes the falling slope of the engine speed verses power characteristic as speed increases. A slightly falling characteristic is typical for reciprocating engines and some aero-derivative turbines. If it is negative the engine power is assumed to be unaffected by the shaft speed, but the maximum permissible fuel flow is taken to fall with falling shaft speed. This is characteristic of single-shaft industrial turbines due to exhaust temperature limits. Typical value = 0.
flim1	0..1	Frequency	Frequency threshold 1 (Flim1). Unit = Hz. Typical value = 59.
flim10	0..1	Frequency	Frequency threshold 10 (Flim10). Unit = Hz. Typical value = 0.
flim2	0..1	Frequency	Frequency threshold 2 (Flim2). Unit = Hz. Typical value = 0.
flim3	0..1	Frequency	Frequency threshold 3 (Flim3). Unit = Hz. Typical value = 0.

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name	mult	type	description
flim4	0..1	Frequency	Frequency threshold 4 (Flim4). Unit = Hz. Typical value = 0.
flim5	0..1	Frequency	Frequency threshold 5 (Flim5). Unit = Hz. Typical value = 0.
flim6	0..1	Frequency	Frequency threshold 6 (Flim6). Unit = Hz. Typical value = 0.
flim7	0..1	Frequency	Frequency threshold 7 (Flim7). Unit = Hz. Typical value = 0.
flim8	0..1	Frequency	Frequency threshold 8 (Flim8). Unit = Hz. Typical value = 0.
flim9	0..1	Frequency	Frequency threshold 9 (Flim9). Unit = Hz. Typical value = 0.
ka	0..1	PU	Acceleration limiter gain (Ka). Typical value = 10.
kdgov	0..1	PU	Governor derivative gain (Kdgov). Typical value = 0.
kigov	0..1	PU	Governor integral gain (Kigov). Typical value = 0,45.
kiload	0..1	PU	Load limiter integral gain for PI controller (Kiload). Typical value = 1.
kimw	0..1	PU	Power controller (reset) gain (Kimw). The default value of 0,01 corresponds to a reset time of 100 seconds. A value of 0,001 corresponds to a relatively slow-acting load controller. Typical value = 0.
kpgov	0..1	PU	Governor proportional gain (Kpgov). Typical value = 4.
kpload	0..1	PU	Load limiter proportional gain for PI controller (Kpload). Typical value = 1.
kturb	0..1	PU	Turbine gain (Kturb). Typical value = 1,9168.
ldref	0..1	PU	Load limiter reference value (Ldref). Typical value = 1.
maxerr	0..1	PU	Maximum value for speed error signal (Maxerr) (> GovCT2.minerr). Typical value = 1.
minerr	0..1	PU	Minimum value for speed error signal (Minerr) (< GovCT2.maxerr). Typical value = -1.
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
plim1	0..1	PU	Power limit 1 (Plim1). Typical value = 0,8325.
plim10	0..1	PU	Power limit 10 (Plim10). Typical value = 0.
plim2	0..1	PU	Power limit 2 (Plim2). Typical value = 0.
plim3	0..1	PU	Power limit 3 (Plim3). Typical value = 0.
plim4	0..1	PU	Power limit 4 (Plim4). Typical value = 0.
plim5	0..1	PU	Power limit 5 (Plim5). Typical value = 0.
plim6	0..1	PU	Power limit 6 (Plim6). Typical value = 0.
plim7	0..1	PU	Power limit 7 (Plim7). Typical value = 0.
plim8	0..1	PU	Power limit 8 (Plim8). Typical value = 0.
plim9	0..1	PU	Power Limit 9 (Plim9). Typical value = 0.
prate	0..1	PU	Ramp rate for frequency-dependent power limit (Prate). Typical value = 0,017.
r	0..1	PU	Permanent droop (R). Typical value = 0,05.
rclose	0..1	Float	Minimum valve closing rate (Rclose). Unit = PU / s. Typical value = -99.

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name	mult	type	description
rdown	0..1	PU	Maximum rate of load limit decrease (Rdown). Typical value = -99.
ropen	0..1	Float	Maximum valve opening rate (Ropen). Unit = PU / s. Typical value = 99.
rselect	0..1	DroopSignalFeedbackKind	Feedback signal for droop (Rselect). Typical value = electricalPower.
rup	0..1	PU	Maximum rate of load limit increase (Rup). Typical value = 99.
ta	0..1	Seconds	Acceleration limiter time constant (Ta) (>= 0). Typical value = 1.
tact	0..1	Seconds	Actuator time constant (Tact) (>= 0). Typical value = 0,4.
tb	0..1	Seconds	Turbine lag time constant (Tb) (>= 0). Typical value = 0,1.
tc	0..1	Seconds	Turbine lead time constant (Tc) (>= 0). Typical value = 0.
tdgov	0..1	Seconds	Governor derivative controller time constant (Tdgov) (>= 0). Typical value = 1.
teng	0..1	Seconds	Transport time delay for diesel engine used in representing diesel engines where there is a small but measurable transport delay between a change in fuel flow setting and the development of torque (Teng) (>= 0). Teng should be zero in all but special cases where this transport delay is of particular concern. Typical value = 0.
tfload	0..1	Seconds	Load limiter time constant (Tfload) (>= 0). Typical value = 3.
tpelec	0..1	Seconds	Electrical power transducer time constant (Tpelec) (>= 0). Typical value = 2,5.
tsa	0..1	Seconds	Temperature detection lead time constant (Tsa) (>= 0). Typical value = 0.
tsb	0..1	Seconds	Temperature detection lag time constant (Tsb) (>= 0). Typical value = 50.
vmax	0..1	PU	Maximum valve position limit (Vmax) (> GovCT2.vmin). Typical value = 1.
vmin	0..1	PU	Minimum valve position limit (Vmin) (< GovCT2.vmax). Typical value = 0,175.
wfnl	0..1	PU	No load fuel flow (Wfnl). Typical value = 0,187.
wfspd	0..1	Boolean	Switch for fuel source characteristic to recognize that fuel flow, for a given fuel valve stroke, can be proportional to engine speed (Wfspd). true = fuel flow proportional to speed (for some gas turbines and diesel engines with positive displacement fuel injectors) false = fuel control system keeps fuel flow independent of engine speed. Typical value = false.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 40 shows all association ends of GovCT2 with other classes.

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Table 40 – Association ends of TurbineGovernorDynamics::GovCT2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.9 GovGAST

Single shaft gas turbine.

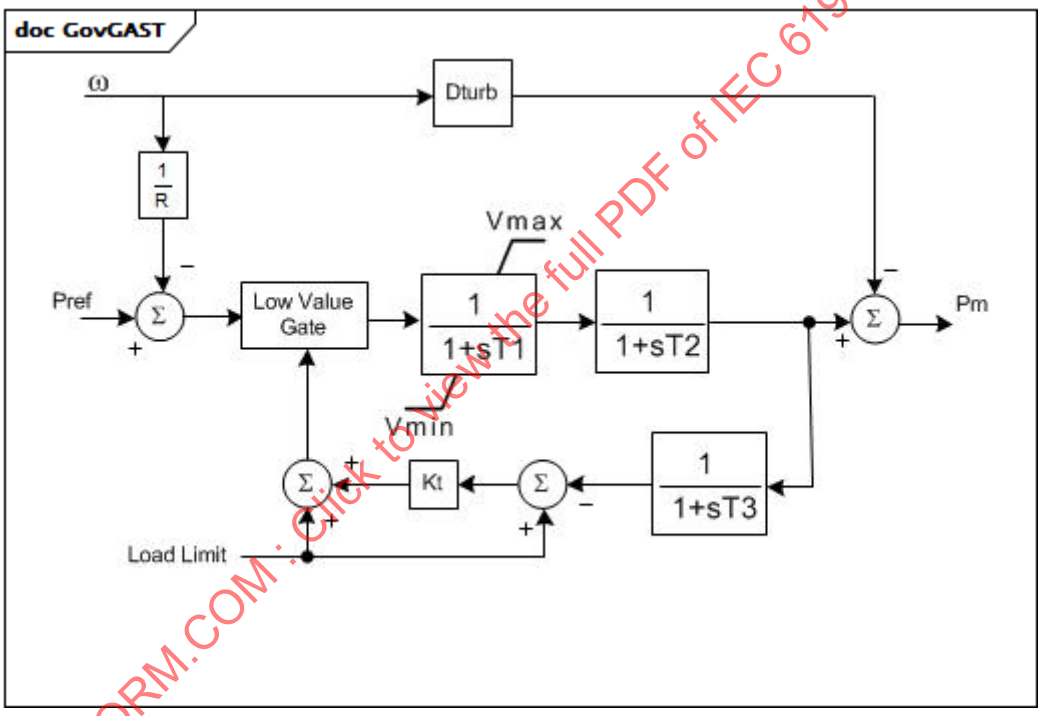

Figure 47 – GovGAST

Figure 47: This diagram describes the GovGAST turbine governor model.

Table 41 shows all attributes of GovGAST.

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Table 41 – Attributes of TurbineGovernorDynamics::GovGAST

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
r	0..1	PU	Permanent droop (R) (>0). Typical value = 0,04.
t1	0..1	Seconds	Governor mechanism time constant (T1) (>= 0). T1 represents the natural valve positioning time constant of the governor for small disturbances, as seen when rate limiting is not in effect. Typical value = 0,5.
t2	0..1	Seconds	Turbine power time constant (T2) (>= 0). T2 represents delay due to internal energy storage of the gas turbine engine. T2 can be used to give a rough approximation to the delay associated with acceleration of the compressor spool of a multi-shaft engine, or with the compressibility of gas in the plenum of a free power turbine of an aero-derivative unit, for example. Typical value = 0,5.
t3	0..1	Seconds	Turbine exhaust temperature time constant (T3) (>= 0). Typical value = 3.
at	0..1	PU	Ambient temperature load limit (Load Limit). Typical value = 1.
kt	0..1	PU	Temperature limiter gain (Kt). Typical value = 3.
vmax	0..1	PU	Maximum turbine power, PU of MWbase (Vmax) (> GovGAST.vmin). Typical value = 1.
vmin	0..1	PU	Minimum turbine power, PU of MWbase (Vmin) (< GovGAST.vmax). Typical value = 0.
dturb	0..1	PU	Turbine damping factor (Dturb). Typical value = 0,18.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 42 shows all association ends of GovGAST with other classes.

Table 42 – Association ends of TurbineGovernorDynamics::GovGAST with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.10 GovGAST1

Modified single shaft gas turbine.

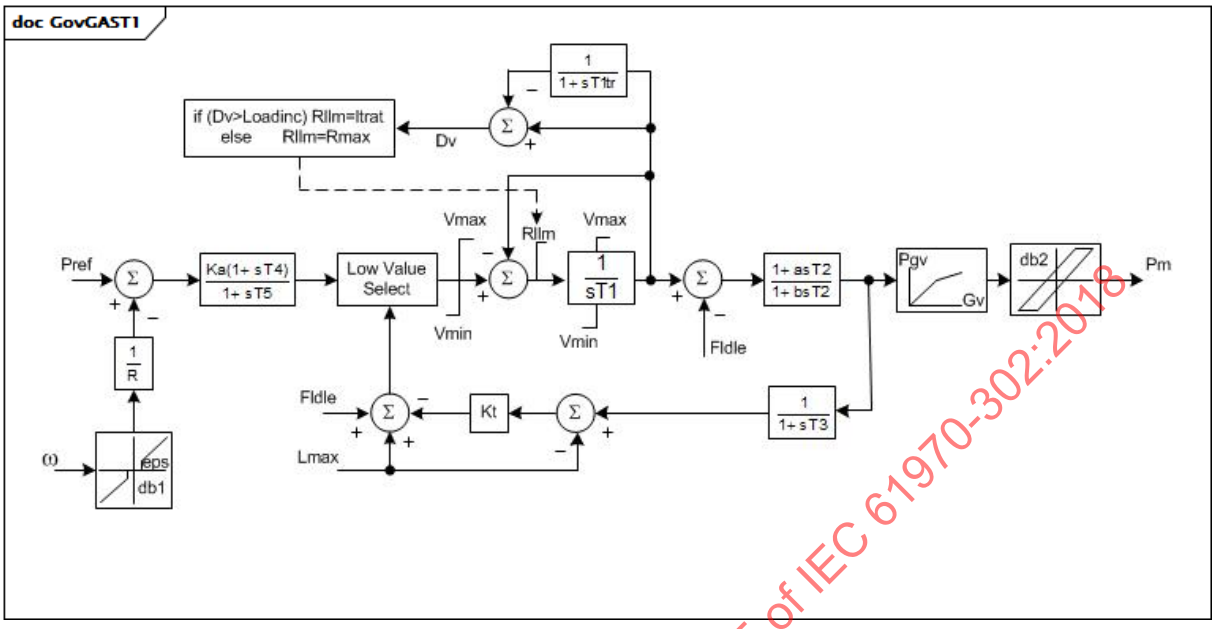

Figure 48 – GovGAST1

Figure 48: This diagram describes the GovGAST1 turbine governor model.

Parameter details:

1) Rmax, Linc, Tltr, Ltrate represent a loading rate limit subsystem. For small excursions about a steady load, the fuel valve can open at a rate of Rmax PU / s. The time constant, Tltr, is used to obtain a long term average valve position. When a large output increase is called for, the fuel valve is allowed to open at the full rate only until the valve opening has moved ahead of the long term average position by Linc PU. After this the valve is permitted to open only at the rate, Ltrat, until the long term average position catches up.
2) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0, 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Vmax > 1,0, the input and output are scaled by Vmax. If Gv1 is a negative number or zero values, the default curve (between 0,0 , 0,0 and 1,0 , 1,0) will be used.

Table 43 shows all attributes of GovGAST1.

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Table 43 – Attributes of TurbineGovernorDynamics::GovGAST1

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
r	0..1	PU	Permanent droop (R) (>0). Typical value = 0,04.
t1	0..1	Seconds	Governor mechanism time constant (T1) (>= 0). T1 represents the natural valve positioning time constant of the governor for small disturbances, as seen when rate limiting is not in effect. Typical value = 0,5.
t2	0..1	Seconds	Turbine power time constant (T2) (>= 0). T2 represents delay due to internal energy storage of the gas turbine engine. T2 can be used to give a rough approximation to the delay associated with acceleration of the compressor spool of a multi-shaft engine, or with the compressibility of gas in the plenum of the free power turbine of an aero-derivative unit, for example. Typical value = 0,5.
t3	0..1	Seconds	Turbine exhaust temperature time constant (T3) (>= 0). T3 represents delay in the exhaust temperature and load limiting system. Typical value = 3.
lmax	0..1	PU	Ambient temperature load limit (Lmax). Lmax is the turbine power output corresponding to the limiting exhaust gas temperature. Typical value = 1.
kt	0..1	PU	Temperature limiter gain (Kt). Typical value = 3.
vmax	0..1	PU	Maximum turbine power, PU of MWbase (Vmax) (> GovGAST1.vmin). Typical value = 1.
vmin	0..1	PU	Minimum turbine power, PU of MWbase (Vmin) (< GovGAST1.vmax). Typical value = 0.
fidle	0..1	PU	Fuel flow at zero power output (Fidle). Typical value = 0,18.
rmax	0..1	Float	Maximum fuel valve opening rate (Rmax). Unit = PU / s. Typical value = 1.
loadinc	0..1	PU	Valve position change allowed at fast rate (Loadinc). Typical value = 0,05.
tltr	0..1	Seconds	Valve position averaging time constant (Tltr) (>= 0). Typical value = 10.
ltrate	0..1	Float	Maximum long term fuel valve opening rate (Ltrate). Typical value = 0,02.
a	0..1	Float	Turbine power time constant numerator scale factor (a). Typical value = 0,8.
b	0..1	Float	Turbine power time constant denominator scale factor (b) (>0). Typical value = 1.
db1	0..1	Frequency	Intentional dead-band width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2,PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
ka	0..1	PU	Governor gain (Ka). Typical value = 0.
t4	0..1	Seconds	Governor lead time constant (T4) (>= 0). Typical value = 0.
t5	0..1	Seconds	Governor lag time constant (T5) (>= 0). If = 0, entire gain and lead-lag block is bypassed. Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject

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name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 44 shows all association ends of GovGAST1 with other classes.

Table 44 – Association ends of TurbineGovernorDynamics::GovGAST1 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.11 GovGAST2

Gas turbine.

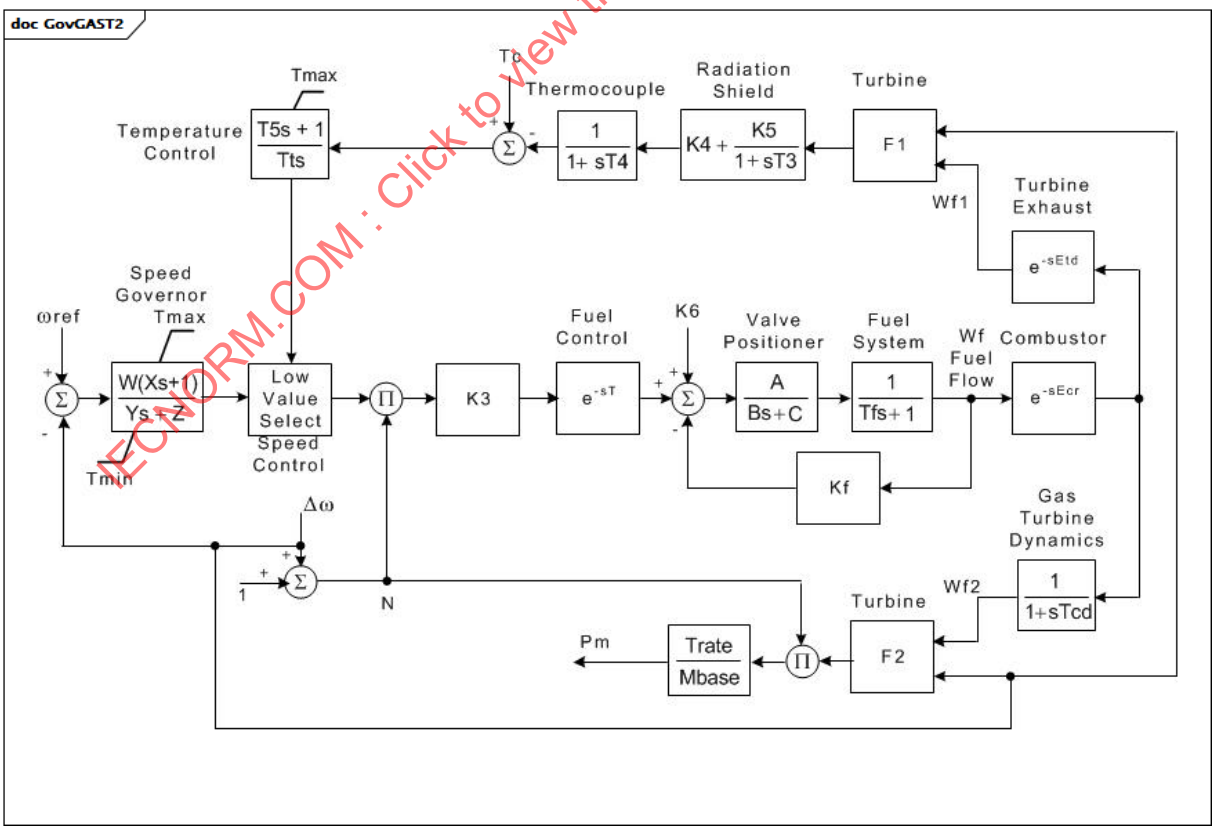

Figure 49 – GovGAST2

Figure 49: This diagram describes the GovGAST2 turbine governor model.

Parameter details:

1) Temperature control output is set to output of speed governor when temperature control input changes from positive to negative.
2) F1 = Tr – Af1(1 – Wf1) – Bf1(delta omega).
3) F2 = Af2 + Bf2(Wf2) – Cf2(delta omega).

Table 45 shows all attributes of GovGAST2.

Table 45 – Attributes of TurbineGovernorDynamics::GovGAST2

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
w	0..1	PU	Governor gain (1/droop) on turbine rating (W).
x	0..1	Seconds	Governor lead time constant (X) (>= 0).
y	0..1	Seconds	Governor lag time constant (Y) (> 0).
z	0..1	Integer	Governor mode (Z). 1 = droop 0 = isochronous.
etd	0..1	Seconds	Turbine and exhaust delay (Etd) (>= 0).
tcd	0..1	Seconds	Compressor discharge time constant (Tcd) (>= 0).
trate	0..1	ActivePower	Turbine rating (Trate). Unit = MW.
t	0..1	Seconds	Fuel control time constant (T) (>= 0).
tmax	0..1	PU	Maximum turbine limit (Tmax) (> GovGAST2.tmin).
tmin	0..1	PU	Minimum turbine limit (Tmin) (< GovGAST2.tmax).
ecr	0..1	Seconds	Combustion reaction time delay (Ecr) (>= 0).
k3	0..1	PU	Ratio of fuel adjustment (K3).
a	0..1	Float	Valve positioner (A).
b	0..1	Float	Valve positioner (B).
c	0..1	Float	Valve positioner (C).
tf	0..1	Seconds	Fuel system time constant (Tf) (>= 0).
kf	0..1	PU	Fuel system feedback (Kf).
k5	0..1	PU	Gain of radiation shield (K5).
k4	0..1	PU	Gain of radiation shield (K4).
t3	0..1	Seconds	Radiation shield time constant (T3) (>= 0).
t4	0..1	Seconds	Thermocouple time constant (T4) (>= 0).
tt	0..1	Seconds	Temperature controller integration rate (Tt) (>= 0).
t5	0..1	Seconds	Temperature control time constant (T5) (>= 0).
af1	0..1	PU	Exhaust temperature parameter (Af1). Unit = PU temperature. Based on temperature in degrees C.
bf1	0..1	PU	(Bf1). Bf1 = E(1 – W) where E (speed sensitivity coefficient) is 0,55 to 0,65 x Tr. Unit = PU temperature. Based on temperature in degrees C.
af2	0..1	PU	Coefficient equal to 0,5(1-speed) (Af2).
bf2	0..1	PU	Turbine torque coefficient Khhv (depends on heating value of fuel stream in combustion chamber) (Bf2).
cf2	0..1	PU	Coefficient defining fuel flow where power output is 0% (Cf2). Synchronous but no output. Typically 0,23 x Khhv (23% fuel flow).
tr	0..1	Temperature	Rated temperature (Tr). Unit = °C depending on parameters Af1 and Bf1.
k6	0..1	PU	Minimum fuel flow (K6).

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name	mult	type	description
tc	0..1	Temperature	Temperature control (Tc). Unit = °F or °C depending on parameters Af1 and Bf1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 46 shows all association ends of GovGAST2 with other classes.

Table 46 – Association ends of TurbineGovernorDynamics::GovGAST2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.12 GovGAST3

Generic turbogas with acceleration and temperature controller.

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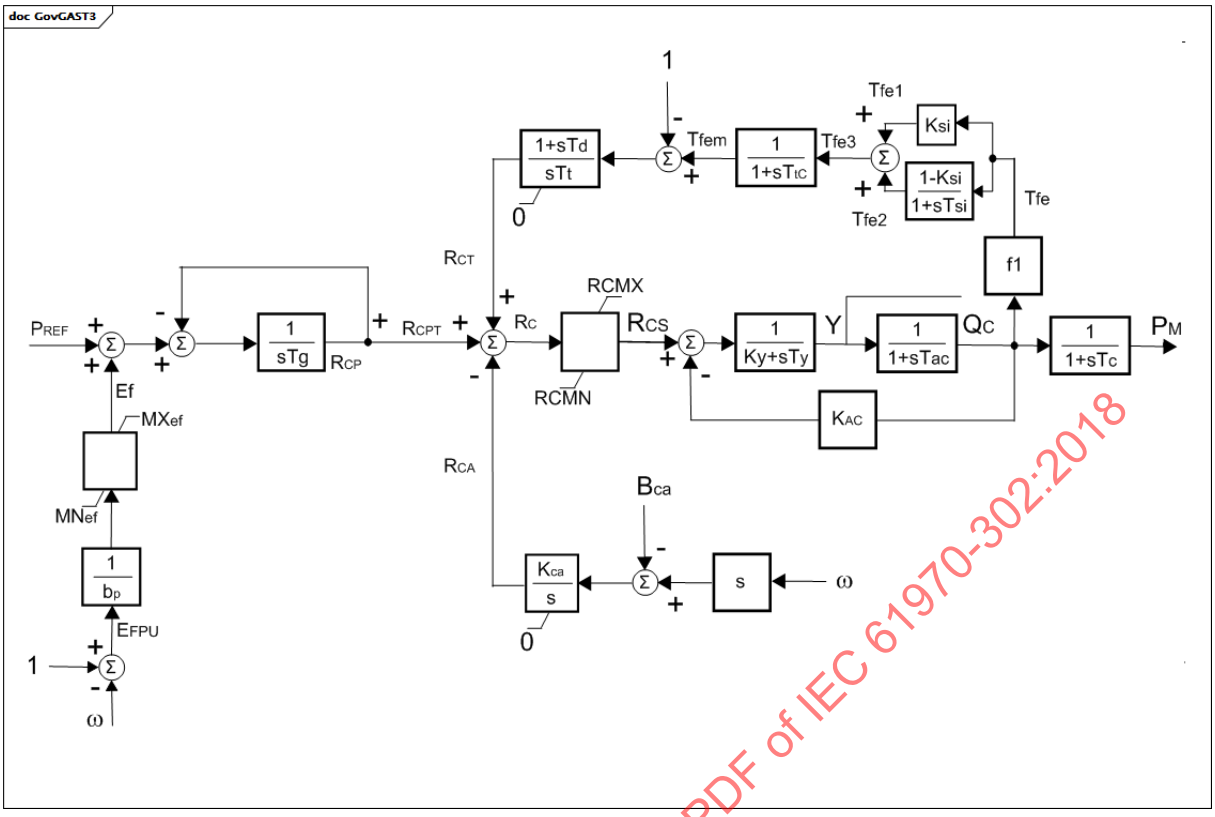

Figure 50 – GovGAST3

Figure 50: This diagram describes the GovGAST3 turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) omega has units of PU speed.
3) Function for exhaust temperature calculation shown in GovGAST3ExhaustTemperature diagram.

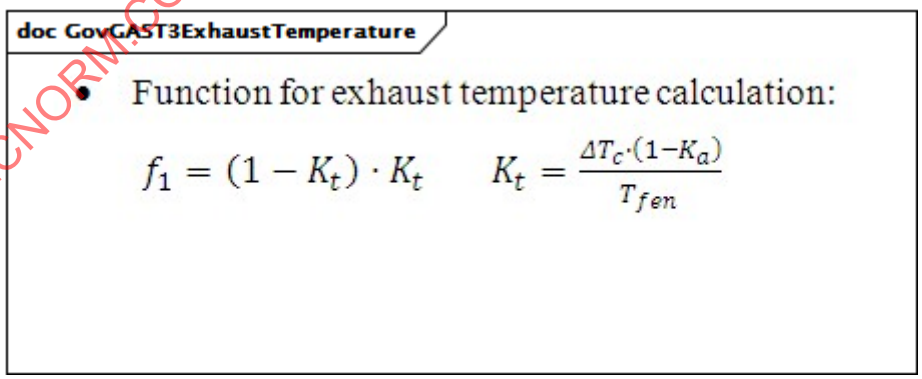

Figure 51 – GovGAST3ExhaustTemperature

Figure 51: This diagram illustrates the function for exhaust temperature calculation.

Table 47 shows all attributes of GovGAST3.

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Table 47 – Attributes of TurbineGovernorDynamics::GovGAST3

name	mult	type	description
bp	0..1	PU	Droop (bp). Typical value = 0,05.
tg	0..1	Seconds	Time constant of speed governor (Tg) (>= 0). Typical value = 0,05.
rcmx	0..1	PU	Maximum fuel flow (RCMX). Typical value = 1.
rcmn	0..1	PU	Minimum fuel flow (RCMN). Typical value = -0,1.
ky	0..1	Float	Coefficient of transfer function of fuel valve positioner (Ky). Typical value = 1.
ty	0..1	Seconds	Time constant of fuel valve positioner (Ty) (>= 0). Typical value = 0,2.
tac	0..1	Seconds	Fuel control time constant (Tac) (>= 0). Typical value = 0,1.
kac	0..1	Float	Fuel system feedback (KAC). Typical value = 0.
tc	0..1	Seconds	Compressor discharge volume time constant (Tc) (>= 0). Typical value = 0,2.
bca	0..1	Float	Acceleration limit set-point (Bca). Unit = 1/s. Typical value = 0,01.
kca	0..1	Float	Acceleration control integral gain (Kca). Unit = 1/s. Typical value = 100.
dtc	0..1	Temperature	Exhaust temperature variation due to fuel flow increasing from 0 to 1 PU (deltaTc). Typical value = 390.
ka	0..1	PU	Minimum fuel flow (Ka). Typical value = 0,23.
tsi	0..1	Seconds	Time constant of radiation shield (Tsi) (>= 0). Typical value = 15.
ksi	0..1	Float	Gain of radiation shield (Ksi). Typical value = 0,8.
ttc	0..1	Seconds	Time constant of thermocouple (Ttc) (>= 0). Typical value = 2,5.
tfen	0..1	Temperature	Turbine rated exhaust temperature correspondent to Pm=1 PU (Tfen). Typical value = 540.
td	0..1	Seconds	Temperature controller derivative gain (Td) (>= 0). Typical value = 3,3.
tt	0..1	Temperature	Temperature controller integration rate (Tt). Typical value = 250.
mxef	0..1	PU	Fuel flow maximum positive error value (MXef). Typical value = 0,05.
mnef	0..1	PU	Fuel flow maximum negative error value (MNef). Typical value = -0,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 48 shows all association ends of GovGAST3 with other classes.

Table 48 – Association ends of TurbineGovernorDynamics::GovGAST3 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.13 GovGAST4

Generic turbogas.

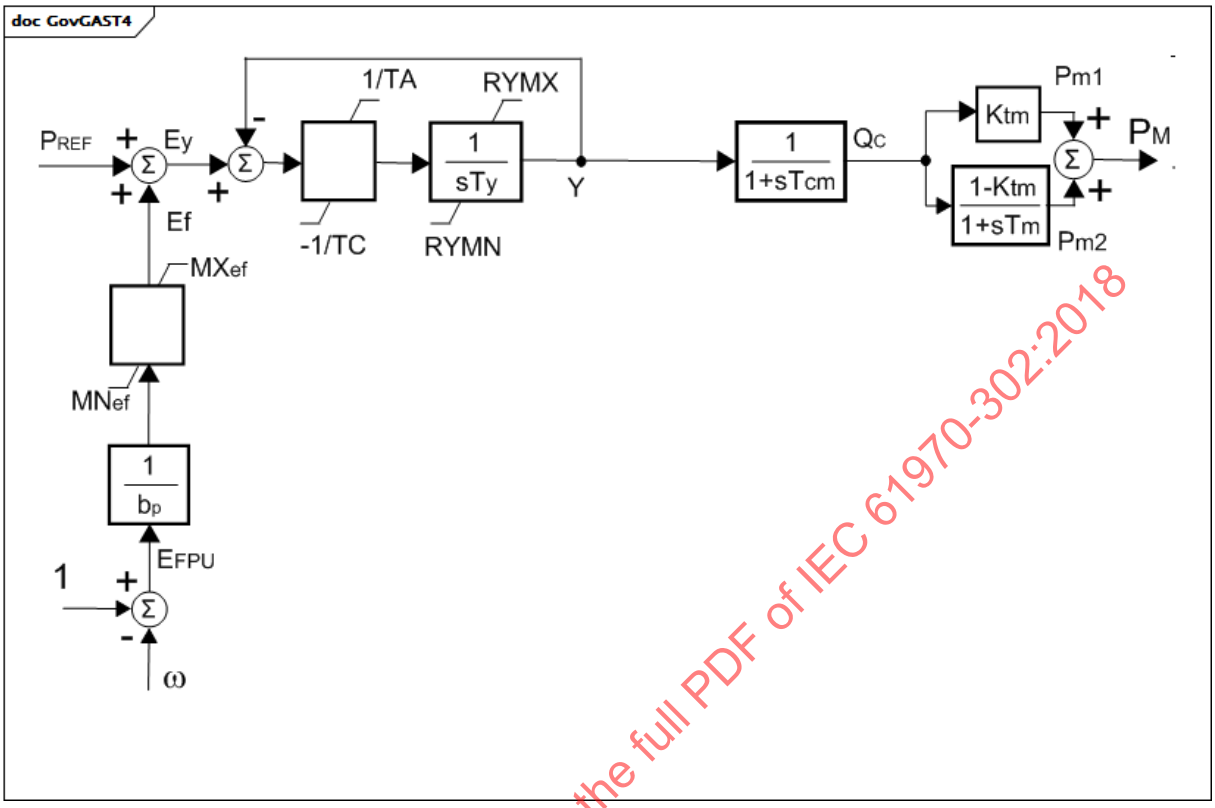

Figure 52 – GovGAST4

Figure 52: This diagram describes the GovGAST4 turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) omega has units of PU speed.

Table 49 shows all attributes of GovGAST4.

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Table 49 – Attributes of TurbineGovernorDynamics::GovGAST4

name	mult	type	description
bp	0..1	PU	Droop (bp). Typical value = 0,05.
ty	0..1	Seconds	Time constant of fuel valve positioner (Ty) (>= 0). Typical value = 0,1.
ta	0..1	Seconds	Maximum gate opening velocity (TA) (>= 0). Typical value = 3.
tc	0..1	Seconds	Maximum gate closing velocity (TC) (>= 0). Typical value = 0,5.
tcm	0..1	Seconds	Fuel control time constant (Tcm) (>= 0). Typical value = 0,1.
ktm	0..1	PU	Compressor gain (Ktm). Typical value = 0.
tm	0..1	Seconds	Compressor discharge volume time constant (Tm) (>= 0). Typical value = 0,2.
rymx	0..1	PU	Maximum valve opening (RYMX). Typical value = 1,1.
rymn	0..1	PU	Minimum valve opening (RYMN). Typical value = 0.
mxef	0..1	PU	Fuel flow maximum positive error value (MXef). Typical value = 0,05.
mnef	0..1	PU	Fuel flow maximum negative error value (MNef). Typical value = -0,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 50 shows all association ends of GovGAST4 with other classes.

Table 50 – Association ends of TurbineGovernorDynamics::GovGAST4 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.14 GovGASTWD

Woodward™ [1] gas turbine governor.

[1] Woodward gas turbines are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.

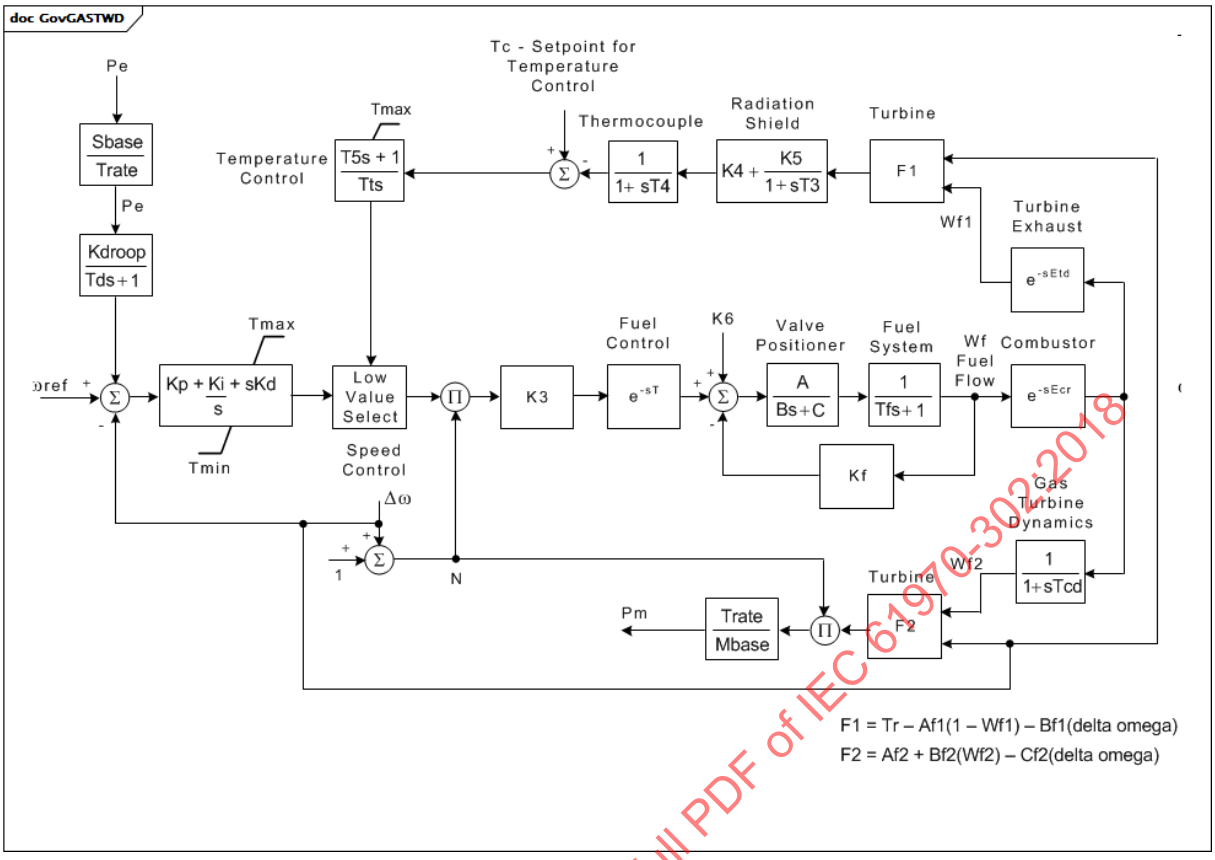

Figure 53 – GovGASTWD

Figure 53: This diagram describes the GovGASTWD turbine governor model.

Parameter details:

1) Temperature control output is set to output of speed governor when temperature control input changes from positive to negative.
2) F1 = Tr – Af1(1 – Wf1) – Bf1(delta omega)
3) F2 = Af2 + Bf2(Wf2) – Cf2(delta omega).

Table 51 shows all attributes of GovGASTWD.

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Table 51 – Attributes of TurbineGovernorDynamics::GovGASTWD

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
kdroop	0..1	PU	(Kdroop) (>= 0).
kp	0..1	PU	PID proportional gain (Kp).
ki	0..1	PU	Isochronous Governor Gain (Ki).
kd	0..1	PU	Drop governor gain (Kd).
etd	0..1	Seconds	Turbine and exhaust delay (Etd) (>= 0).
tcd	0..1	Seconds	Compressor discharge time constant (Tcd) (>= 0).
trate	0..1	ActivePower	Turbine rating (Trate). Unit = MW.
t	0..1	Seconds	Fuel control time constant (T) (>= 0).
tmax	0..1	PU	Maximum Turbine limit (Tmax) (> GovGASTWD.tmin).
tmin	0..1	PU	Minimum turbine limit (Tmin) (< GovGASTWD.tmax).
ecr	0..1	Seconds	Combustion reaction time delay (Ecr) (>= 0).
k3	0..1	PU	Ratio of fuel adjustment (K3).
a	0..1	Float	Valve positioner (A).
b	0..1	Float	Valve positioner (B).
c	0..1	Float	Valve positioner (C).
tf	0..1	Seconds	Fuel system time constant (Tf) (>= 0).
kf	0..1	PU	Fuel system feedback (Kf).
k5	0..1	PU	Gain of radiation shield (K5).
k4	0..1	PU	Gain of radiation shield (K4).
t3	0..1	Seconds	Radiation shield time constant (T3) (>= 0).
t4	0..1	Seconds	Thermocouple time constant (T4) (>= 0).
tt	0..1	Seconds	Temperature controller integration rate (Tt) (>= 0).
t5	0..1	Seconds	Temperature control time constant (T5) (>= 0).
af1	0..1	PU	Exhaust temperature parameter (Af1).
bf1	0..1	PU	(Bf1). Bf1 = E(1-w) where E (speed sensitivity coefficient) is 0,55 to 0,65 x Tr.
af2	0..1	PU	Coefficient equal to 0,5(1-speed) (Af2).
bf2	0..1	PU	Turbine torque coefficient Khhv (depends on heating value of fuel stream in combustion chamber) (Bf2).
cf2	0..1	PU	Coefficient defining fuel flow where power output is 0 % (Cf2). Synchronous but no output. Typically 0,23 x Khhv (23 % fuel flow).
tr	0..1	Temperature	Rated temperature (Tr).
k6	0..1	PU	Minimum fuel flow (K6).
tc	0..1	Temperature	Temperature control (Tc).
td	0..1	Seconds	Power transducer time constant (Td) (>= 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 52 shows all association ends of GovGASTWD with other classes.

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Table 52 – Association ends of TurbineGovernorDynamics::GovGASTWD with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.15 GovHydro1

Basic hydro turbine governor.

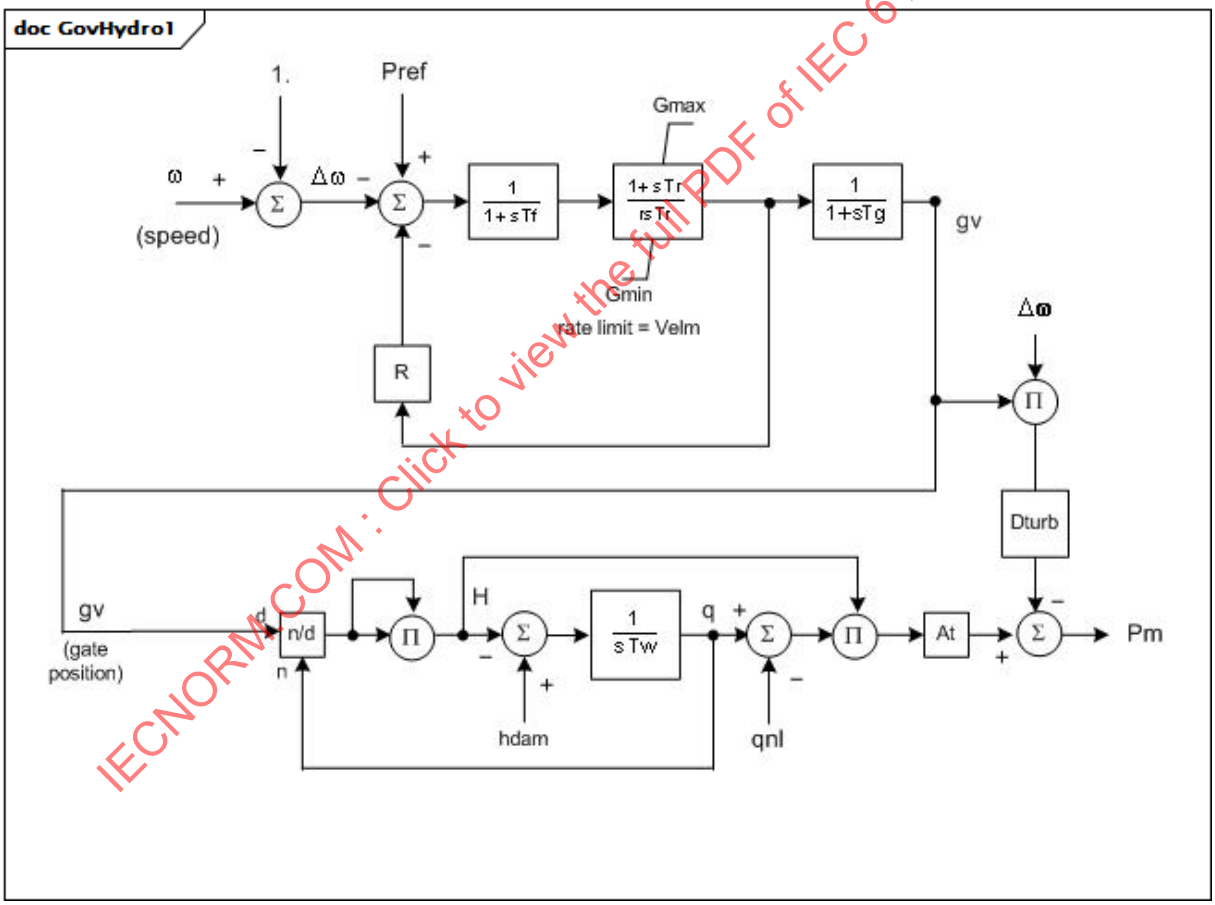

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Figure 54 – GovHydro1

Figure 54: This diagram describes the GovHydro1 turbine governor model.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.

2) The gates travel over a range of 1,0 PU from fully closed to fully opened. The gate position is normally greater than zero at zero power and normally less than 1,0 when power is 1,0 PU. Gmax and Gmin are operating limits.

3) Dturb has units of delta P (PU of mwcap) /delta speed (PU).

Table 53 shows all attributes of GovHydro1.

Table 53 – Attributes of TurbineGovernorDynamics::GovHydro1

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
rperm	0..1	PU	Permanent droop (R) (> 0). Typical value = 0,04.
rtemp	0..1	PU	Temporary droop (r) (> GovHydro1.rperm). Typical value = 0,3.
tr	0..1	Seconds	Washout time constant (Tr) (> 0). Typical value = 5.
tf	0..1	Seconds	Filter time constant (Tf) (> 0). Typical value = 0,05.
tg	0..1	Seconds	Gate servo time constant (Tg) (> 0). Typical value = 0,5.
velm	0..1	Float	Maximum gate velocity (Vlem) (> 0). Typical value = 0,2.
gmax	0..1	PU	Maximum gate opening (Gmax) (> 0 and > GovHydro.gmin). Typical value = 1.
gmin	0..1	PU	Minimum gate opening (Gmin) (>= 0 and < GovHydro1.gmax). Typical value = 0.
tw	0..1	Seconds	Water inertia time constant (Tw) (> 0). Typical value = 1.
at	0..1	PU	Turbine gain (At) (> 0). Typical value = 1,2.
dturb	0..1	PU	Turbine damping factor (Dturb) (>= 0). Typical value = 0,5.
qnl	0..1	PU	No-load flow at nominal head (qnl) (>= 0). Typical value = 0,08.
hdam	0..1	PU	Turbine nominal head (hdam). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 54 shows all association ends of GovHydro1 with other classes.

Table 54 – Association ends of TurbineGovernorDynamics::GovHydro1 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.16 GovHydro2

IEEE hydro turbine governor with straightforward penstock configuration and hydraulic-dashpot governor.

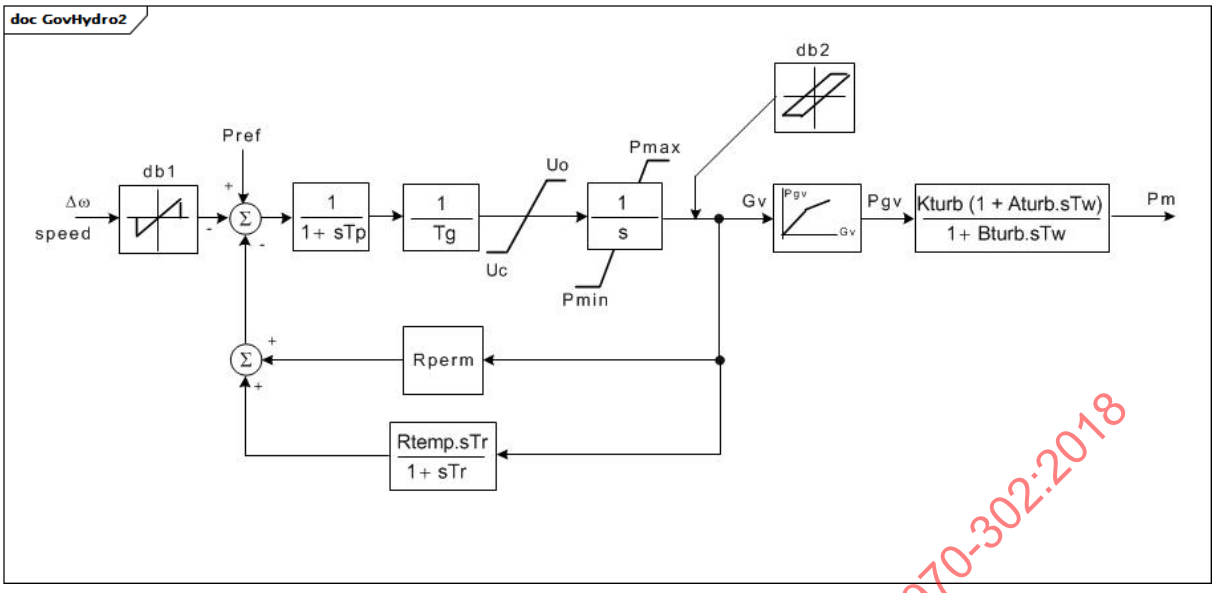

Figure 55 – GovHydro2

Figure 55: This diagram describes the GovHydro2 turbine governor model.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.
2) This turbine governor model is a reasonable approximation to the performance of simple hydro plants for small motions of the gates about a given load, but it represents the variation of water inertia effect with load only if the values of the turbine parameters are properly adjusted by the user as load is varied. For idealized turbine model, set Kturb = 1,0, Aturb = -1,0, Bturb = 0,5.
3) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0.) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.
4) For compatibility with older versions of this model: Kturb = a23, Aturb = a11 – a13 x a21/a23, Bturb = a11.

Table 55 shows all attributes of GovHydro2.

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Table 55 – Attributes of TurbineGovernorDynamics::GovHydro2

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
tg	0..1	Seconds	Gate servo time constant (Tg) (> 0). Typical value = 0,5.
tp	0..1	Seconds	Pilot servo valve time constant (Tp) (>= 0). Typical value = 0,03.
uo	0..1	Float	Maximum gate opening velocity (Uo). Unit = PU / s. Typical value = 0,1.
uc	0..1	Float	Maximum gate closing velocity (Uc) (< 0). Unit = PU / s. Typical value = -0,1.
pmax	0..1	PU	Maximum gate opening (Pmax) (> GovHydro2.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening (Pmin) (< GovHydro2.pmax). Typical value = 0.
rperm	0..1	PU	Permanent droop (Rperm). Typical value = 0,05.
rtemp	0..1	PU	Temporary droop (Rtemp). Typical value = 0,5.
tr	0..1	Seconds	Dashpot time constant (Tr) (>= 0). Typical value = 12.
tw	0..1	Seconds	Water inertia time constant (Tw) (>= 0). Typical value = 2.
kturb	0..1	PU	Turbine gain (Kturb). Typical value = 1.
aturb	0..1	PU	Turbine numerator multiplier (Aturb). Typical value = -1.
bturb	0..1	PU	Turbine denominator multiplier (Bturb) (> 0). Typical value = 0,5.
db1	0..1	Frequency	Intentional deadband width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional deadband (db2). Unit = MW. Typical value = 0.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 56 shows all association ends of GovHydro2 with other classes.

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Table 56 – Association ends of TurbineGovernorDynamics::GovHydro2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.17 GovHydro3

Modified IEEE hydro governor-turbine. This model differs from that defined in the IEEE modelling guideline paper in that the limits on gate position and velocity do not permit "wind up" of the upstream signals.

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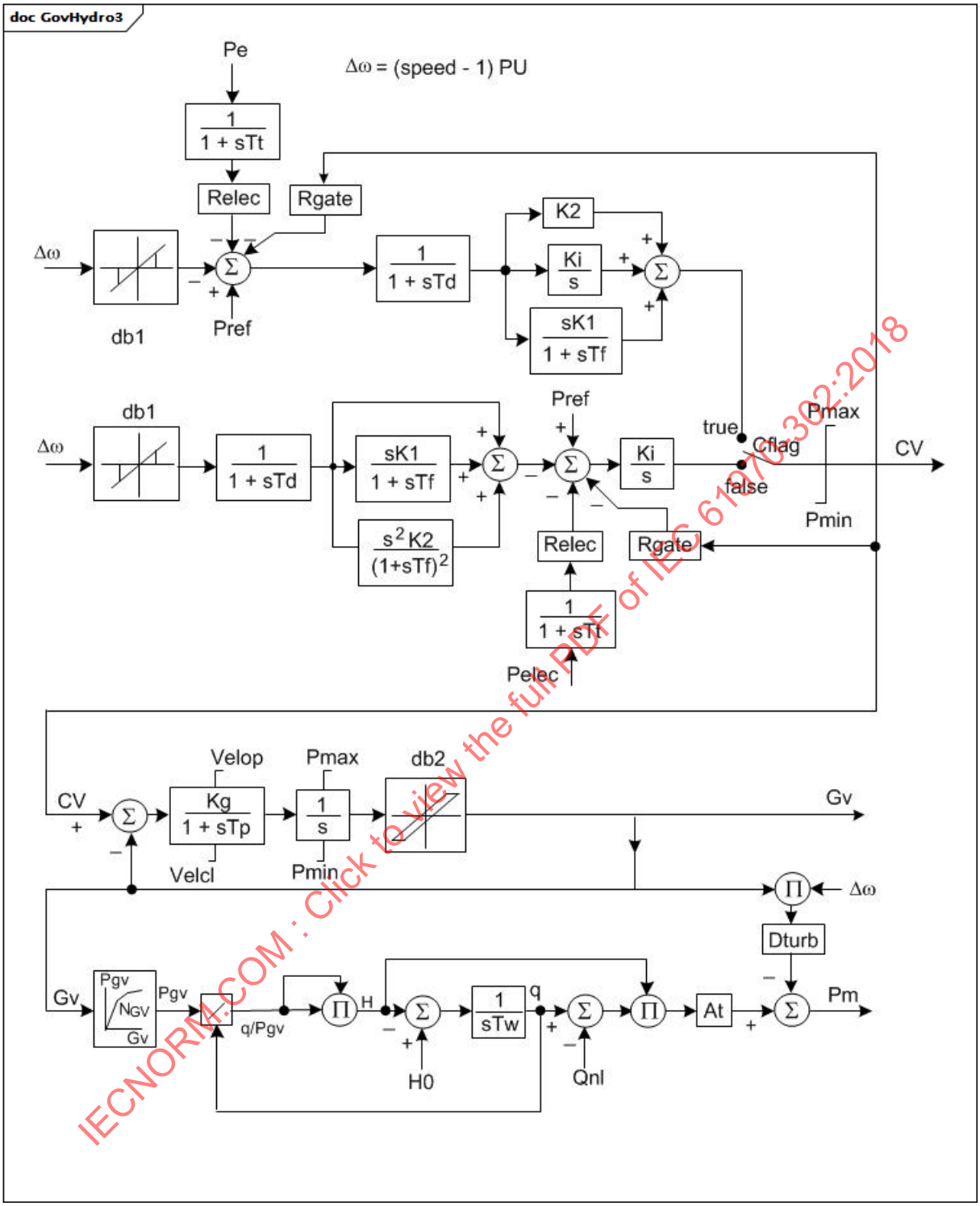

Figure 56 – GovHydro3

Figure 56: This diagram describes the GovHydro3 turbine governor model.

Parameter details:

1) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

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Table 57 shows all attributes of GovHydro3.

Table 57 – Attributes of TurbineGovernorDynamics::GovHydro3

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
pmax	0..1	PU	Maximum gate opening, PU of MWbase (Pmax) (> GovHydro3.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening, PU of MWbase (Pmin) (< GovHydro3.pmax). Typical value = 0.
governorControl	0..1	Boolean	Governor control flag (Cflag). true = PID control is active false = double derivative control is active. Typical value = true.
rgate	0..1	PU	Steady-state droop, PU, for governor output feedback (Rgate). Typical value = 0.
relec	0..1	PU	Steady-state droop, PU, for electrical power feedback (Relec). Typical value = 0,05.
td	0..1	Seconds	Input filter time constant (Td) (>= 0). Typical value = 0,05.
tf	0..1	Seconds	Washout time constant (Tf) (>= 0). Typical value = 0,1.
tp	0..1	Seconds	Gate servo time constant (Tp) (>= 0). Typical value = 0,05.
velop	0..1	Float	Maximum gate opening velocity (Velop). Unit = PU / s. Typical value = 0,2.
velcl	0..1	Float	Maximum gate closing velocity (Velcl). Unit = PU / s. Typical value = -0,2.
k1	0..1	PU	Derivative gain (K1). Typical value = 0,01.
k2	0..1	PU	Double derivative gain, if Cflag = -1 (K2). Typical value = 2,5.
ki	0..1	PU	Integral gain (Ki). Typical value = 0,5.
kg	0..1	PU	Gate servo gain (Kg). Typical value = 2.
tt	0..1	Seconds	Power feedback time constant (Tt) (>= 0). Typical value = 0,2.
db1	0..1	Frequency	Intentional dead-band width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
tw	0..1	Seconds	Water inertia time constant (Tw) (>= 0). If = 0, block is bypassed. Typical value = 1.
at	0..1	PU	Turbine gain (At) (>0). Typical value = 1,2.
dturb	0..1	PU	Turbine damping factor (Dturb). Typical value = 0,2.
qnl	0..1	PU	No-load turbine flow at nominal head (Qnl). Typical value = 0,08.
h0	0..1	PU	Turbine nominal head (H0). Typical value = 1.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.

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name	mult	type	description
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 58 shows all association ends of GovHydro3 with other classes.

Table 58 – Association ends of TurbineGovernorDynamics::GovHydro3 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.18 GovHydro4

Hydro turbine and governor. Represents plants with straight-forward penstock configurations and hydraulic governors of the traditional 'dashpot' type. This model can be used to represent simple, Francis/Pelton or Kaplan turbines.

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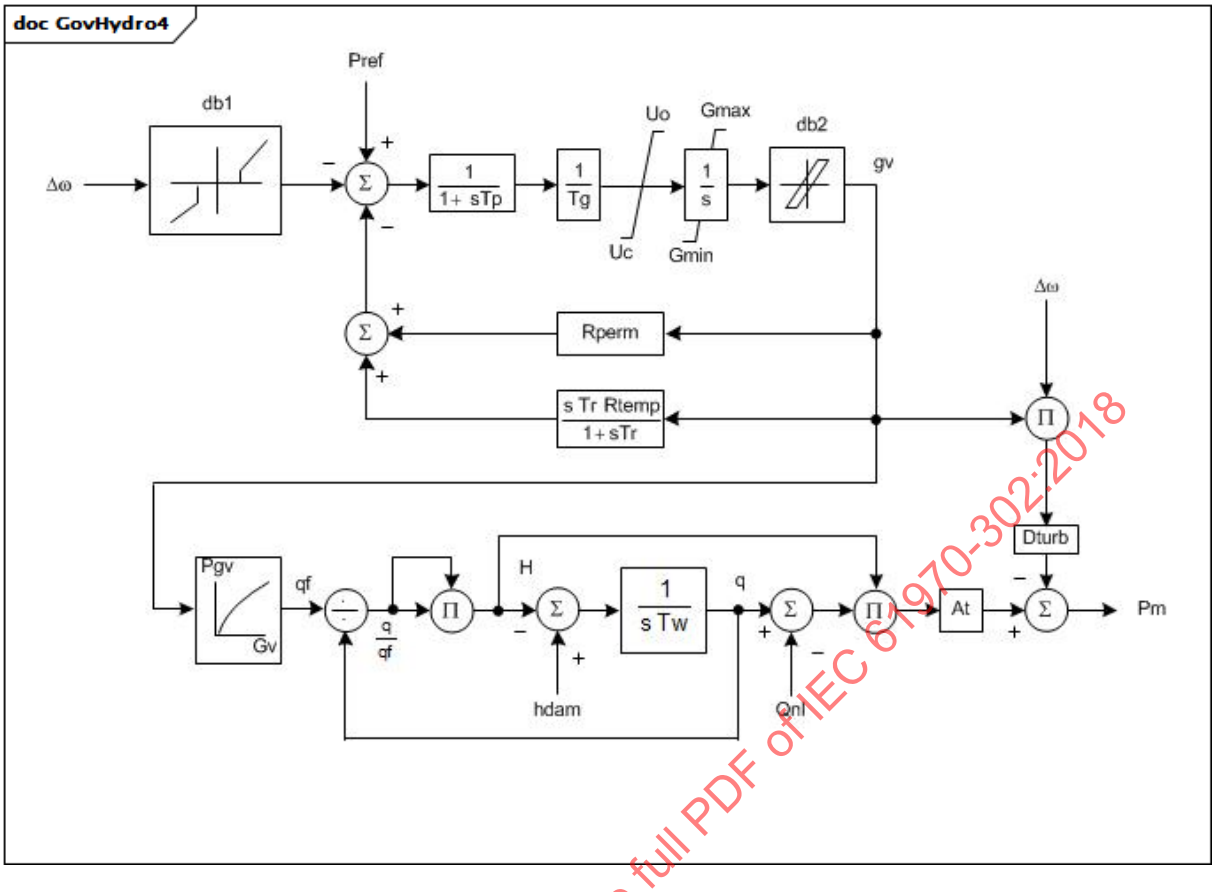

Figure 57 – GovHydro4

Figure 57: This diagram describes the GovHydro4 turbine governor model.

Parameter details:

1) The GovHydro4 model can be used to represent three different standard model variants: simple, Francis/Pelton and Kaplan.
2) The gates travel over a range of 1 to 0 PU from fully closed to fully opened. The gates are at a position greater than zero at zero power and, normally, less than 1 PU when power is 1 PU. Gmax and Gmin are operating limits.
3) The following parameter combinations are used by the variants to represent gate-head-flow power characteristics:
   - Simple: the line with slope At and intercept Qnl describes the gate opening-to-turbine power characteristic (as shown in the GovHydro4SimpleHydroTurbine diagram). This curve is proportional to turbine power, with the constant of proportionality being a function of available head. This constant is specified by the turbine gain, At. Parameters Gv0 to Gv5, Pgv0 to Pgv5, and Bgv0 to Bgv5 are not considered.
   - Francis/Pelton turbine model: (Gv0, Pgv0) thru (Gv5, Pgv5) are used to describe the non-linear gate opening-to-turbine power characteristic (as shown in the GovHydro4FrancisPeltonTurbine diagram). Bgv0 to Bgv5 are not considered.
   - Kaplan turbine model: (Gv0, Pgv0) thru (Gv5, Pgv5) and (Gv0, Bv0) thru (Gv5, Bgv5) are used to describe the non-linear characteristics of gate opening-to-turbine power and gate opening-to-blade angle (as shown in the GovHydro4KaplanTurbine diagram).

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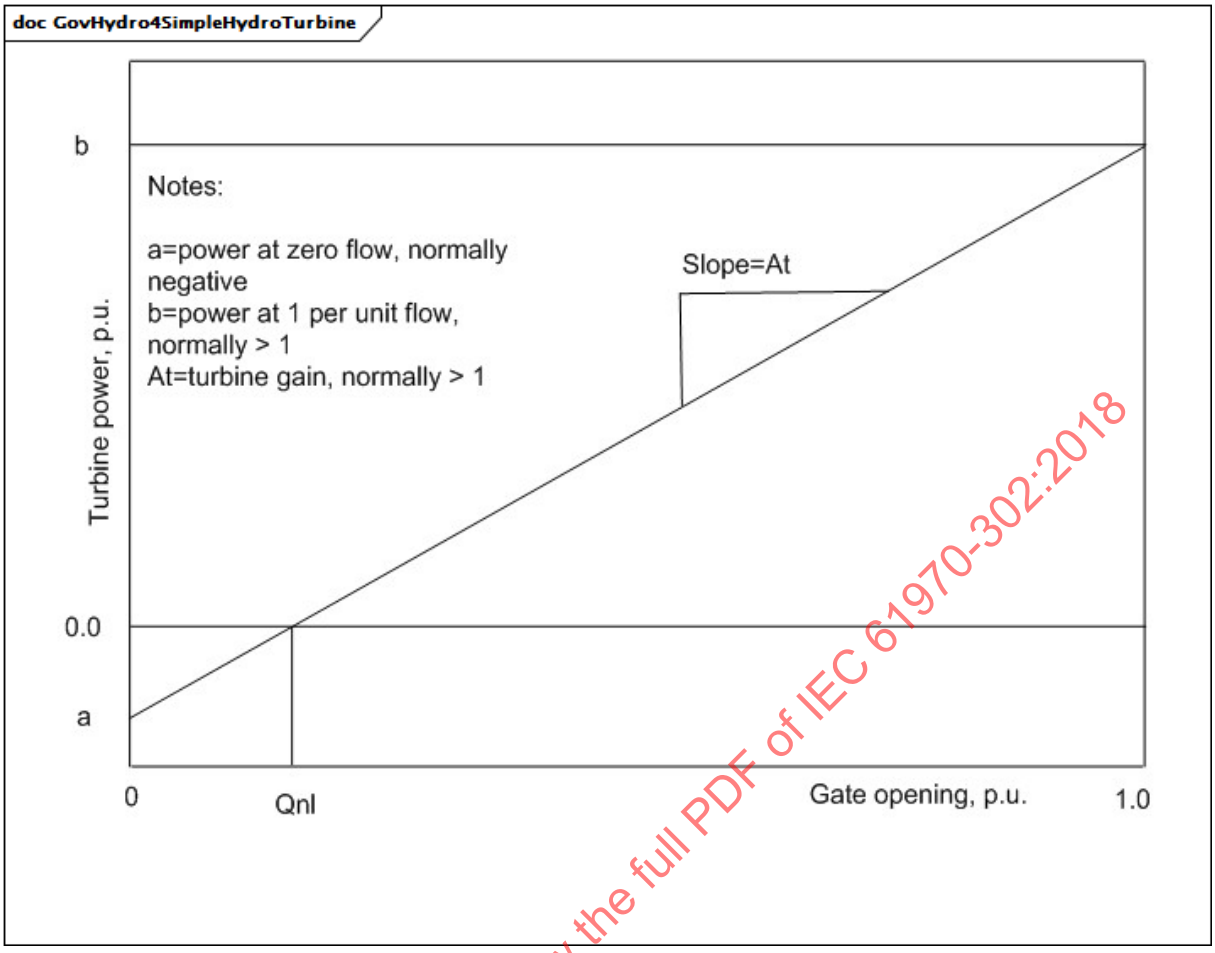

Figure 58 – GovHydro4SimpleHydroTurbine

Figure 58: This diagram illustrates the gate-head-flow-power characteristics for a simple general purpose model.

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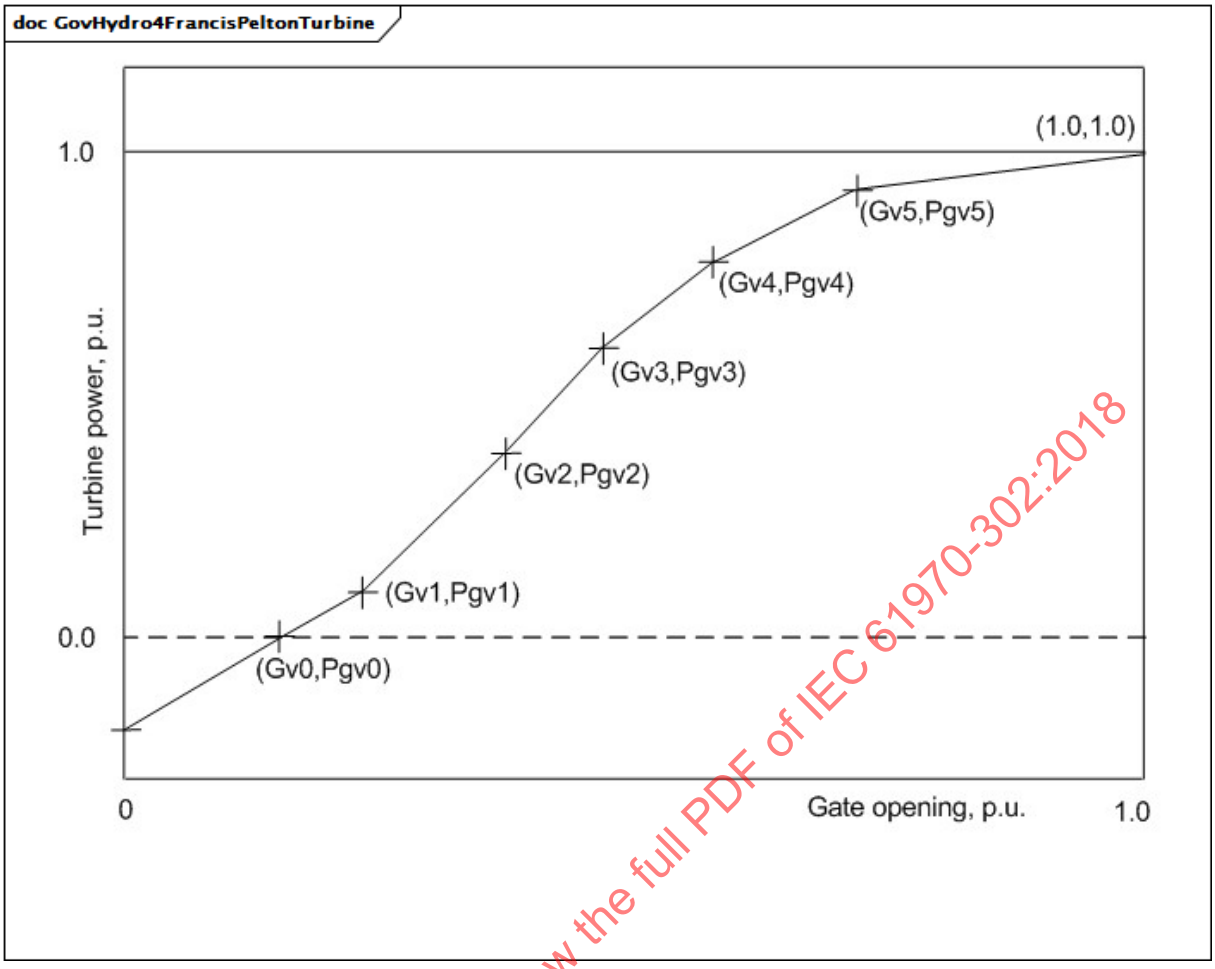

Figure 59 – GovHydro4FrancisPeltonTurbine

Figure 59: This diagram illustrates the gate-head-flow-power characteristics for a Francis/Pelton turbine model.

Parameter details:

1) The curve described by (Gv0, Pgv0) to (Gv5, Pgv5) describes the relationship of flow through the turbine to stroke of the gate actuating servomotor.
2) If Gv0 is greater than 0, the first two data points will be used to extrapolate downward for gate positions less than Gv0 If Gv0 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

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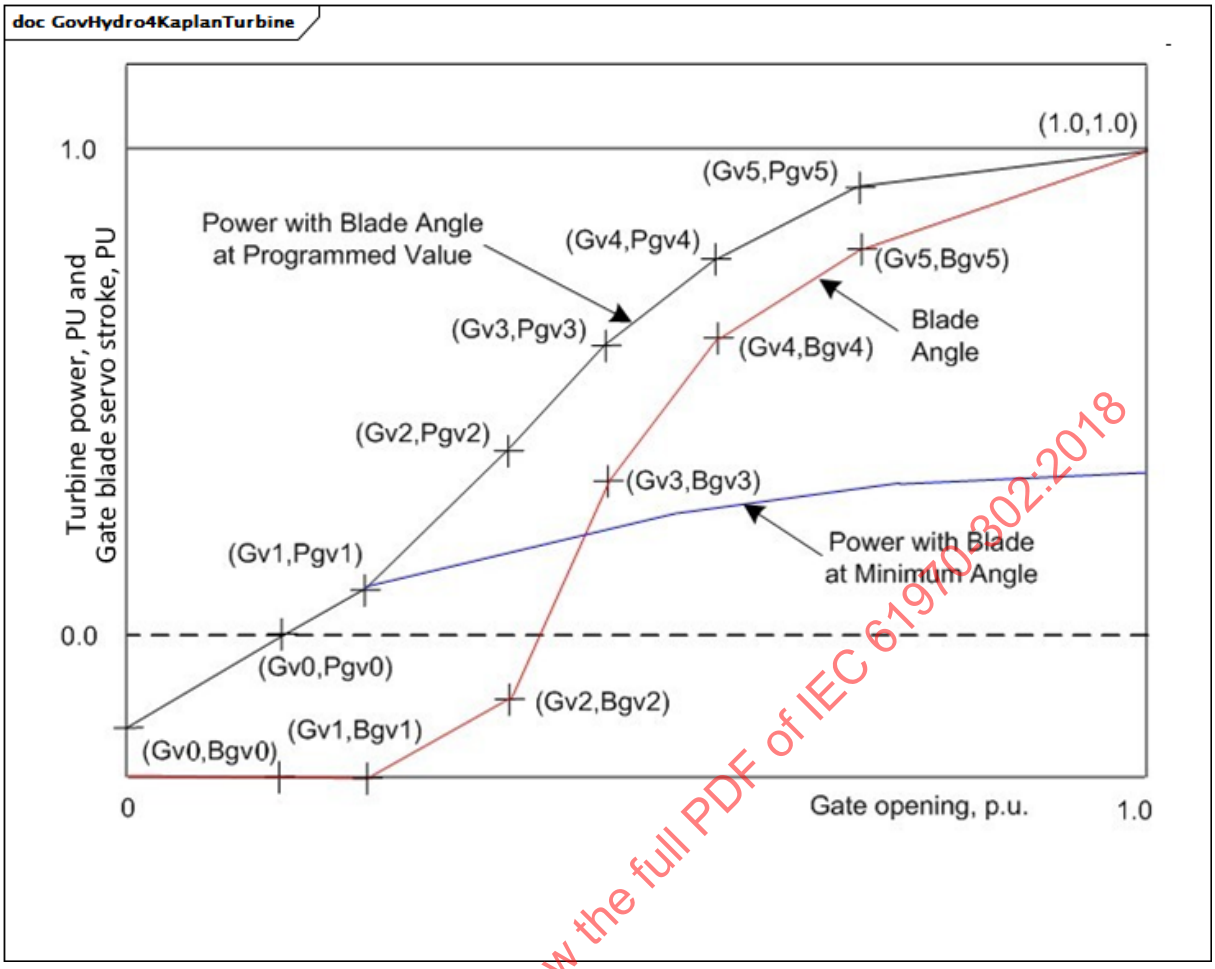

Figure 60 – GovHydro4KaplanTurbine

Figure 60: This diagram illustrates the non-linear characteristics of gate opening-to-turbine power and gate opening-to-blade angle for a Kaplan turbine model.

Parameter details:

1) The curve described by (Gv0, Pgv0) to (Gv5, Pgv5) describes the relationship of flow through the turbine to stroke of the gate actuating servomotor.
2) If Gv0 is greater than 0, the first two data points will be used to extrapolate downward for gate positions less than Gv0 If Gv0 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

Table 59 shows all attributes of GovHydro4.

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Table 59 – Attributes of TurbineGovernorDynamics::GovHydro4

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
tg	0..1	Seconds	Gate servo time constant (Tg) (> 0). Typical value = 0,5.
tp	0..1	Seconds	Pilot servo time constant (Tp) (>= 0). Typical value = 0,1.
uo	0..1	Float	Max gate opening velocity (Uo). Typical value = 0,2.
uc	0..1	Float	Max gate closing velocity (Uc). Typical value = 0,2.
gmax	0..1	PU	Maximum gate opening, PU of MWbase (Gmax) (> GovHydro4.gmin). Typical value = 1.
gmin	0..1	PU	Minimum gate opening, PU of MWbase (Gmin) (< GovHydro4.gmax). Typical value = 0.
rperm	0..1	Seconds	Permanent droop (Rperm) (>= 0). Typical value = 0,05.
rtemp	0..1	Seconds	Temporary droop (Rtemp) (>= 0). Typical value = 0,3.
tr	0..1	Seconds	Dashpot time constant (Tr) (>= 0). Typical value = 5.
tw	0..1	Seconds	Water inertia time constant (Tw) (> 0). Typical value = 1.
at	0..1	PU	Turbine gain (At). Typical value = 1,2.
dturb	0..1	PU	Turbine damping factor (Dturb). Unit = delta P (PU of MWbase) / delta speed (PU). Typical value for simple = 0,5, Francis/Pelton = 1,1, Kaplan = 1,1.
hdam	0..1	PU	Head available at dam (hdam). Typical value = 1.
qnl	0..1	PU	No-load flow at nominal head (Qnl). Typical value for simple = 0,08, Francis/Pelton = 0, Kaplan = 0.
db1	0..1	Frequency	Intentional deadband width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
gv0	0..1	PU	Nonlinear gain point 0, PU gv (Gv0) (= 0 for simple). Typical for Francis/Pelton = 0,1, Kaplan = 0,1.
pgv0	0..1	PU	Nonlinear gain point 0, PU power (Pgv0) (= 0 for simple). Typical value = 0.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1) (= 0 for simple, > GovHydro4.gv0 for Francis/Pelton and Kaplan). Typical value for Francis/Pelton = 0,4, Kaplan = 0,4.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1) (= 0 for simple). Typical value for Francis/Pelton = 0,42, Kaplan = 0,35.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2) (= 0 for simple, > GovHydro4.gv1 for Francis/Pelton and Kaplan). Typical value for Francis/Pelton = 0,5, Kaplan = 0,5.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2) (= 0 for simple). Typical value for Francis/Pelton = 0,56, Kaplan = 0,468.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3) (= 0 for simple, > GovHydro4.gv2 for Francis/Pelton and Kaplan). Typical value for Francis/Pelton = 0,7, Kaplan = 0,7.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3) (= 0 for simple). Typical value for Francis/Pelton = 0,8, Kaplan = 0,796.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4) (= 0 for simple, > GovHydro4.gv3 for Francis/Pelton and Kaplan). Typical value for Francis/Pelton = 0,8, Kaplan = 0,8.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4) (= 0 for simple). Typical value for Francis/Pelton = 0,9, Kaplan = 0,917.

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name	mult	type	description
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5) (= 0 for simple, < 1 and > GovHydro4.gv4 for Francis/Pelton and Kaplan). Typical value for Francis/Pelton = 0,9, Kaplan = 0,9.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5) (= 0 for simple). Typical value for Francis/Pelton = 0,97, Kaplan = 0,99.
bgv0	0..1	PU	Kaplan blade servo point 0 (Bgv0) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 0.
bgv1	0..1	PU	Kaplan blade servo point 1 (Bgv1) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 0.
bgv2	0..1	PU	Kaplan blade servo point 2 (Bgv2) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 0,1.
bgv3	0..1	PU	Kaplan blade servo point 3 (Bgv3) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 0,667.
bgv4	0..1	PU	Kaplan blade servo point 4 (Bgv4) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 0,9.
bgv5	0..1	PU	Kaplan blade servo point 5 (Bgv5) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 1.
bmax	0..1	Float	Maximum blade adjustment factor (Bmax) (= 0 for simple, = 0 for Francis/Pelton). Typical value for Kaplan = 1,1276.
tblade	0..1	Seconds	Blade servo time constant (Tblade) (>= 0). Typical value = 100.
model	0..1	GovHydro4ModelKind	The kind of model being represented (simple, Francis/Pelton or Kaplan).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 60 shows all association ends of GovHydro4 with other classes.

Table 60 – Association ends of TurbineGovernorDynamics::GovHydro4 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.19 GovHydroDD

Double derivative hydro governor and turbine.

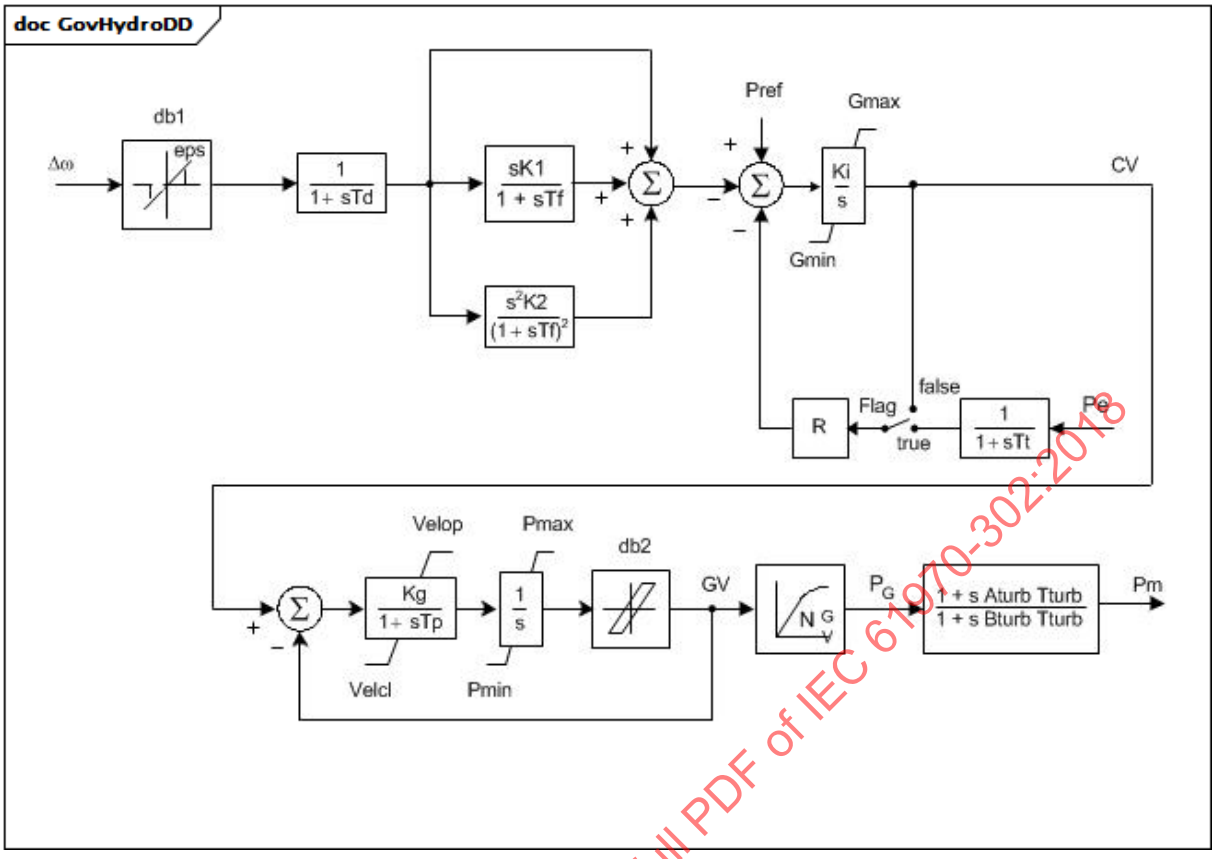

Figure 61 – GovHydroDD

Figure 61: This diagram describes the GovHydroDD turbine governor model.

Parameter details:

1) If Tf is input as zero, but K1 or K2 is not zero, Tf is set to a small value (4 times integration time step). If Bturb x Tturb is less than 4 times integration time step, Tturb is set to zero to bypass the block.
2) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero values, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.
3) For a hydro turbine, set Tturb = Tw (water starting time), set Aturb = -1,0 and Bturb = 0,5. For a diesel engine or two-shaft gas turbine, set Aturb = 0,8 and Bturb = 1,0 and Tturb = 1 s. For a small steam turbine with a non-reheat steam supply or a single- shaft gas turbine, set Aturb = 0,0 and Bturb = 1,0 and Tturb = 0,2 s.

Table 61 shows all attributes of GovHydroDD.

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Table 61 – Attributes of TurbineGovernorDynamics::GovHydroDD

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (>0). Unit = MW.
pmax	0..1	PU	Maximum gate opening, PU of MWbase (Pmax) (> GovHydroDD.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening, PU of MWbase (Pmin) (> GovHydroDD.pmax). Typical value = 0.
r	0..1	PU	Steady state droop (R). Typical value = 0,05.
td	0..1	Seconds	Input filter time constant (Td) (>= 0). If = 0, block is bypassed. Typical value = 0.
tf	0..1	Seconds	Washout time constant (Tf) (>= 0). Typical value = 0,1.
tp	0..1	Seconds	Gate servo time constant (Tp) (>= 0). If = 0, block is bypassed. Typical value = 0,35.
velop	0..1	Float	Maximum gate opening velocity (Velop). Unit = PU / s. Typical value = 0,09.
velcl	0..1	Float	Maximum gate closing velocity (Velcl). Unit = PU / s. Typical value = -0,14.
k1	0..1	PU	Single derivative gain (K1). Typical value = 3,6.
k2	0..1	PU	Double derivative gain (K2). Typical value = 0,2.
ki	0..1	PU	Integral gain (Ki). Typical value = 1.
kg	0..1	PU	Gate servo gain (Kg). Typical value = 3.
tturb	0..1	Seconds	Turbine time constant (Tturb) (>= 0). See parameter detail 3. Typical value = 0,8.
aturb	0..1	PU	Turbine numerator multiplier (Aturb) (see parameter detail 3). Typical value = -1.
bturb	0..1	PU	Turbine denominator multiplier (Bturb) (see parameter detail 3). Typical value = 0,5.
tt	0..1	Seconds	Power feedback time constant (Tt) (>= 0). If = 0, block is bypassed. Typical value = 0,02.
db1	0..1	Frequency	Intentional dead-band width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
gmax	0..1	PU	Maximum gate opening (Gmax) (> GovHydroDD.gmin). Typical value = 0.
gmin	0..1	PU	Minimum gate opening (Gmin) (< GovHydroDD.gmax). Typical value = 0.

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name	mult	type	description
inputSignal	0..1	Boolean	Input signal switch (Flag). true = Pe input is used false = feedback is received from CV. Flag is normally dependent on Tt. If Tt is zero, Flag is set to false. If Tt is not zero, Flag is set to true. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 62 shows all association ends of GovHydroDD with other classes.

Table 62 – Association ends of TurbineGovernorDynamics::GovHydroDD with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.20 GovHydroFrancis

Detailed hydro unit – Francis model. This model can be used to represent three types of governors.

A schematic of the hydraulic system of detailed hydro unit models, such as Francis and Pelton, is provided in the DetailedHydroModelHydraulicSystem diagram.

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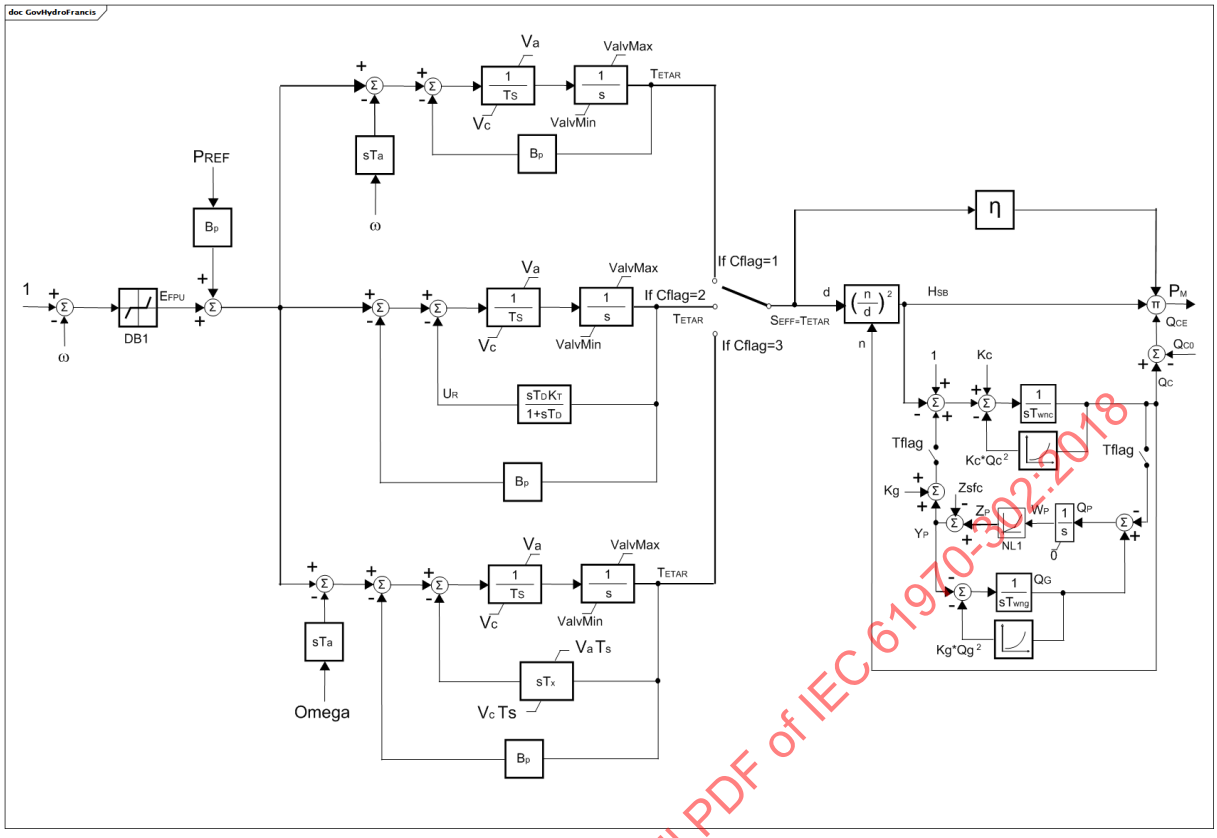

Figure 62 – GovHydroFrancis

Figure 62: This diagram describes the GovHydroFrancis turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) Rated hydraulic head, Hn in metres, and rated flow, Qn in cubic metres per s, are the design parameters of the hydraulic system capability.
3) Hydraulic system head attributes (Zsfc, H1, H2) are in metres but in the block diagram are in PU on base of Hn in metres.
4) Hydraulic area attributes (Av0, Av1) are in square metres but in the block diagram are in PU on base of Qn / Hn in square metres per s.
5) omega has units of PU speed.
6) Non-linear gain and efficiency equations are shown in GovHydroFrancisNonLinearGainAndEfficiency diagram.

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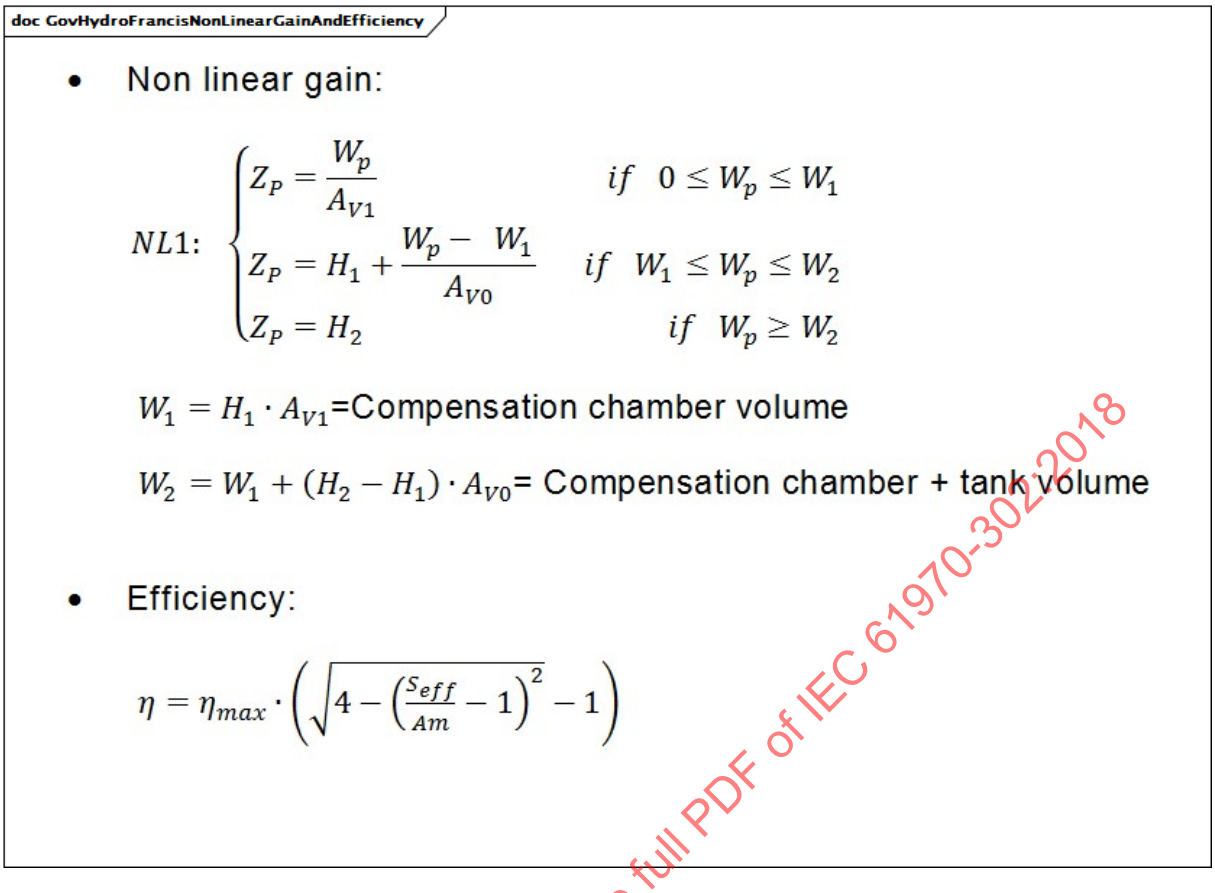

Figure 63 – GovHydroFrancisNonLinearGainAndEfficiency

Figure 63: This diagram illustrates the non-linear gain and efficiency equations.

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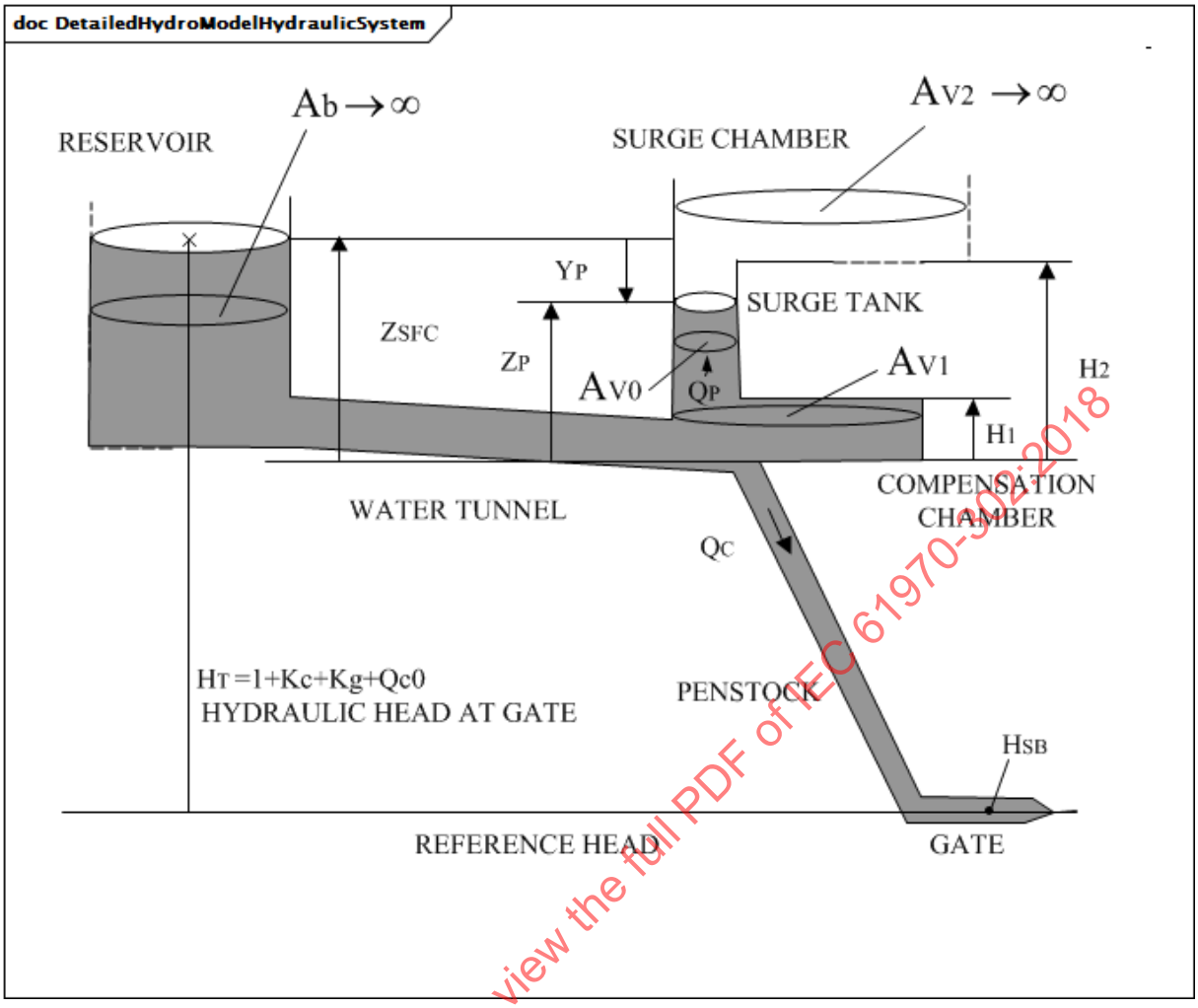

Figure 64 – DetailedHydroModelHydraulicSystem

Figure 64: This diagram illustrates the detailed hydro model of a hydraulic system.

Table 63 shows all attributes of GovHydroFrancis.

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Table 63 – Attributes of TurbineGovernorDynamics::GovHydroFrancis

name	mult	type	description
am	0..1	PU	Opening section SEFF at the maximum efficiency (Am). Typical value = 0,7.
av0	0..1	Area	Area of the surge tank (AV0). Unit = m2. Typical value = 30.
av1	0..1	Area	Area of the compensation tank (AV1). Unit = m2. Typical value = 700.
bp	0..1	PU	Droop (Bp). Typical value = 0,05.
db1	0..1	Frequency	Intentional dead-band width (DB1). Unit = Hz. Typical value = 0.
etamax	0..1	PU	Maximum efficiency (EtaMax). Typical value = 1,05.
governorControl	0..1	FrancisGovernorControlKind	Governor control flag (Cflag). Typical value = mechanicHydrolicTachoAccelerator.
h1	0..1	Length	Head of compensation chamber water level with respect to the level of penstock (H1). Unit = km. Typical value = 0,004.
h2	0..1	Length	Head of surge tank water level with respect to the level of penstock (H2). Unit = km. Typical value = 0,040.
hn	0..1	Length	Rated hydraulic head (Hn). Unit = km. Typical value = 0,250.
kc	0..1	PU	Penstock loss coefficient (due to friction) (Kc). Typical value = 0,025.
kg	0..1	PU	Water tunnel and surge chamber loss coefficient (due to friction) (Kg). Typical value = 0,025.
kt	0..1	PU	Washout gain (Kt). Typical value = 0,25.
qc0	0..1	PU	No-load turbine flow at nominal head (Qc0). Typical value = 0,1.
qn	0..1	VolumeFlowRate	Rated flow (Qn). Unit = m3/s. Typical value = 250.
ta	0..1	Seconds	Derivative gain (Ta) (>= 0). Typical value = 3.
td	0..1	Seconds	Washout time constant (Td) (>= 0). Typical value = 6.
ts	0..1	Seconds	Gate servo time constant (Ts) (>= 0). Typical value = 0,5.
twnc	0..1	Seconds	Water inertia time constant (Twnc) (>= 0). Typical value = 1.
twng	0..1	Seconds	Water tunnel and surge chamber inertia time constant (Twng) (>= 0). Typical value = 3.
tx	0..1	Seconds	Derivative feedback gain (Tx) (>= 0). Typical value = 1.
va	0..1	Float	Maximum gate opening velocity (Va). Unit = PU / s. Typical value = 0,06.
valvmax	0..1	PU	Maximum gate opening (ValvMax) (> GovHydroFrancis.valvmin). Typical value = 1,1.
valvmin	0..1	PU	Minimum gate opening (ValvMin) (< GovHydroFrancis.valvmax). Typical value = 0.
vc	0..1	Float	Maximum gate closing velocity (Vc). Unit = PU / s. Typical value = -0,06.

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name	mult	type	description
waterTunnelSurgeChamberSimulation	0..1	Boolean	Water tunnel and surge chamber simulation (Tflag). true = enable of water tunnel and surge chamber simulation false = inhibit of water tunnel and surge chamber simulation. Typical value = false.
zsfc	0..1	Length	Head of upper water level with respect to the level of penstock (Zsfc). Unit = km. Typical value = 0,025.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 64 shows all association ends of GovHydroFrancis with other classes.

Table 64 – Association ends of TurbineGovernorDynamics::GovHydroFrancis with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.21 GovHydroPelton

Detailed hydro unit – Pelton model. This model can be used to represent the dynamic related to water tunnel and surge chamber.

The DetailedHydroModelHydraulicSystem diagram, located under the GovHydroFrancis class, provides a schematic of the hydraulic system of detailed hydro unit models, such as Francis and Pelton.

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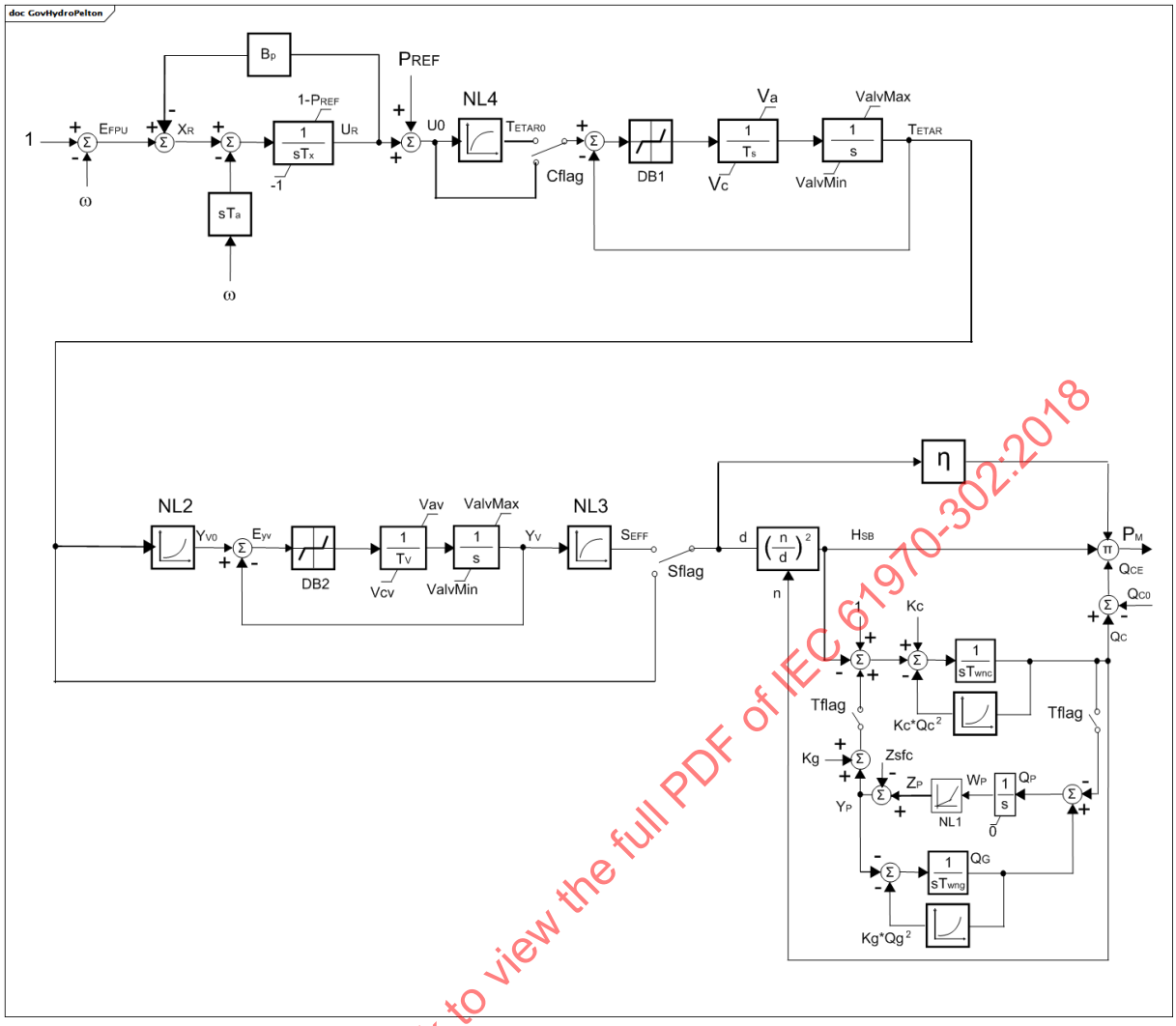

Figure 65 – GovHydroPelton

Figure 65: This diagram describes the GovHydroPelton turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) Rated hydraulic head, Hn, in metres, and rated flow, Qn, in cubic metres per s, are the design parameters of the hydraulic system capability.
3) Hydraulic system head attributes (Zsfc, H1, H2) are in metres but in the block diagram are in PU on base of Hn in metres.
4) Hydraulic area attributes (Av0, Av1) are in square metres but in the block diagram are in PU on base of Qn / Hn in square metres per s.
5) omega has units of PU speed.
6) Non-linear gains and efficiency shown in GovHydroPeltonNonLinearGainAndEfficiency diagram.

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doc GovHydroPeltonNonLinearGainAndEfficiency

- Non linear gains:

$$NL1: \begin{cases} Z_p = \dfrac{W_p}{A_{V1}} & if \quad 0 \le W_p \le W_1 \\ Z_p = H_1 + \dfrac{W_p - W_1}{A_{V0}} & if \quad W_1 \le W_p \le W_2 \\ Z_p = H_2 & if \quad W_p \ge W_2 \end{cases}$$

$$NL2: \quad Y_{V0} = (TetaR)^3$$

$$NL3: \quad S_{eff} = -1.1 + \sqrt{1.21 + Y_V \cdot (4.2 - Y_V)}$$

$$NL4: \quad TetaR0 = \left(2.1 - \sqrt{5.62 - (U_0 + 1.1)^2}\right)^{1/3}$$

$W_1 = H_1.A_{V1}$ = Compensation chamber volume
$W_2 = W_1 + (H_2 - H_1).A_{V0}$ = Compensation chamber + tank volume

- Efficiency:

$$\eta = \begin{cases} 1 & if \ S_{eff} \ge 0.3 \\ 0.7 + S_{eff} & if \ 0.13 \le S_{eff} < 0.3 \\ 13.83 \cdot (S_{eff} - 0.07) & if \ 0.07 \le S_{eff} < 0.13 \\ 0 & if \ S_{eff} < 0.07 \end{cases}$$

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Figure 66 – GovHydroPeltonNonLinearGainAndEfficiency

Figure 66: This diagram illustrates the non-linear gain and efficiency equations.

Table 65 shows all attributes of GovHydroPelton.

Table 65 – Attributes of TurbineGovernorDynamics::GovHydroPelton

name	mult	type	description
av0	0..1	Area	Area of the surge tank (AV0). Unit = m2. Typical value = 30.
av1	0..1	Area	Area of the compensation tank (AV1). Unit = m2. Typical value = 700.
bp	0..1	PU	Droop (bp). Typical value = 0,05.
db1	0..1	Frequency	Intentional dead-band width (DB1). Unit = Hz. Typical value = 0.
db2	0..1	Frequency	Intentional dead-band width of valve opening error (DB2). Unit = Hz. Typical value = 0,01.
h1	0..1	Length	Head of compensation chamber water level with respect to the level of penstock (H1). Unit = km. Typical value = 0,004.
h2	0..1	Length	Head of surge tank water level with respect to the level of penstock (H2). Unit = km. Typical value = 0,040.
hn	0..1	Length	Rated hydraulic head (Hn). Unit = km. Typical value = 0,250.
kc	0..1	PU	Penstock loss coefficient (due to friction) (Kc). Typical value = 0,025.
kg	0..1	PU	Water tunnel and surge chamber loss coefficient (due to friction) (Kg). Typical value = 0,025.
qc0	0..1	PU	No-load turbine flow at nominal head (Qc0). Typical value = 0,05.
qn	0..1	VolumeFlowRate	Rated flow (Qn). Unit = m3/s. Typical value = 250.
simplifiedPelton	0..1	Boolean	Simplified Pelton model simulation (Sflag). true = enable of simplified Pelton model simulation false = enable of complete Pelton model simulation (non-linear gain). Typical value = true.
staticCompensating	0..1	Boolean	Static compensating characteristic (Cflag). It should be true if simplifiedPelton = false. true = enable of static compensating characteristic false = inhibit of static compensating characteristic. Typical value = false.
ta	0..1	Seconds	Derivative gain (accelerometer time constant) (Ta) (>= 0). Typical value = 3.
ts	0..1	Seconds	Gate servo time constant (Ts) (>= 0). Typical value = 0,15.
tv	0..1	Seconds	Servomotor integrator time constant (Tv) (>= 0). Typical value = 0,3.
twnc	0..1	Seconds	Water inertia time constant (Twnc) (>= 0). Typical value = 1.
twng	0..1	Seconds	Water tunnel and surge chamber inertia time constant (Twng) (>= 0). Typical value = 3.
tx	0..1	Seconds	Electronic integrator time constant (Tx) (>= 0). Typical value = 0,5.
va	0..1	Float	Maximum gate opening velocity (Va). Unit = PU / s. Typical value = 0,06.
valvmax	0..1	PU	Maximum gate opening (ValvMax) (> GovHydroPelton.valvmin). Typical value = 1,1.
valvmin	0..1	PU	Minimum gate opening (ValvMin) (< GovHydroPelton.valvmax). Typical value = 0.

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name	mult	type	description
vav	0..1	PU	Maximum servomotor valve opening velocity (Vav). Typical value = 0,1.
vc	0..1	Float	Maximum gate closing velocity (Vc). Unit = PU / s. Typical value = -0,06.
vcv	0..1	PU	Maximum servomotor valve closing velocity (Vcv). Typical value = -0,1.
waterTunnelSurgeChamberSimulation	0..1	Boolean	Water tunnel and surge chamber simulation (Tflag). true = enable of water tunnel and surge chamber simulation false = inhibit of water tunnel and surge chamber simulation. Typical value = false.
zsfc	0..1	Length	Head of upper water level with respect to the level of penstock (Zsfc). Unit = km. Typical value = 0,025.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 66 shows all association ends of GovHydroPelton with other classes.

Table 66 – Association ends of TurbineGovernorDynamics::GovHydroPelton with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.22 GovHydroPID

PID governor and turbine.

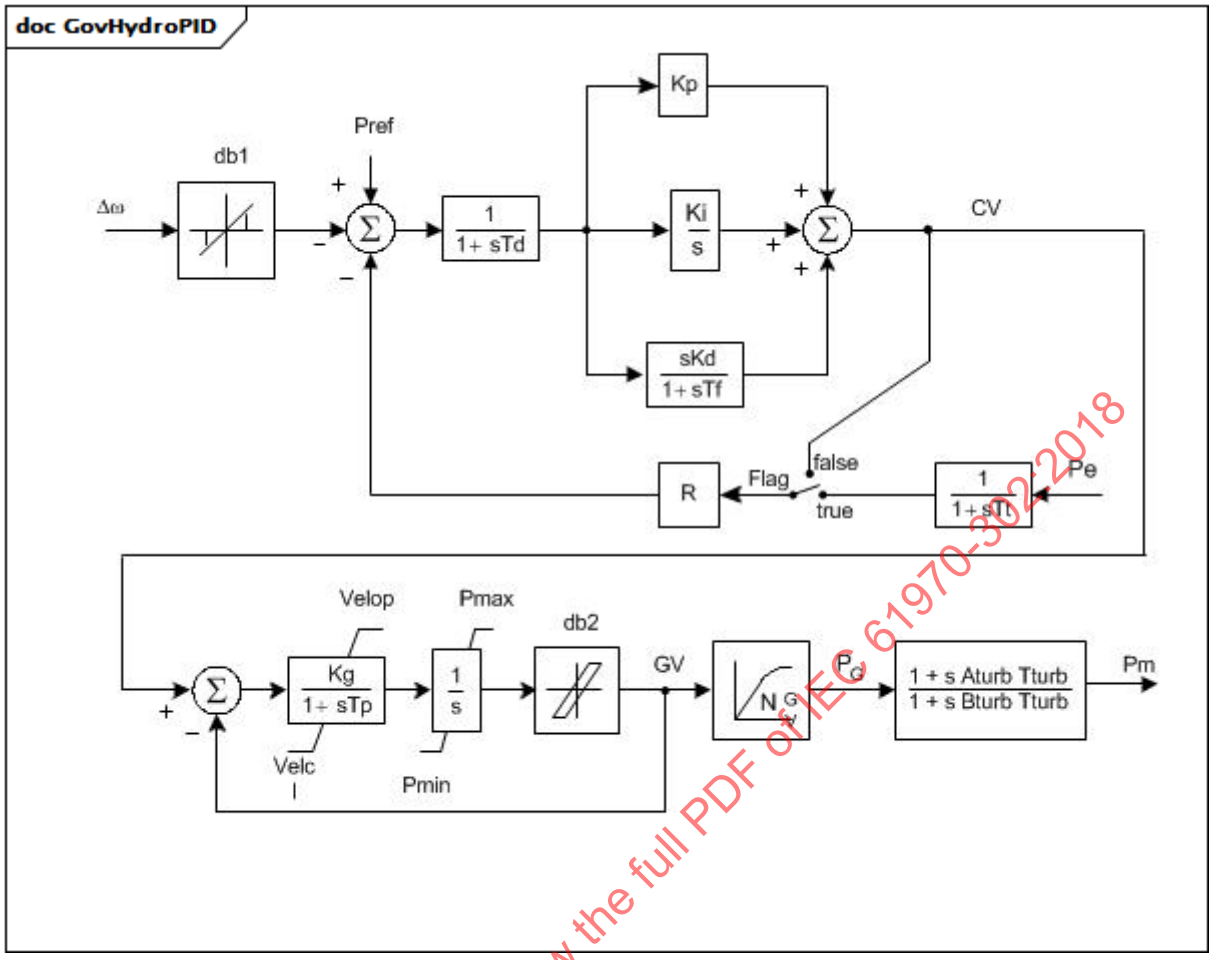

Figure 67 – GovHydroPID

Figure 67: This diagram describes the GovHydroPID turbine governor model.

Parameter details:

1) If Tf is zero, but Kd is not zero, Tf is set to a small value (4 times integration time step).
2) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.
3) For a hydro turbine, set Tturb = Tw (water starting time), set Aturb = -1 and Bturb = 0,5. For a diesel engine or two-shaft gas turbine, set Aturb = 0,8 and Bturb = 1 and Tturb = 1 s. For a small steam turbine with a non-reheat steam supply or a single- shaft gas turbine, set Aturb = 0 and Bturb = 1 and Tturb = 0 s.

Table 67 shows all attributes of GovHydroPID.

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Table 67 – Attributes of TurbineGovernorDynamics::GovHydroPID

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
pmax	0..1	PU	Maximum gate opening, PU of MWbase (Pmax) (> GovHydroPID.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening, PU of MWbase (Pmin) (< GovHydroPID.pmax). Typical value = 0.
r	0..1	PU	Steady state droop (R). Typical value = 0,05.
td	0..1	Seconds	Input filter time constant (Td) (>= 0). If = 0, block is bypassed. Typical value = 0.
tf	0..1	Seconds	Washout time constant (Tf) (>= 0). Typical value = 0,1.
tp	0..1	Seconds	Gate servo time constant (Tp) (>= 0). If = 0, block is bypassed. Typical value = 0,35.
velop	0..1	Float	Maximum gate opening velocity (Velop). Unit = PU / s. Typical value = 0,09.
velcl	0..1	Float	Maximum gate closing velocity (Velcl). Unit = PU / s. Typical value = -0,14.
kd	0..1	PU	Derivative gain (Kd). Typical value = 1,11.
kp	0..1	PU	Proportional gain (Kp). Typical value = 0,1.
ki	0..1	PU	Integral gain (Ki). Typical value = 0,36.
kg	0..1	PU	Gate servo gain (Kg). Typical value = 2,5.
tturb	0..1	Seconds	Turbine time constant (Tturb) (>= 0). See Parameter detail 3. Typical value = 0,8.
aturb	0..1	PU	Turbine numerator multiplier (Aturb) (see parameter detail 3). Typical value -1.
bturb	0..1	PU	Turbine denominator multiplier (Bturb) (see parameter detail 3). Typical value = 0,5.
tt	0..1	Seconds	Power feedback time constant (Tt) (>= 0). If = 0, block is bypassed. Typical value = 0,02.
db1	0..1	Frequency	Intentional dead-band width (db1). Unit = Hz. Typical value = 0.
inputSignal	0..1	Boolean	Input signal switch (Flag). true = Pe input is used false = feedback is received from CV. Flag is normally dependent on Tt. If Tt is zero, Flag is set to false. If Tt is not zero, Flag is set to true. Typical value = true.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock

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name	mult	type	description
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 68 shows all association ends of GovHydroPID with other classes.

Table 68 – Association ends of TurbineGovernorDynamics::GovHydroPID with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.23 GovHydroPID2

Hydro turbine and governor. Represents plants with straightforward penstock configurations and "three term" electro-hydraulic governors (i.e. WoodwardTM electronic).

[Footnote: Woodward electronic governors are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

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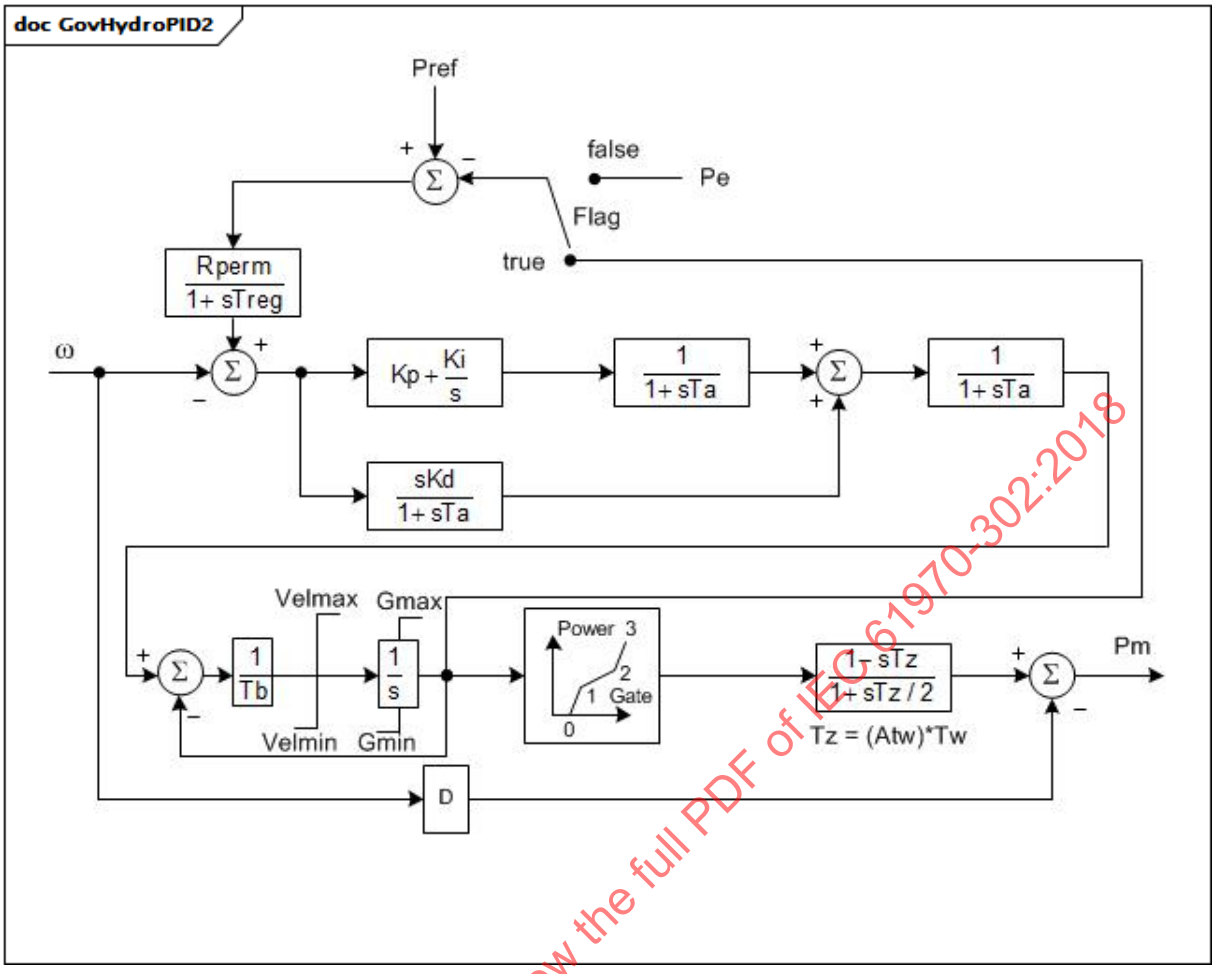

Figure 68 – GovHydroPID2

Figure 68: This diagram describes the GovHydroPID2 turbine governor model.

Parameter details:

1) The gates travel over a range of 1,0 PU from fully closed to fully opened. The gates are at a position greater than zero at zero power and, normally, less than 1,0 when power is 1,0 PU.
2) G0, G1, P1, G2, P2, and P3 specify the variation of power with gate G2 > G1 > G0.
3) This model uses a simplified turbine-penstock model that does not account for the variation of the water inertia effect with gate opening. To make this model correspond to other models using the "classical" turbine-penstock model, set Atw to unity. To approximate water inertia effects at part load, Atw can be set to the PU gate opening about which perturbations are centred.

Table 69 shows all attributes of GovHydroPID2.

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Table 69 – Attributes of TurbineGovernorDynamics::GovHydroPID2

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (>0). Unit = MW.
treg	0..1	Seconds	Speed detector time constant (Treg) (>= 0). Typical value = 0.
rperm	0..1	PU	Permanent drop (Rperm). Typical value = 0.
kp	0..1	PU	Proportional gain (Kp). Typical value = 0.
ki	0..1	Float	Reset gain (Ki). Unit = PU/s. Typical value = 0.
kd	0..1	PU	Derivative gain (Kd). Typical value = 0.
ta	0..1	Seconds	Controller time constant (Ta) (>= 0). Typical value = 0.
tb	0..1	Seconds	Gate servo time constant (Tb) (> 0).
velmax	0..1	Float	Maximum gate opening velocity (Velmax) (< GovHydroPID2.velmin). Unit = PU / s. Typical value = 0.
velmin	0..1	Float	Maximum gate closing velocity (Velmin) (> GovHydroPID2.velmax). Unit = PU / s. Typical value = 0.
gmax	0..1	PU	Maximum gate opening (Gmax) (> GovHydroPID2.gmin). Typical value = 0.
gmin	0..1	PU	Minimum gate opening (Gmin) (> GovHydroPID2.gmax). Typical value = 0.
tw	0..1	Seconds	Water inertia time constant (Tw) (>= 0). Typical value = 0.
d	0..1	PU	Turbine damping factor (D). Unit = delta P / delta speed. Typical value = 0.
g0	0..1	PU	Gate opening at speed no load (G0). Typical value = 0.
g1	0..1	PU	Intermediate gate opening (G1). Typical value = 0.
p1	0..1	PU	Power at gate opening G1 (P1). Typical value = 0.
g2	0..1	PU	Intermediate gate opening (G2). Typical value = 0.
p2	0..1	PU	Power at gate opening G2 (P2). Typical value = 0.
p3	0..1	PU	Power at full opened gate (P3). Typical value = 0.
atw	0..1	PU	Factor multiplying Tw (Atw). Typical value = 0.
feedbackSignal	0..1	Boolean	Feedback signal type flag (Flag). true = use gate position feedback signal false = use Pe.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 70 shows all association ends of GovHydroPID2 with other classes.

Table 70 – Association ends of TurbineGovernorDynamics::GovHydroPID2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.24 GovHydroR

Fourth order lead-lag governor and hydro turbine.

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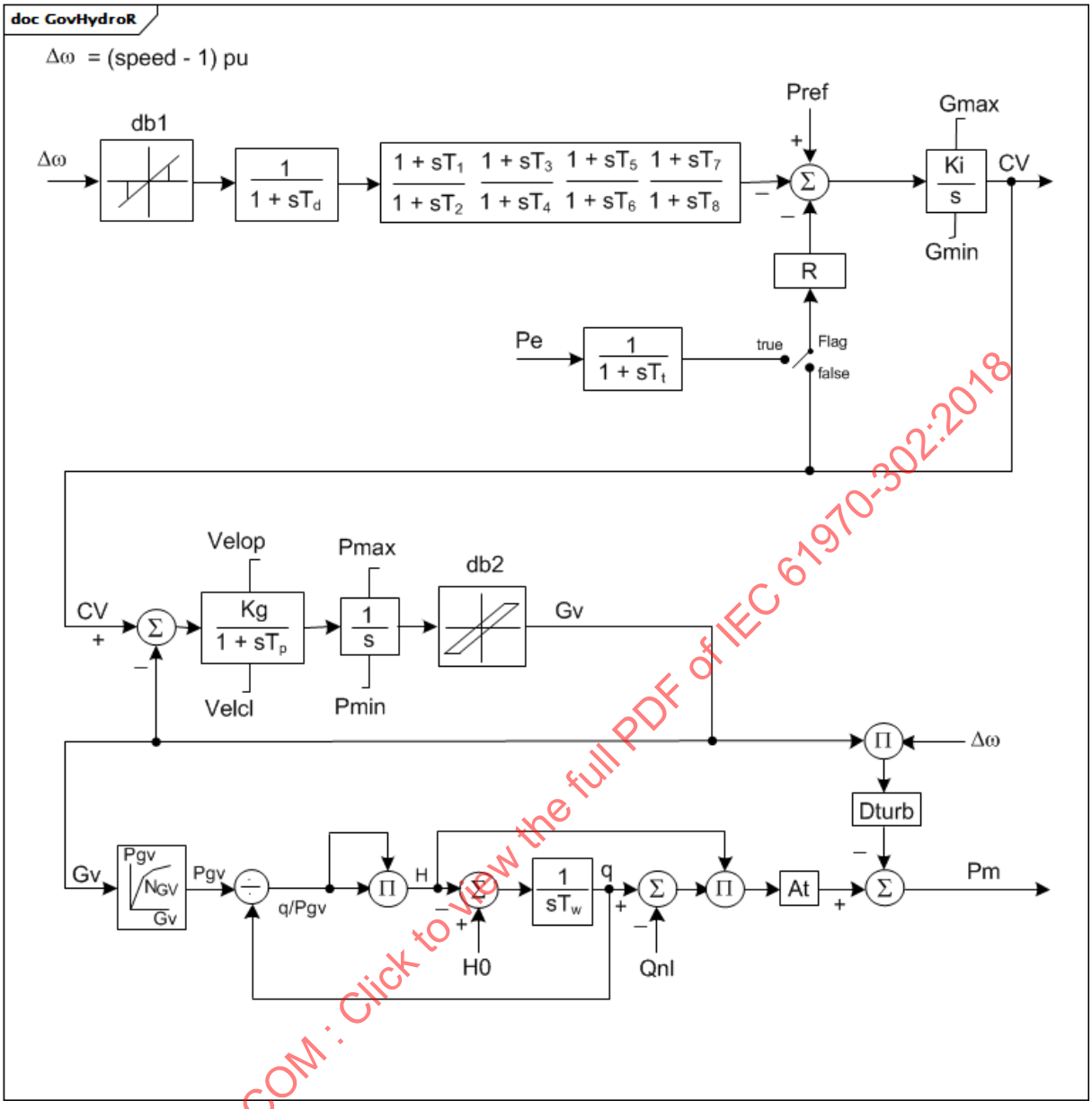

Figure 69 – GovHydroR

Figure 69: This diagram describes the GovHydroR turbine governor model.

Parameter details:

1) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

Table 71 shows all attributes of GovHydroR.

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Table 71 – Attributes of TurbineGovernorDynamics::GovHydroR

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
pmax	0..1	PU	Maximum gate opening, PU of MWbase (Pmax) (> GovHydroR.pmin). Typical value = 1.
pmin	0..1	PU	Minimum gate opening, PU of MWbase (Pmin) (< GovHydroR.pmax). Typical value = 0.
r	0..1	PU	Steady-state droop (R). Typical value = 0,05.
td	0..1	Seconds	Input filter time constant (Td) (>= 0). Typical value = 0,05.
t1	0..1	Seconds	Lead time constant 1 (T1) (>= 0). Typical value = 1,5.
t2	0..1	Seconds	Lag time constant 1 (T2) (>= 0). Typical value = 0,1.
t3	0..1	Seconds	Lead time constant 2 (T3) (>= 0). Typical value = 1,5.
t4	0..1	Seconds	Lag time constant 2 (T4) (>= 0). Typical value = 0,1.
t5	0..1	Seconds	Lead time constant 3 (T5) (>= 0). Typical value = 0.
t6	0..1	Seconds	Lag time constant 3 (T6) (>= 0). Typical value = 0,05.
t7	0..1	Seconds	Lead time constant 4 (T7) (>= 0). Typical value = 0.
t8	0..1	Seconds	Lag time constant 4 (T8) (>= 0). Typical value = 0,05.
tp	0..1	Seconds	Gate servo time constant (Tp) (>= 0). Typical value = 0,05.
velop	0..1	Float	Maximum gate opening velocity (Velop). Unit = PU / s. Typical value = 0,2.
velcl	0..1	Float	Maximum gate closing velocity (Velcl). Unit = PU / s. Typical value = -0,2.
ki	0..1	PU	Integral gain (Ki). Typical value = 0,5.
kg	0..1	PU	Gate servo gain (Kg). Typical value = 2.
gmax	0..1	PU	Maximum governor output (Gmax) (> GovHydroR.gmin). Typical value = 1,05.
gmin	0..1	PU	Minimum governor output (Gmin) (< GovHydroR.gmax). Typical value = -0,05.
tt	0..1	Seconds	Power feedback time constant (Tt) (>= 0). Typical value = 0.
inputSignal	0..1	Boolean	Input signal switch (Flag). true = Pe input is used false = feedback is received from CV. Flag is normally dependent on Tt. If Tt is zero, Flag is set to false. If Tt is not zero, Flag is set to true. Typical value = true.
db1	0..1	Frequency	Intentional dead-band width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
db2	0..1	ActivePower	Unintentional dead-band (db2). Unit = MW. Typical value = 0.
tw	0..1	Seconds	Water inertia time constant (Tw) (> 0). Typical value = 1.
at	0..1	PU	Turbine gain (At). Typical value = 1,2.
dturb	0..1	PU	Turbine damping factor (Dturb). Typical value = 0,2.
qnl	0..1	PU	No-load turbine flow at nominal head (Qnl). Typical value = 0,08.
h0	0..1	PU	Turbine nominal head (H0). Typical value = 1.
gv1	0..1	PU	Nonlinear gain point 1, PU gv (Gv1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain point 1, PU power (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain point 2, PU gv (Gv2). Typical value = 0.
pgv2	0..1	PU	Nonlinear gain point 2, PU power (Pgv2). Typical value = 0.
gv3	0..1	PU	Nonlinear gain point 3, PU gv (Gv3). Typical value = 0.
pgv3	0..1	PU	Nonlinear gain point 3, PU power (Pgv3). Typical value = 0.
gv4	0..1	PU	Nonlinear gain point 4, PU gv (Gv4). Typical value = 0.

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name	mult	type	description
pgv4	0..1	PU	Nonlinear gain point 4, PU power (Pgv4). Typical value = 0.
gv5	0..1	PU	Nonlinear gain point 5, PU gv (Gv5). Typical value = 0.
pgv5	0..1	PU	Nonlinear gain point 5, PU power (Pgv5). Typical value = 0.
gv6	0..1	PU	Nonlinear gain point 6, PU gv (Gv6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain point 6, PU power (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 72 shows all association ends of GovHydroR with other classes.

Table 72 – Association ends of TurbineGovernorDynamics::GovHydroR with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.25 GovHydroWEH

WoodwardTM electric hydro governor.

[Footnote: Woodward electric hydro governors are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

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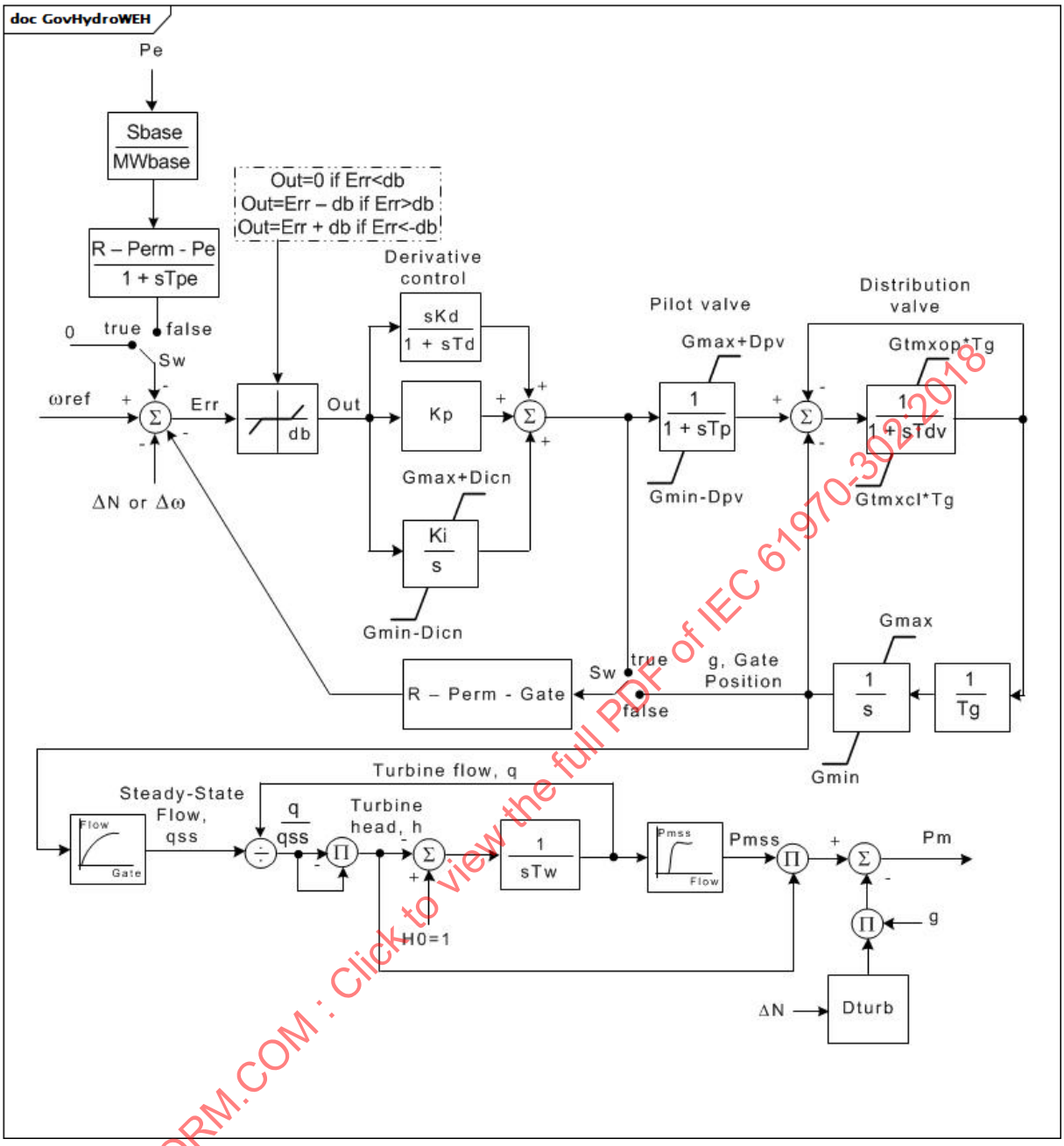

Figure 70 – GovHydroWEH

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Figure 70: This diagram describes the GovHydroWEH turbine governor model.

Parameter details:

1) The nonlinear relationship between gate position and water flow can be input with up to 5 points specified by pairs of .gvn and .fln attributes.
2) The nonlinear relationship between turbine flow and mechanical power output (on machine MVA rating) can be input with up to 10 points specified by pairs of .fpn and .pmssn attributes.

Table 73 shows all attributes of GovHydroWEH.

Table 73 – Attributes of TurbineGovernorDynamics::GovHydroWEH

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
rpg	0..1	Float	Permanent droop for governor output feedback (R-Perm-Gate).
rpp	0..1	Float	Permanent droop for electrical power feedback (R-Perm-Pe).
tpe	0..1	Seconds	Electrical power droop time constant (Tpe) (>= 0).
kp	0..1	PU	Derivative control gain (Kp).
ki	0..1	PU	Derivative controller Integral gain (Ki).
kd	0..1	PU	Derivative controller derivative gain (Kd).
td	0..1	Seconds	Derivative controller time constant (Td) (>= 0). Limits the derivative characteristic beyond a breakdown frequency to avoid amplification of high-frequency noise.
tp	0..1	Seconds	Pilot valve time lag time constant (Tp) (>= 0).
tdv	0..1	Seconds	Distributive valve time lag time constant (Tdv) (>= 0).
tg	0..1	Seconds	Value to allow the distribution valve controller to advance beyond the gate movement rate limit (Tg) (>= 0).
gtmxop	0..1	PU	Maximum gate opening rate (Gtmxop).
gtmxcl	0..1	PU	Maximum gate closing rate (Gtmxcl).
gmax	0..1	PU	Maximum gate position (Gmax) (> GovHydroWEH.gmin).
gmin	0..1	PU	Minimum gate position (Gmin) (< GovHydroWEH.gmax).
dturb	0..1	PU	Turbine damping factor (Dturb). Unit = delta P (PU of MWbase) / delta speed (PU).
tw	0..1	Seconds	Water inertia time constant (Tw) (> 0).
db	0..1	PU	Speed deadband (db).
dpv	0..1	PU	Value to allow the pilot valve controller to advance beyond the gate limits (Dpv).
dicn	0..1	PU	Value to allow the integral controller to advance beyond the gate limits (Dicn).
feedbackSignal	0..1	Boolean	Feedback signal selection (Sw). true = PID output (if R-Perm-Gate = droop and R-Perm-Pe = 0) false = electrical power (if R-Perm-Gate = 0 and R-Perm-Pe = droop) or false = gate position (if R-Perm-Gate = droop and R-Perm-Pe = 0). Typical value = false.
gv1	0..1	PU	Gate 1 (Gv1). Gate Position value for point 1 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
gv2	0..1	PU	Gate 2 (Gv2). Gate Position value for point 2 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
gv3	0..1	PU	Gate 3 (Gv3). Gate Position value for point 3 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
gv4	0..1	PU	Gate 4 (Gv4). Gate Position value for point 4 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
gv5	0..1	PU	Gate 5 (Gv5). Gate Position value for point 5 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
fl1	0..1	PU	Flowgate 1 (Fl1). Flow value for gate position point 1 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.

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name	mult	type	description
fl2	0..1	PU	Flowgate 2 (Fl2). Flow value for gate position point 2 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
fl3	0..1	PU	Flowgate 3 (Fl3). Flow value for gate position point 3 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
fl4	0..1	PU	Flowgate 4 (Fl4). Flow value for gate position point 4 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
fl5	0..1	PU	Flowgate 5 (Fl5). Flow value for gate position point 5 for lookup table representing water flow through the turbine as a function of gate position to produce steady state flow.
fp1	0..1	PU	Flow P1 (Fp1). Turbine flow value for point 1 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp2	0..1	PU	Flow P2 (Fp2). Turbine flow value for point 2 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp3	0..1	PU	Flow P3 (Fp3). Turbine flow value for point 3 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp4	0..1	PU	Flow P4 (Fp4). Turbine flow value for point 4 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp5	0..1	PU	Flow P5 (Fp5). Turbine flow value for point 5 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp6	0..1	PU	Flow P6 (Fp6). Turbine flow value for point 6 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp7	0..1	PU	Flow P7 (Fp7). Turbine flow value for point 7 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp8	0..1	PU	Flow P8 (Fp8). Turbine flow value for point 8 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp9	0..1	PU	Flow P9 (Fp9). Turbine flow value for point 9 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
fp10	0..1	PU	Flow P10 (Fp10). Turbine flow value for point 10 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss1	0..1	PU	Pmss flow P1 (Pmss1). Mechanical power output for turbine flow point 1 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss2	0..1	PU	Pmss flow P2 (Pmss2). Mechanical power output for turbine flow point 2 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss3	0..1	PU	Pmss flow P3 (Pmss3). Mechanical power output for turbine flow point 3 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss4	0..1	PU	Pmss flow P4 (Pmss4). Mechanical power output for turbine flow point 4 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss5	0..1	PU	Pmss flow P5 (Pmss5). Mechanical power output for turbine flow point 5 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss6	0..1	PU	Pmss flow P6 (Pmss6). Mechanical power output for turbine flow point 6 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss7	0..1	PU	Pmss flow P7 (Pmss7). Mechanical power output for turbine flow point 7 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss8	0..1	PU	Pmss flow P8 (Pmss8). Mechanical power output for turbine flow point 8 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.

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name	mult	type	description
pmss9	0..1	PU	Pmss flow P9 (Pmss9). Mechanical power output for turbine flow point 9 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
pmss10	0..1	PU	Pmss flow P10 (Pmss10). Mechanical power output for turbine flow point 10 for lookup table representing PU mechanical power on machine MVA rating as a function of turbine flow.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 74 shows all association ends of GovHydroWEH with other classes.

Table 74 – Association ends of TurbineGovernorDynamics::GovHydroWEH with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.26 GovHydroWPID

WoodwardTM PID hydro governor.

[Footnote: Woodward PID hydro governors are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

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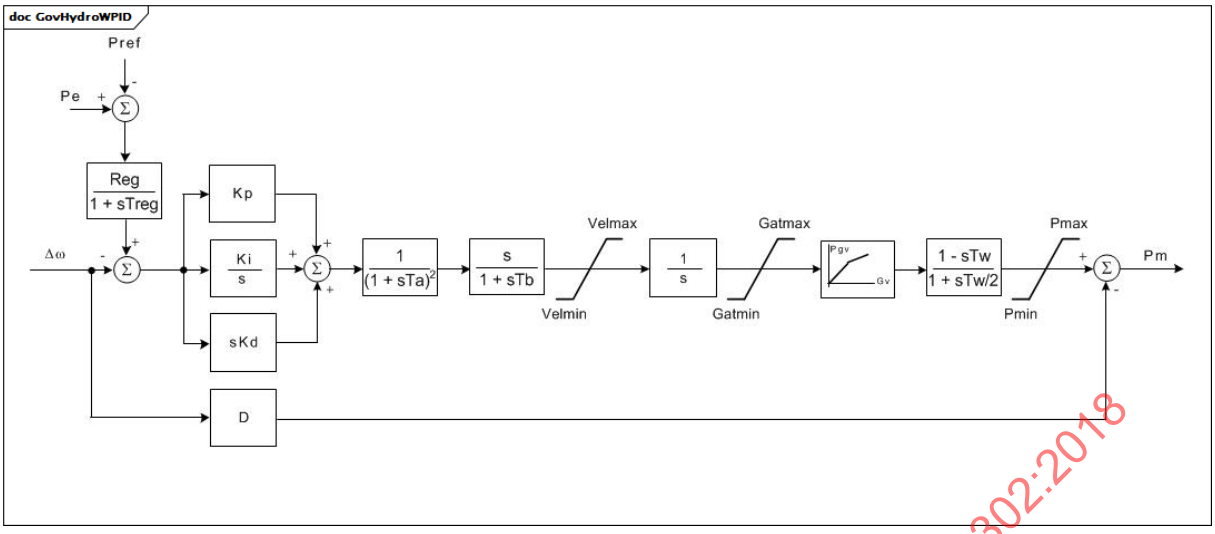

Figure 71 – GovHydroWPID

Figure 71: This diagram describes the GovHydroWPID turbine governor model.

Parameter details:

1) The nonlinear gain between gate position and power can be input with up to 3 points. The (0,0 , 0,0) point can be assumed. In this model, Gv3 = 1,0 and the output is not allowed to go above 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default hydro curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

Table 75 shows all attributes of GovHydroWPID.

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Table 75 – Attributes of TurbineGovernorDynamics::GovHydroWPID

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
treg	0..1	Seconds	Speed detector time constant (Treg) (>= 0).
reg	0..1	PU	Permanent drop (Reg).
kp	0..1	PU	Proportional gain (Kp). Typical value = 0,1.
ki	0..1	PU	Reset gain (Ki). Typical value = 0,36.
kd	0..1	PU	Derivative gain (Kd). Typical value = 1,11.
ta	0..1	Seconds	Controller time constant (Ta) (>= 0). Typical value = 0.
tb	0..1	Seconds	Gate servo time constant (Tb) (>= 0). Typical value = 0.
velmax	0..1	PU	Maximum gate opening velocity (Velmax) (> GovHydroWPID.velmin). Unit = PU / s. Typical value = 0.
velmin	0..1	PU	Maximum gate closing velocity (Velmin) (< GovHydroWPID.velmax). Unit = PU / s. Typical value = 0.
gatmax	0..1	PU	Gate opening limit maximum (Gatmax) (> GovHydroWPID.gatmin).
gatmin	0..1	PU	Gate opening limit minimum (Gatmin) (< GovHydroWPID.gatmax).
tw	0..1	Seconds	Water inertia time constant (Tw) (>= 0). Typical value = 0.
pmax	0..1	PU	Maximum power output (Pmax) (> GovHydroWPID.pmin).
pmin	0..1	PU	Minimum power output (Pmin) (< GovHydroWPID.pmax).
d	0..1	PU	Turbine damping factor (D). Unit = delta P / delta speed.
gv3	0..1	PU	Gate position 3 (Gv3) (= 1,0).
gv1	0..1	PU	Gate position 1 (Gv1).
pgv1	0..1	PU	Output at Gv1 PU of MWbase (Pgv1).
gv2	0..1	PU	Gate position 2 (Gv2).
pgv2	0..1	PU	Output at Gv2 PU of MWbase (Pgv2).
pgv3	0..1	PU	Output at Gv3 PU of MWbase (Pgv3).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 76 shows all association ends of GovHydroWPID with other classes.

Table 76 – Association ends of TurbineGovernorDynamics::GovHydroWPID with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.27 GovSteam0

A simplified steam turbine governor.

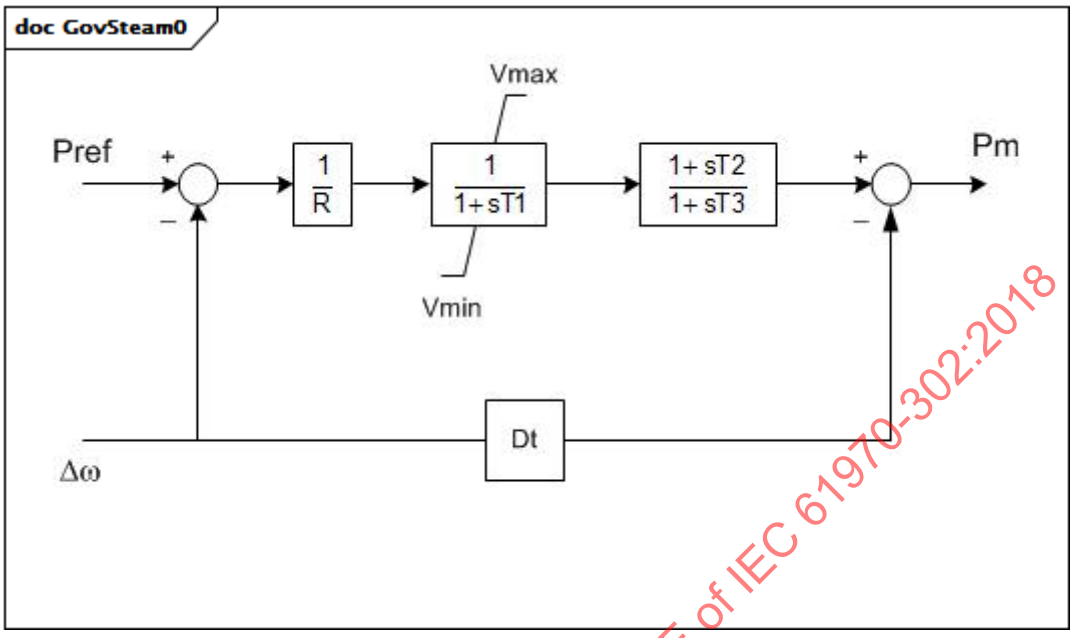

Figure 72 – GovSteam0

Figure 72: This diagram describes the GovSteam0 turbine governor model.

Parameter details:

1) To represent a non-reheat turbine set T2= 0 and T3 to about 0,5 s. For reheat turbine, set T2 = T3 x (HP turbine fraction).

Table 77 shows all attributes of GovSteam0.

Table 77 – Attributes of TurbineGovernorDynamics::GovSteam0

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
r	0..1	PU	Permanent droop (R). Typical value = 0,05.
t1	0..1	Seconds	Steam bowl time constant (T1) (> 0). Typical value = 0,5.
vmax	0..1	PU	Maximum valve position, PU of mwcap (Vmax) (> GovSteam0.vmin). Typical value = 1.
vmin	0..1	PU	Minimum valve position, PU of mwcap (Vmin) (< GovSteam0.vmax). Typical value = 0.
t2	0..1	Seconds	Numerator time constant of T2/T3 block (T2) (>= 0). Typical value = 3.
t3	0..1	Seconds	Reheater time constant (T3) (> 0). Typical value = 10.
dt	0..1	PU	Turbine damping coefficient (Dt). Unit = delta P / delta speed. Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 78 shows all association ends of GovSteam0 with other classes.

Table 78 – Association ends of TurbineGovernorDynamics::GovSteam0 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.28 GovSteam1

Steam turbine governor, based on the GovSteamIEEE1 (with optional deadband and nonlinear valve gain added).

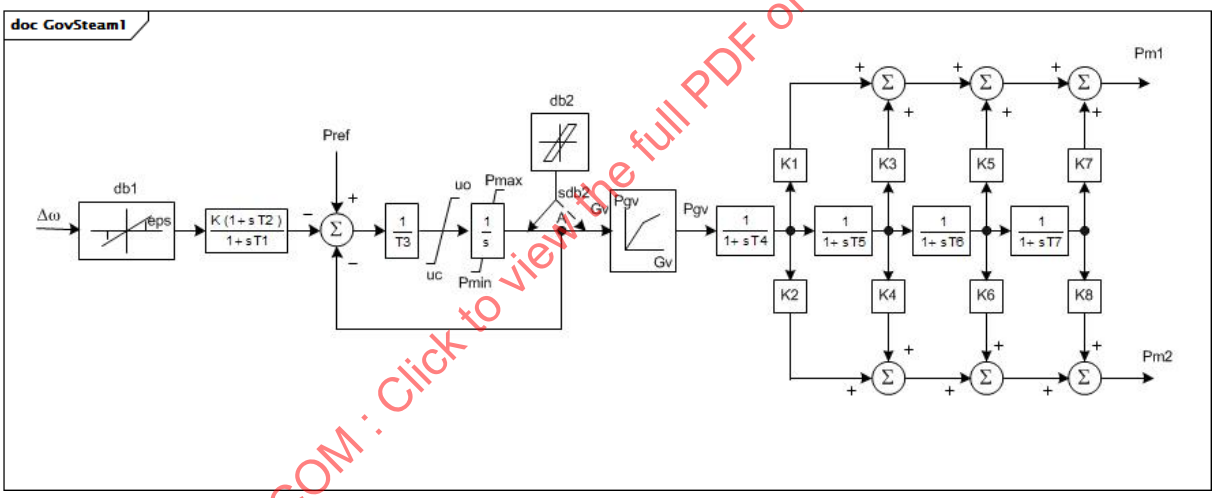

Figure 73 – GovSteam1

Figure 73: This diagram describes the GovSteam1 turbine governor model.

Parameter details:

1) PU parameters are on base of MWbase, which is normally the MW capability of the turbine.
2) For a tandem-compound turbine, the parameters K2, K4, K6, and K8 are ignored. For a cross-compound turbine, two generators are connected to this turbine-governor model.
3) Each generator shall be represented in the load flow by data on its own MVA base. The values of K1, K3, K5, and K7 shall be specified to describe the proportionate development of power on the first turbine shaft. K2, K4, K6, and K8 shall describe the second turbine shaft. Normally K1 + K3 + K5 + K7 = 1,0 and K2 + K4 + K6 + K8 = 1,0 (if second generator is present).
4) The division of power between the two shafts is in proportion to the values of MVA bases of the two generators. The initial condition load flow should, therefore, have the two generators loaded to the same fraction of each one's MVA base.

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5) The intentional input speed deadband follows the relationship shown in the GovSteamIEEE1InputSpeedDeadband diagram.

6) The unintentional deadband can be used to represent backlash hysteresis in the control components by the relationship shown in the GovSteamIEEE1BacklashHysteresis diagram.

7) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero, the default curve (between (0,0 , 0,0) and (1,0 , 1,0)) will be used.

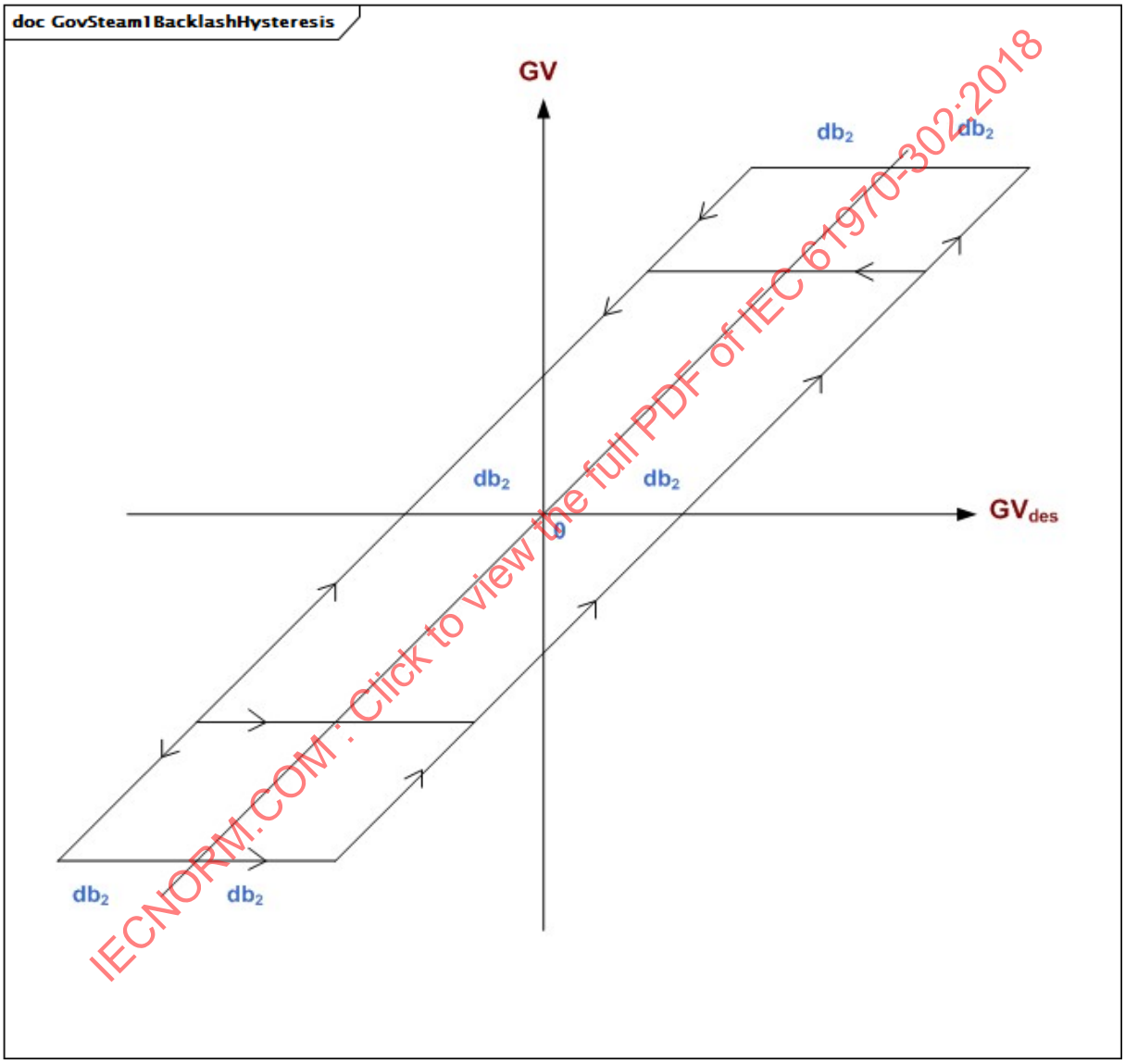

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Figure 74 – GovSteam1BacklashHysteresis

Figure 74: This diagram illustrates the backlash hysteresis.

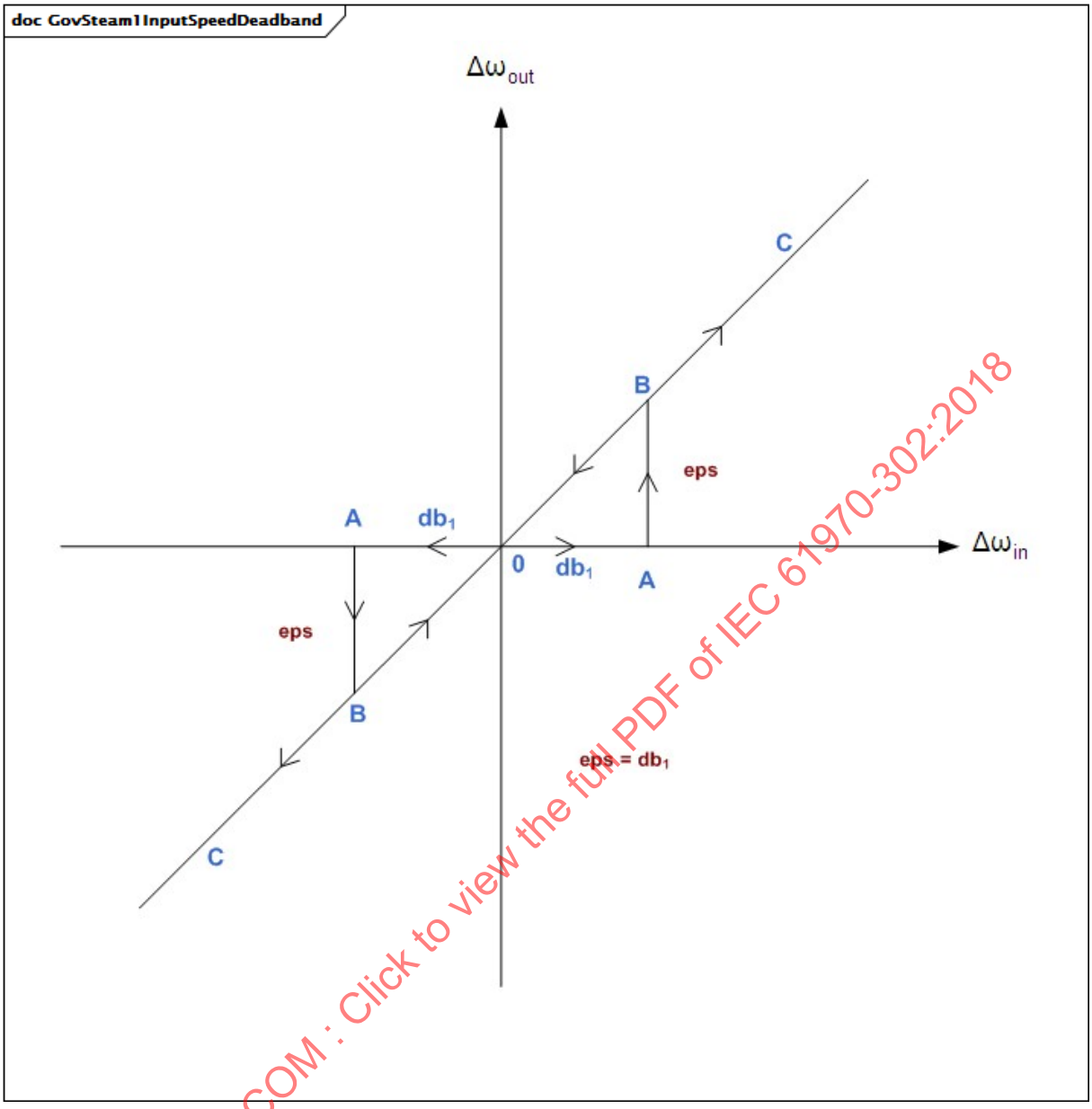

Figure 75 – GovSteam1InputSpeedDeadband

Figure 75: This diagram illustrates the input speed deadband.

Table 79 shows all attributes of GovSteam1.

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Table 79 – Attributes of TurbineGovernorDynamics::GovSteam1

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
k	0..1	PU	Governor gain (reciprocal of droop) (K) (> 0). Typical value = 25.
t1	0..1	Seconds	Governor lag time constant (T1) (>= 0). Typical value = 0.
t2	0..1	Seconds	Governor lead time constant (T2) (>= 0). Typical value = 0.
t3	0..1	Seconds	Valve positioner time constant (T3) (> 0). Typical value = 0,1.
uo	0..1	Float	Maximum valve opening velocity (Uo) (> 0). Unit = PU / s. Typical value = 1.
uc	0..1	Float	Maximum valve closing velocity (Uc) (< 0). Unit = PU / s. Typical value = -10.
pmax	0..1	PU	Maximum valve opening (Pmax) (> GovSteam1.pmin). Typical value = 1.
pmin	0..1	PU	Minimum valve opening (Pmin) (>= 0 and < GovSteam1.pmax). Typical value = 0.
t4	0..1	Seconds	Inlet piping/steam bowl time constant (T4) (>= 0). Typical value = 0,3.
k1	0..1	Float	Fraction of HP shaft power after first boiler pass (K1). Typical value = 0,2.
k2	0..1	Float	Fraction of LP shaft power after first boiler pass (K2). Typical value = 0.
t5	0..1	Seconds	Time constant of second boiler pass (T5) (>= 0). Typical value = 5.
k3	0..1	Float	Fraction of HP shaft power after second boiler pass (K3). Typical value = 0,3.
k4	0..1	Float	Fraction of LP shaft power after second boiler pass (K4). Typical value = 0.
t6	0..1	Seconds	Time constant of third boiler pass (T6) (>= 0). Typical value = 0,5.
k5	0..1	Float	Fraction of HP shaft power after third boiler pass (K5). Typical value = 0,5.
k6	0..1	Float	Fraction of LP shaft power after third boiler pass (K6). Typical value = 0.
t7	0..1	Seconds	Time constant of fourth boiler pass (T7) (>= 0). Typical value = 0.
k7	0..1	Float	Fraction of HP shaft power after fourth boiler pass (K7). Typical value = 0.
k8	0..1	Float	Fraction of LP shaft power after fourth boiler pass (K8). Typical value = 0.
db1	0..1	Frequency	Intentional deadband width (db1). Unit = Hz. Typical value = 0.
eps	0..1	Frequency	Intentional db hysteresis (eps). Unit = Hz. Typical value = 0.
sdb1	0..1	Boolean	Intentional deadband indicator. true = intentional deadband is applied false = intentional deadband is not applied. Typical value = true.
sdb2	0..1	Boolean	Unintentional deadband location. true = intentional deadband is applied before point "A" false = intentional deadband is applied after point "A". Typical value = true.
db2	0..1	ActivePower	Unintentional deadband (db2). Unit = MW. Typical value = 0.
valve	0..1	Boolean	Nonlinear valve characteristic. true = nonlinear valve characteristic is used false = nonlinear valve characteristic is not used. Typical value = true.
gv1	0..1	PU	Nonlinear gain valve position point 1 (GV1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain power value point 1 (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain valve position point 2 (GV2). Typical value = 0,4.
pgv2	0..1	PU	Nonlinear gain power value point 2 (Pgv2). Typical value = 0,75.
gv3	0..1	PU	Nonlinear gain valve position point 3 (GV3). Typical value = 0,5.
pgv3	0..1	PU	Nonlinear gain power value point 3 (Pgv3). Typical value = 0,91.

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name	mult	type	description
gv4	0..1	PU	Nonlinear gain valve position point 4 (GV4). Typical value = 0,6.
pgv4	0..1	PU	Nonlinear gain power value point 4 (Pgv4). Typical value = 0,98.
gv5	0..1	PU	Nonlinear gain valve position point 5 (GV5). Typical value = 1.
pgv5	0..1	PU	Nonlinear gain power value point 5 (Pgv5). Typical value = 1.
gv6	0..1	PU	Nonlinear gain valve position point 6 (GV6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain power value point 6 (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 80 shows all association ends of GovSteam1 with other classes.

Table 80 – Association ends of TurbineGovernorDynamics::GovSteam1 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.29 GovSteam2

Simplified governor.

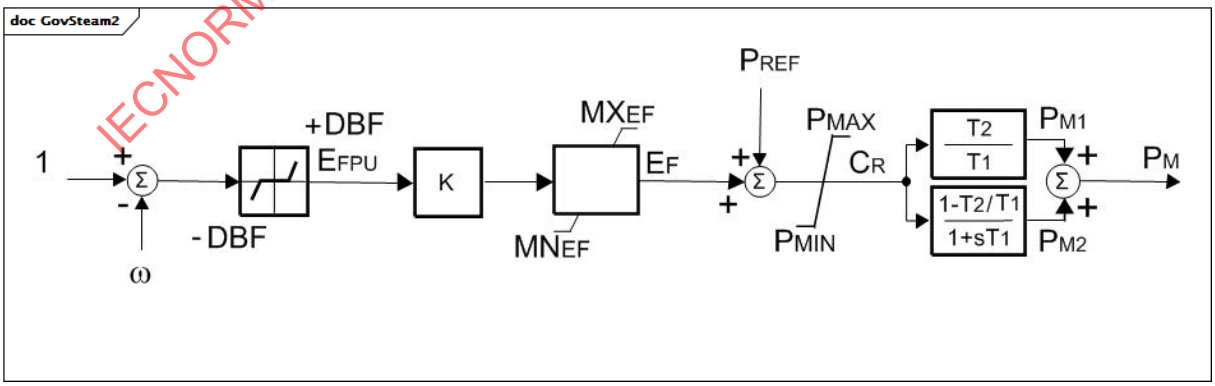

Figure 76 – GovSteam2

Figure 76: This diagram describes the GovSteam2 turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) This model can be used for both thermal and hydro power plants.
3) omega has units of per unit speed.

Table 81 shows all attributes of GovSteam2.

Table 81 – Attributes of TurbineGovernorDynamics::GovSteam2

name	mult	type	description
k	0..1	Float	Governor gain (reciprocal of droop) (K). Typical value = 20.
dbf	0..1	PU	Frequency deadband (DBF). Typical value = 0.
t1	0..1	Seconds	Governor lag time constant (T1) (> 0). Typical value = 0,45.
t2	0..1	Seconds	Governor lead time constant (T2) (>= 0). Typical value = 0.
pmax	0..1	PU	Maximum fuel flow (PMAX) (> GovSteam2.pmin). Typical value = 1.
pmin	0..1	PU	Minimum fuel flow (PMIN) (< GovSteam2.pmax). Typical value = 0.
mxef	0..1	PU	Fuel flow maximum positive error value (MXEF). Typical value = 1.
mnef	0..1	PU	Fuel flow maximum negative error value (MNEF). Typical value = -1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 82 shows all association ends of GovSteam2 with other classes.

Table 82 – Association ends of TurbineGovernorDynamics::GovSteam2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.30 GovSteamBB

European governor model.

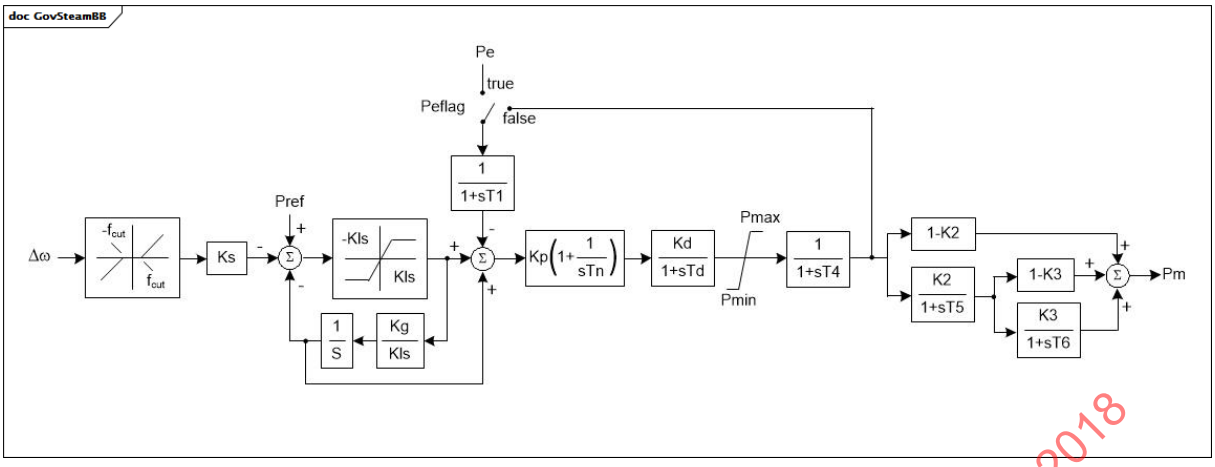

Figure 77 – GovSteamBB

Figure 77: This diagram describes the GovSteamBB turbine governor model.

Table 83 shows all attributes of GovSteamBB.

Table 83 – Attributes of TurbineGovernorDynamics::GovSteamBB

name	mult	type	description
fcut	0..1	PU	Frequency deadband (fcut) (>= 0). Typical value = 0,002.
ks	0..1	PU	Gain (Ks). Typical value = 21,0.
kls	0..1	PU	Gain (Kls) (> 0). Typical value = 0,1.
kg	0..1	PU	Gain (Kg). Typical value = 1,0.
t1	0..1	Seconds	Time constant (T1). Typical value = 0,05.
kp	0..1	PU	Gain (Kp). Typical value = 1,0.
tn	0..1	Seconds	Time constant (Tn) (> 0). Typical value = 1,0.
kd	0..1	PU	Gain (Kd). Typical value = 1,0.
td	0..1	Seconds	Time constant (Td) (> 0). Typical value = 1,0.
pmax	0..1	PU	High power limit (Pmax) (> GovSteamBB.pmin). Typical value = 1,0.
pmin	0..1	PU	Low power limit (Pmin) (< GovSteamBB.pmax). Typical value = 0.
t4	0..1	Seconds	Time constant (T4). Typical value = 0,15.
k2	0..1	PU	Gain (K2). Typical value = 0,75.
t5	0..1	Seconds	Time constant (T5). Typical value = 12,0.
k3	0..1	PU	Gain (K3). Typical value = 0,5.
t6	0..1	Seconds	Time constant (T6). Typical value = 0,75.
peflag	0..1	Boolean	Electric power input selection (Peflag). true = electric power input false = feedback signal. Typical value = false.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 84 shows all association ends of GovSteamBB with other classes.

Table 84 – Association ends of TurbineGovernorDynamics::GovSteamBB with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.31 GovSteamCC

Cross compound turbine governor. Unlike tandem compound units, cross compound units are not on the same shaft.

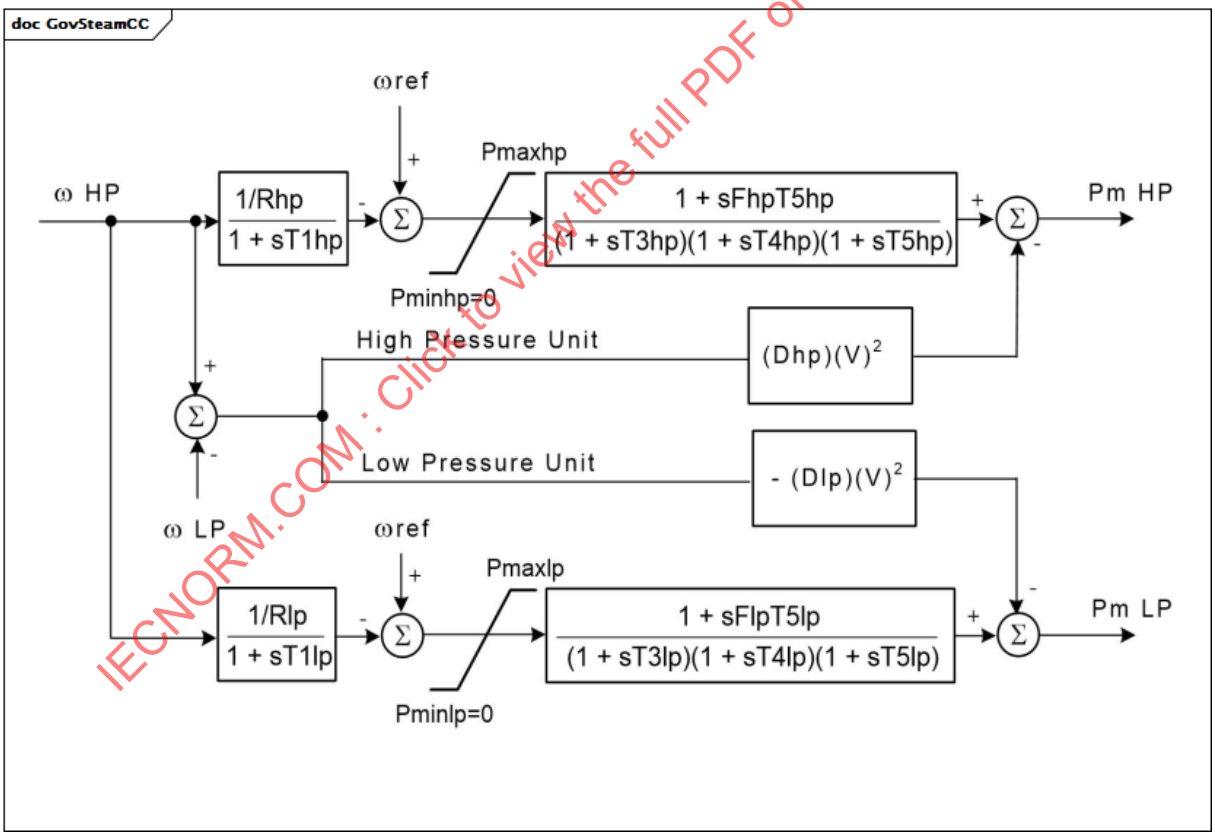

Figure 78 – GovSteamCC

Figure 78: This diagram describes the GovSteamCC turbine governor model.

Parameter details:

1) Both generators shall be present and in service.

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2) Each generator shall be represented in the load flow by data stated on its own MVA base. The division of power between the two turbines is determined by the values of MWbase of the two generators, not by the values of Fhp and Flp.

3) The rotor speed reference values (omegaref) are the respective reference values of the units, each of which has its own separate shaft with each its own generator and exciter.

4) V is the terminal voltage.

5) Fhp and Flp can be used to represent the presence of dual reheat stages for a single turbine. If there is only one reheat stage, between the HP and LP turbines, Fhp and Flp should normally be unity and zero, respectively, and T5lp should be set to the reheater time constant.

6) Dhp and Dlp give a rough approximation of the damping of intermachine speed oscillations by electromagnetic effects. When the generators are represented by the round rotor model with proper values for subtransient time constants, this damping is represented accurately in the generator electrical torques and Dhp and Dlp should be set to zero.

7) If any of the time constants are zero, they are bypassed.

Table 85 shows all attributes of GovSteamCC.

Table 85 – Attributes of TurbineGovernorDynamics::GovSteamCC

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
pmaxhp	0..1	PU	Maximum HP value position (Pmaxhp). Typical value = 1.
rhp	0..1	PU	HP governor droop (Rhp) (> 0). Typical value = 0,05.
t1hp	0..1	Seconds	HP governor time constant (T1hp) (>= 0). Typical value = 0,1.
t3hp	0..1	Seconds	HP turbine time constant (T3hp) (>= 0). Typical value = 0,1.
t4hp	0..1	Seconds	HP turbine time constant (T4hp) (>= 0). Typical value = 0,1.
t5hp	0..1	Seconds	HP reheater time constant (T5hp) (>= 0). Typical value = 10.
fhp	0..1	PU	Fraction of HP power ahead of reheater (Fhp). Typical value = 0,3.
dhp	0..1	PU	HP damping factor (Dhp). Typical value = 0.
pmaxlp	0..1	PU	Maximum LP value position (Pmaxlp). Typical value = 1.
rlp	0..1	PU	LP governor droop (Rlp) (> 0). Typical value = 0,05.
t1lp	0..1	Seconds	LP governor time constant (T1lp) (>= 0). Typical value = 0,1.
t3lp	0..1	Seconds	LP turbine time constant (T3lp) (>= 0). Typical value = 0,1.
t4lp	0..1	Seconds	LP turbine time constant (T4lp) (>= 0). Typical value = 0,1.
t5lp	0..1	Seconds	LP reheater time constant (T5lp) (>= 0). Typical value = 10.
flp	0..1	PU	Fraction of LP power ahead of reheater (Flp). Typical value = 0,7.
dlp	0..1	PU	LP damping factor (Dlp). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 86 shows all association ends of GovSteamCC with other classes.

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Table 86 – Association ends of TurbineGovernorDynamics::GovSteamCC with other classes

mult from	name	mult to	type	description
0..1	LowPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: CrossCompoundTurbineGovernorDyanmics
0..1	HighPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: CrossCompoundTurbineGovernorDyanmics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.32 GovSteamEU

Simplified boiler and steam turbine with PID governor.

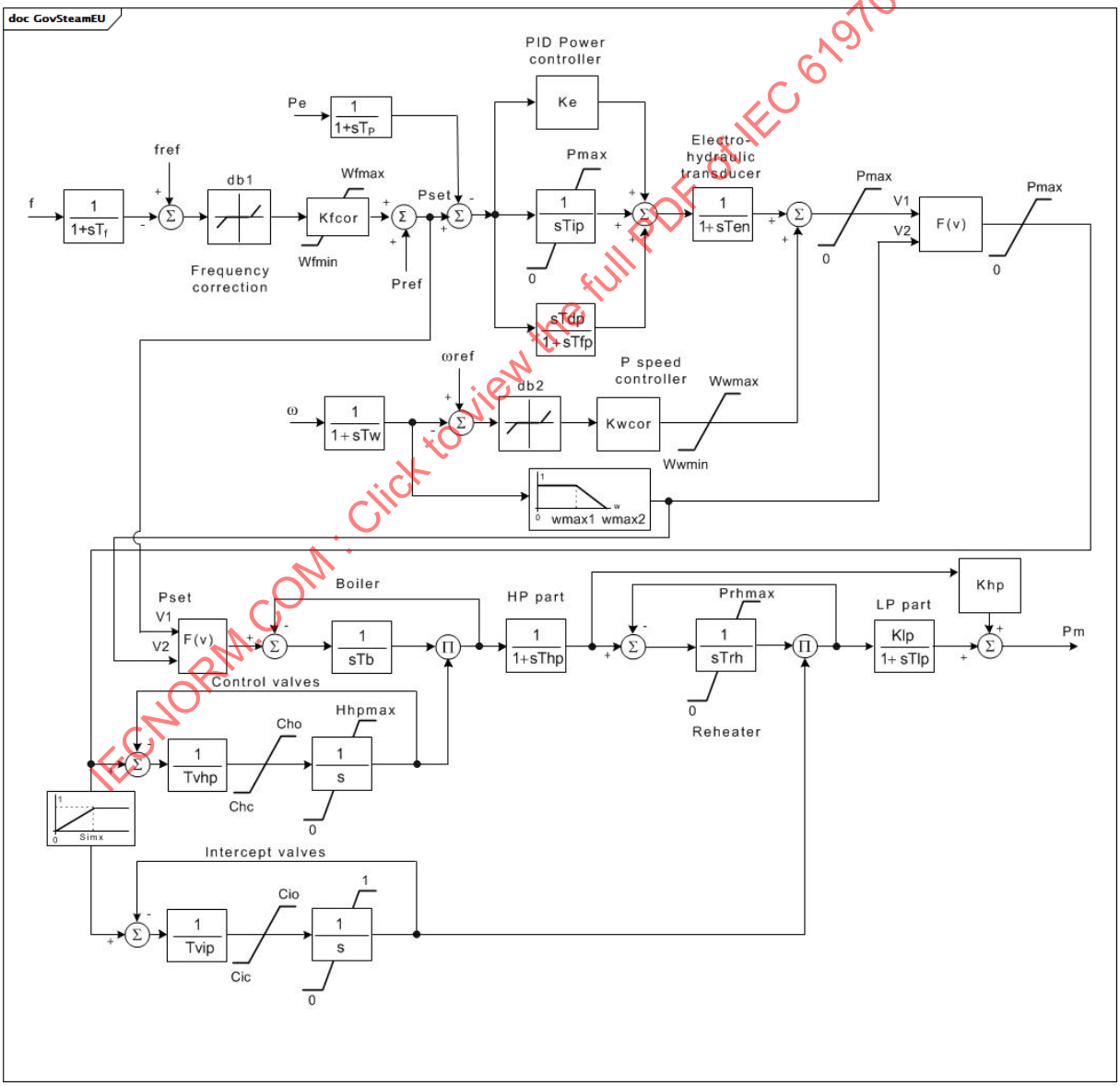

Figure 79 – GovSteamEU

Figure 79: This diagram describes the GovSteamEU turbine governor model.

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Parameter details:

1) PU parameters are on base of turbine MW capability MWbase.
2) To represent a non-reheat turbine, set Trh = 0 and Tlp to about 0,5 s.
3) F(v) is minimum value selection.
4) Frequency (f) is local (nodal) frequency.

Table 87 shows all attributes of GovSteamEU.

Table 87 – Attributes of TurbineGovernorDynamics::GovSteamEU

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
tp	0..1	Seconds	Power transducer time constant (Tp) (>= 0). Typical value = 0,07.
ke	0..1	PU	Gain of the power controller (Ke). Typical value = 0,65.
tip	0..1	Seconds	Integral time constant of the power controller (Tip) (>= 0). Typical value = 2.
tdp	0..1	Seconds	Derivative time constant of the power controller (Tdp) (>= 0). Typical value = 0.
tfp	0..1	Seconds	Time constant of the power controller (Tfp) (>= 0). Typical value = 0.
tf	0..1	Seconds	Frequency transducer time constant (Tf) (>= 0). Typical value = 0.
kfcor	0..1	PU	Gain of the frequency corrector (Kfcor). Typical value = 20.
db1	0..1	PU	Deadband of the frequency corrector (db1). Typical value = 0.
wfmax	0..1	PU	Upper limit for frequency correction (Wfmax) (> GovSteamEU.wfmin). Typical value = 0,05.
wfmin	0..1	PU	Lower limit for frequency correction (Wfmin) (< GovSteamEU.wfmax). Typical value = -0,05.
pmax	0..1	PU	Maximal active power of the turbine (Pmax). Typical value = 1.
ten	0..1	Seconds	Electro hydraulic transducer (Ten) (>= 0). Typical value = 0,1.
tw	0..1	Seconds	Speed transducer time constant (Tw) (>= 0). Typical value = 0,02.
komegacor	0..1	PU	Gain of the speed governor (Kwcor). Typical value = 20.
db2	0..1	PU	Deadband of the speed governor (db2). Typical value = 0,0004.
wwmax	0..1	PU	Upper limit for the speed governor (Wwmax) (> GovSteamEU.wwmin). Typical value = 0,1.
wwmin	0..1	PU	Lower limit for the speed governor frequency correction (Wwmin) (< GovSteamEU.wwmax). Typical value = -1.
wmax1	0..1	PU	Emergency speed control lower limit (wmax1). Typical value = 1,025.
wmax2	0..1	PU	Emergency speed control upper limit (wmax2). Typical value = 1,05.
tvhp	0..1	Seconds	Control valves servo time constant (Tvhp) (>= 0). Typical value = 0,1.
cho	0..1	Float	Control valves rate opening limit (Cho). Unit = PU / s. Typical value = 0,17.
chc	0..1	Float	Control valves rate closing limit (Chc). Unit = PU / s. Typical value = -3,3.
hhpmax	0..1	PU	Maximum control valve position (Hhpmax). Typical value = 1.
tvip	0..1	Seconds	Intercept valves servo time constant (Tvip) (>= 0). Typical value = 0,15.
cio	0..1	PU	Intercept valves rate opening limit (Cio). Typical value = 0,123.
cic	0..1	PU	Intercept valves rate closing limit (Cic). Typical value = -2,2.
simx	0..1	PU	Intercept valves transfer limit (Simx). Typical value = 0,425.
thp	0..1	Seconds	High pressure (HP) time constant of the turbine (Thp) (>= 0). Typical value = 0,31.
trh	0..1	Seconds	Reheater time constant of the turbine (Trh) (>= 0). Typical value = 8.
tlp	0..1	Seconds	Low pressure (LP) time constant of the turbine (Tlp) (>= 0). Typical value = 0,45.
prhmax	0..1	PU	Maximum low pressure limit (Prhmax). Typical value = 1,4.

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name	mult	type	description
khp	0..1	PU	Fraction of total turbine output generated by HP part (Khp). Typical value = 0,277.
klp	0..1	PU	Fraction of total turbine output generated by HP part (Klp). Typical value = 0,723.
tb	0..1	Seconds	Boiler time constant (Tb) (>= 0). Typical value = 100.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 88 shows all association ends of GovSteamEU with other classes.

Table 88 – Association ends of TurbineGovernorDynamics::GovSteamEU with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.33 GovSteamFV2

Steam turbine governor with reheat time constants and modelling of the effects of fast valve closing to reduce mechanical power.

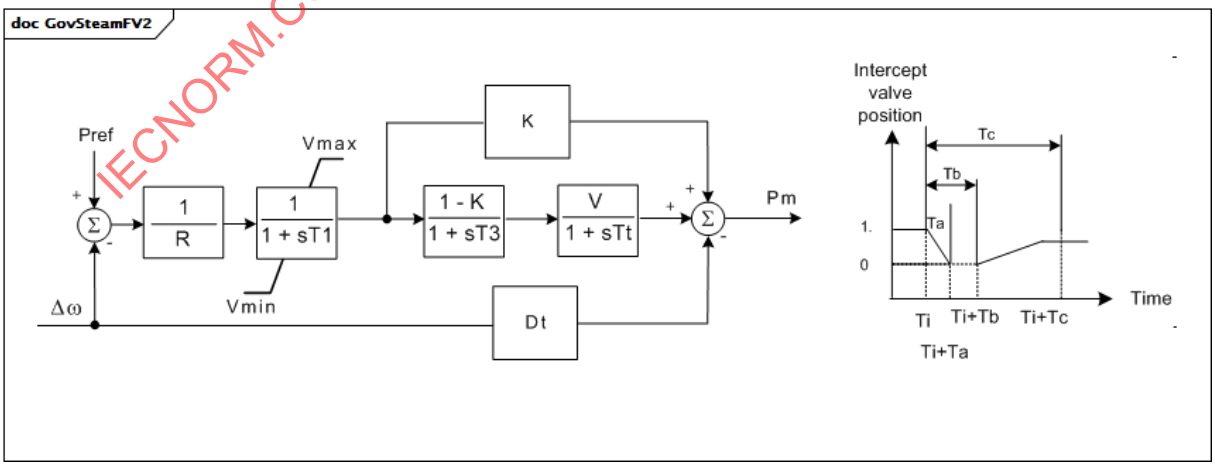

Figure 80 – GovSteamFV2

Figure 80: This diagram describes the GovSteamFV2 turbine governor model.

Parameter details:

1) Valve position is determined by the time curve. The valve position is either 1 or 0.
2) Ti (Initial time to begin fast valving) is a user-defined parameter at the time of the simulation and is not exchanged. Ti is assumed to be 0,1 s. It is used to review the effect of the fast valving.

Table 89 shows all attributes of GovSteamFV2.

Table 89 – Attributes of TurbineGovernorDynamics::GovSteamFV2

name	mult	type	description
dt	0..1	PU	(Dt).
k	0..1	PU	Fraction of the turbine power developed by turbine sections not involved in fast valving (K).
mwbase	0..1	ActivePower	Alternate base used instead of machine base in equipment model if necessary (MWbase) (> 0). Unit = MW.
r	0..1	PU	(R).
t1	0..1	Seconds	Governor time constant (T1) (>= 0).
t3	0..1	Seconds	Reheater time constant (T3) (>= 0).
ta	0..1	Seconds	Time after initial time for valve to close (Ta) (>= 0).
tb	0..1	Seconds	Time after initial time for valve to begin opening (Tb) (>= 0).
tc	0..1	Seconds	Time after initial time for valve to become fully open (Tc) (>= 0).
tt	0..1	Seconds	Time constant with which power falls off after intercept valve closure (Tt) (>= 0).
vmax	0..1	PU	(Vmax) (> GovSteamFV2.vmin).
vmin	0..1	PU	(Vmin) (< GovSteamFV2.vmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 90 shows all association ends of GovSteamFV2 with other classes.

Table 90 – Association ends of TurbineGovernorDynamics::GovSteamFV2 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.34 GovSteamFV3

Simplified GovSteamIEEE1 steam turbine governor with Prmax limit and fast valving.

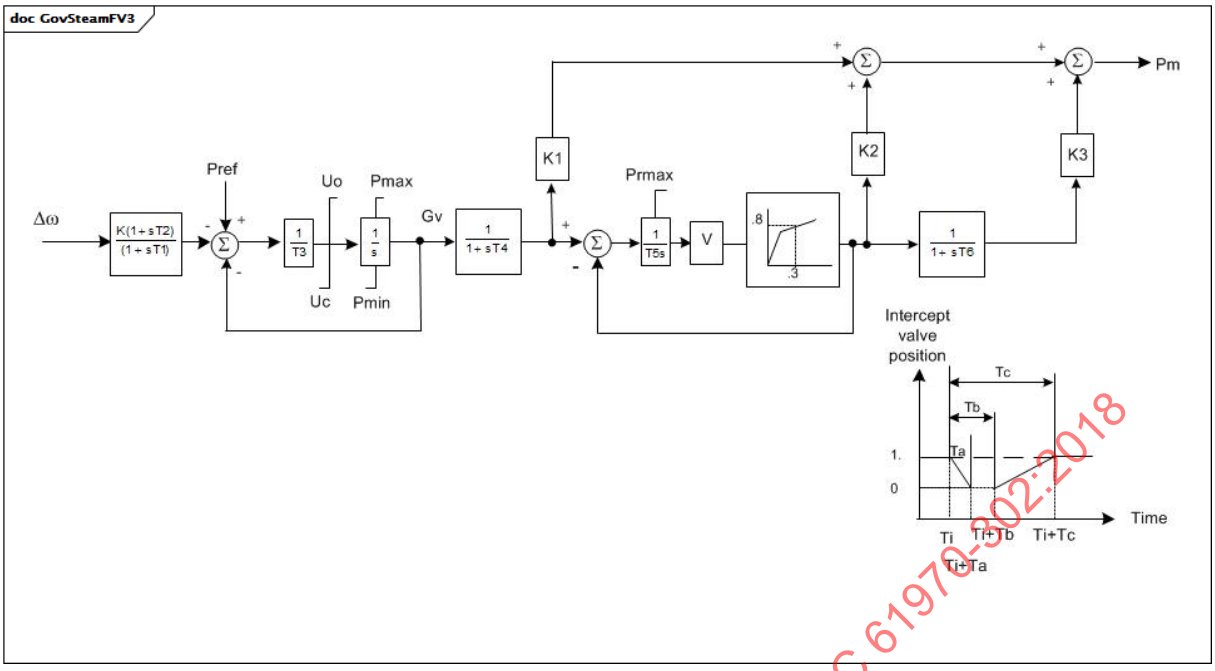

Figure 81 – GovSteamFV3

Figure 81: This diagram describes the GovSteamFV3 turbine governor model.

Parameter details:

1) The gains K1, K2, K3 describe the division of power output among turbine stages. Normally, K1 + K2 + K3 = 1.
2) The times Ta, Tb, and Tc are all with respect to the initiation time.
3) The value Prmax is a limit on the pressure in the reheater. Normally, this value should be about 1,10 PU.
4) The nonlinear gain between gate position and power can be input with up to 6 points. The (0,0 , 0,0) and (1,0 , 1,0) points can be assumed. The output is not allowed to go beyond 0,0 and 1,0. However, if Pmax > 1,0, the input and output are scaled by Pmax. If Gv1 is a negative number or zero values, the default curve (between 0,0 , 0,0 and 1,0 , 1,0) will be used.
5) Ti (initial time to begin fast valving) is a user-defined parameter at the time of the simulation and it is not exchanged. Ti is assumed to be 0,1 s. It is used to review the effect of the fast valving.

Table 91 shows all attributes of GovSteamFV3.

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Table 91 – Attributes of TurbineGovernorDynamics::GovSteamFV3

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
k	0..1	PU	Governor gain, (reciprocal of droop) (K). Typical value = 20.
t1	0..1	Seconds	Governor lead time constant (T1) (>= 0). Typical value = 0.
t2	0..1	Seconds	Governor lag time constant (T2) (>= 0). Typical value = 0.
t3	0..1	Seconds	Valve positioner time constant (T3) (> 0). Typical value = 0.
uo	0..1	Float	Maximum valve opening velocity (Uo). Unit = PU / s. Typical value = 0,1.
uc	0..1	Float	Maximum valve closing velocity (Uc). Unit = PU / s. Typical value = -1.
pmax	0..1	PU	Maximum valve opening, PU of MWbase (Pmax) (> GovSteamFV3.pmin). Typical value = 1.
pmin	0..1	PU	Minimum valve opening, PU of MWbase (Pmin) (< GovSteamFV3.pmax). Typical value = 0.
t4	0..1	Seconds	Inlet piping/steam bowl time constant (T4) (>= 0). Typical value = 0,2.
k1	0..1	PU	Fraction of turbine power developed after first boiler pass (K1). Typical value = 0,2.
t5	0..1	Seconds	Time constant of second boiler pass (i.e. reheater) (T5) (> 0 if fast valving is used, otherwise >= 0). Typical value = 0,5.
k2	0..1	PU	Fraction of turbine power developed after second boiler pass (K2). Typical value = 0,2.
t6	0..1	Seconds	Time constant of crossover or third boiler pass (T6) (>= 0). Typical value = 10.
k3	0..1	PU	Fraction of hp turbine power developed after crossover or third boiler pass (K3). Typical value = 0,6.
ta	0..1	Seconds	Time to close intercept valve (IV) (Ta) (>= 0). Typical value = 0,97.
tb	0..1	Seconds	Time until IV starts to reopen (Tb) (>= 0). Typical value = 0,98.
tc	0..1	Seconds	Time until IV is fully open (Tc) (>= 0). Typical value = 0,99.
prmax	0..1	PU	Max. pressure in reheater (Prmax). Typical value = 1.
gv1	0..1	PU	Nonlinear gain valve position point 1 (GV1). Typical value = 0.
pgv1	0..1	PU	Nonlinear gain power value point 1 (Pgv1). Typical value = 0.
gv2	0..1	PU	Nonlinear gain valve position point 2 (GV2). Typical value = 0,4.
pgv2	0..1	PU	Nonlinear gain power value point 2 (Pgv2). Typical value = 0,75.
gv3	0..1	PU	Nonlinear gain valve position point 3 (GV3). Typical value = 0,5.
pgv3	0..1	PU	Nonlinear gain power value point 3 (Pgv3). Typical value = 0,91.
gv4	0..1	PU	Nonlinear gain valve position point 4 (GV4). Typical value = 0,6.
pgv4	0..1	PU	Nonlinear gain power value point 4 (Pgv4). Typical value = 0,98.
gv5	0..1	PU	Nonlinear gain valve position point 5 (GV5). Typical value = 1.
pgv5	0..1	PU	Nonlinear gain power value point 5 (Pgv5). Typical value = 1.
gv6	0..1	PU	Nonlinear gain valve position point 6 (GV6). Typical value = 0.
pgv6	0..1	PU	Nonlinear gain power value point 6 (Pgv6). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 92 shows all association ends of GovSteamFV3 with other classes.

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Table 92 – Association ends of TurbineGovernorDynamics::GovSteamFV3 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.35 GovSteamFV4

Detailed electro-hydraulic governor for steam unit.

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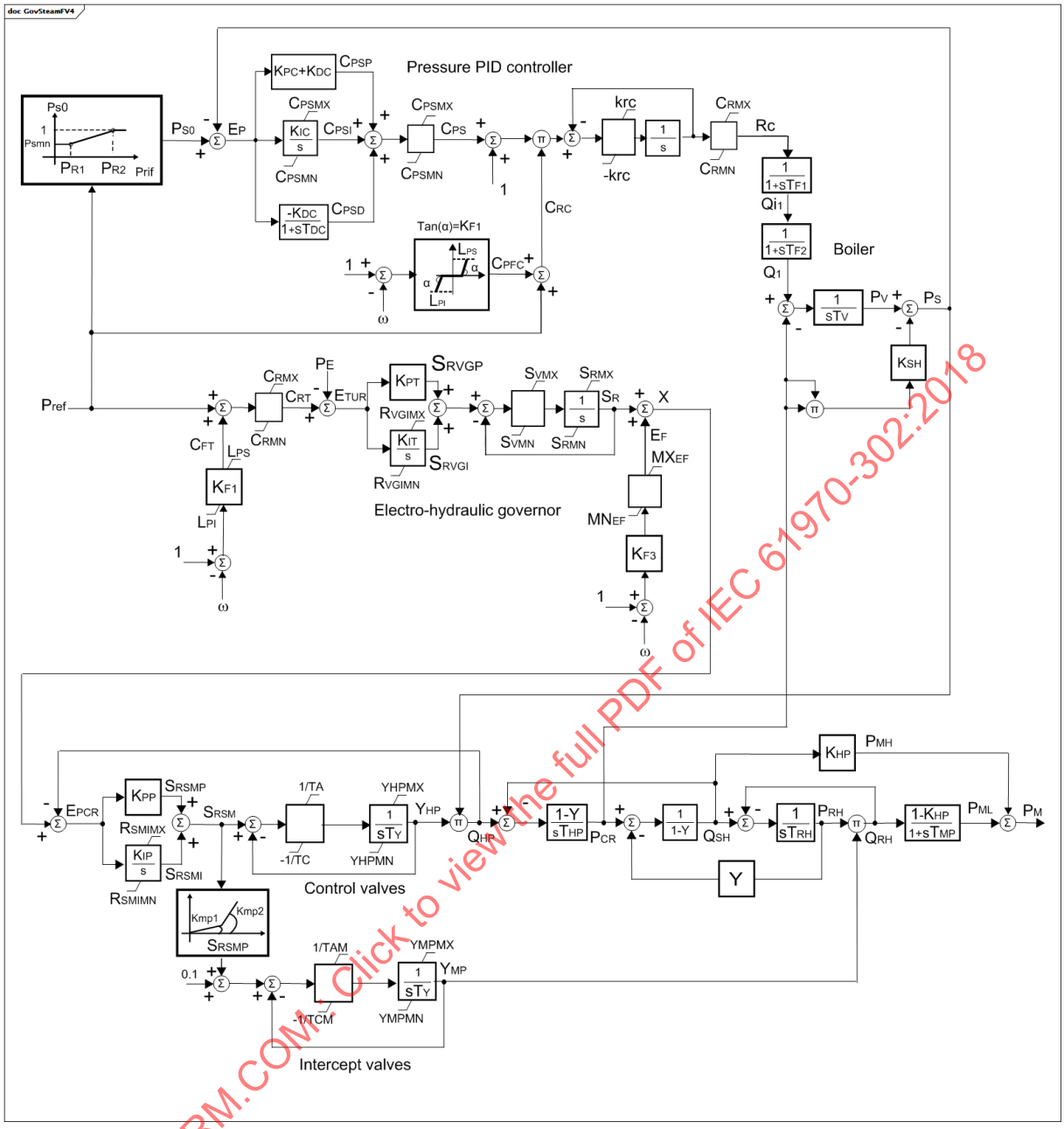

Figure 82 – GovSteamFV4

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Figure 82: This diagram describes the GovSteamFV4 turbine governor model.

Parameter details:

1) PU parameters are on base of MW capability of the turbine.
2) This model can be used for steam units in coordinated control, not belonging to a combined-cycle power plant.
3) omega has units of per unit speed.

Table 93 shows all attributes of GovSteamFV4.

Table 93 – Attributes of TurbineGovernorDynamics::GovSteamFV4

name	mult	type	description
kf1	0..1	PU	Frequency bias (reciprocal of droop) (Kf1). Typical value = 20.
kf3	0..1	PU	Frequency control (reciprocal of droop) (Kf3). Typical value = 20.
lps	0..1	PU	Maximum positive power error (Lps). Typical value = 0,03.
lpi	0..1	PU	Maximum negative power error (Lpi). Typical value = -0,15.
mxef	0..1	PU	Upper limit for frequency correction (MXEF). Typical value = 0,05.
mnef	0..1	PU	Lower limit for frequency correction (MNEF). Typical value = -0,05.
crmx	0..1	PU	Maximum value of regulator set-point (Crmx). Typical value = 1,2.
crmn	0..1	PU	Minimum value of regulator set-point (Crmn). Typical value = 0.
kpt	0..1	PU	Proportional gain of electro-hydraulic regulator (Kpt). Typical value = 0,3.
kit	0..1	PU	Integral gain of electro-hydraulic regulator (Kit). Typical value = 0,04.
rvgmx	0..1	PU	Maximum value of integral regulator (Rvgmx). Typical value = 1,2.
rvgmn	0..1	PU	Minimum value of integral regulator (Rvgmn). Typical value = 0.
svmx	0..1	Float	Maximum regulator gate opening velocity (Svmx). Typical value = 0,0333.
svmn	0..1	Float	Maximum regulator gate closing velocity (Svmn). Typical value = -0,0333.
srmx	0..1	PU	Maximum valve opening (Srmx). Typical value = 1,1.
srmn	0..1	PU	Minimum valve opening (Srmn). Typical value = 0.
kpp	0..1	PU	Proportional gain of pressure feedback regulator (Kpp). Typical value = 1.
kip	0..1	PU	Integral gain of pressure feedback regulator (Kip). Typical value = 0,5.
rsmimx	0..1	PU	Maximum value of integral regulator (Rsmimx). Typical value = 1,1.
rsmimn	0..1	PU	Minimum value of integral regulator (Rsmimn). Typical value = 0.
kmp1	0..1	PU	First gain coefficient of intercept valves characteristic (Kmp1). Typical value = 0,5.
kmp2	0..1	PU	Second gain coefficient of intercept valves characteristic (Kmp2). Typical value = 3,5.
srsmp	0..1	PU	Intercept valves characteristic discontinuity point (Srsmp). Typical value = 0,43.
ta	0..1	Seconds	Control valves rate opening time (Ta) (>= 0). Typical value = 0,8.
tc	0..1	Seconds	Control valves rate closing time (Tc) (>= 0). Typical value = 0,5.
ty	0..1	Seconds	Control valves servo time constant (Ty) (>= 0). Typical value = 0,1.
yhpmx	0..1	PU	Maximum control valve position (Yhpmx). Typical value = 1,1.
yhpmn	0..1	PU	Minimum control valve position (Yhpmn). Typical value = 0.
tam	0..1	Seconds	Intercept valves rate opening time (Tam) (>= 0). Typical value = 0,8.
tcm	0..1	Seconds	Intercept valves rate closing time (Tcm) (>= 0). Typical value = 0,5.
ympmx	0..1	PU	Maximum intercept valve position (Ympmx). Typical value = 1,1.
ympmn	0..1	PU	Minimum intercept valve position (Ympmn). Typical value = 0.
y	0..1	PU	Coefficient of linearized equations of turbine (Stodola formulation) (Y). Typical value = 0,13.
thp	0..1	Seconds	High pressure (HP) time constant of the turbine (Thp) (>= 0). Typical value = 0,15.
trh	0..1	Seconds	Reheater time constant of the turbine (Trh) (>= 0). Typical value = 10.
tmp	0..1	Seconds	Low pressure (LP) time constant of the turbine (Tmp) (>= 0). Typical value = 0,4.
khp	0..1	PU	Fraction of total turbine output generated by HP part (Khp). Typical value = 0,35.
pr1	0..1	PU	First value of pressure set point static characteristic (Pr1). Typical value = 0,2.
pr2	0..1	PU	Second value of pressure set point static characteristic, corresponding to Ps0 = 1,0 PU (Pr2). Typical value = 0,75.
psmn	0..1	PU	Minimum value of pressure set point static characteristic (Psmn). Typical value = 1.
kpc	0..1	PU	Proportional gain of pressure regulator (Kpc). Typical value = 0,5.

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name	mult	type	description
kic	0..1	PU	Integral gain of pressure regulator (Kic). Typical value = 0,0033.
kdc	0..1	PU	Derivative gain of pressure regulator (Kdc). Typical value = 1.
tdc	0..1	Seconds	Derivative time constant of pressure regulator (Tdc) (>= 0). Typical value = 90.
cpsmx	0..1	PU	Maximum value of pressure regulator output (Cpsmx). Typical value = 1.
cpsmn	0..1	PU	Minimum value of pressure regulator output (Cpsmn). Typical value = -1.
krc	0..1	PU	Maximum variation of fuel flow (Krc). Typical value = 0,05.
tf1	0..1	Seconds	Time constant of fuel regulation (Tf1) (>= 0). Typical value = 10.
tf2	0..1	Seconds	Time constant of steam chest (Tf2) (>= 0). Typical value = 10.
tv	0..1	Seconds	Boiler time constant (Tv) (>= 0). Typical value = 60.
ksh	0..1	PU	Pressure loss due to flow friction in the boiler tubes (Ksh). Typical value = 0,08.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 94 shows all association ends of GovSteamFV4 with other classes.

Table 94 – Association ends of TurbineGovernorDynamics::GovSteamFV4 with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.6.36 GovSteamSGO

Simplified steam turbine governor.

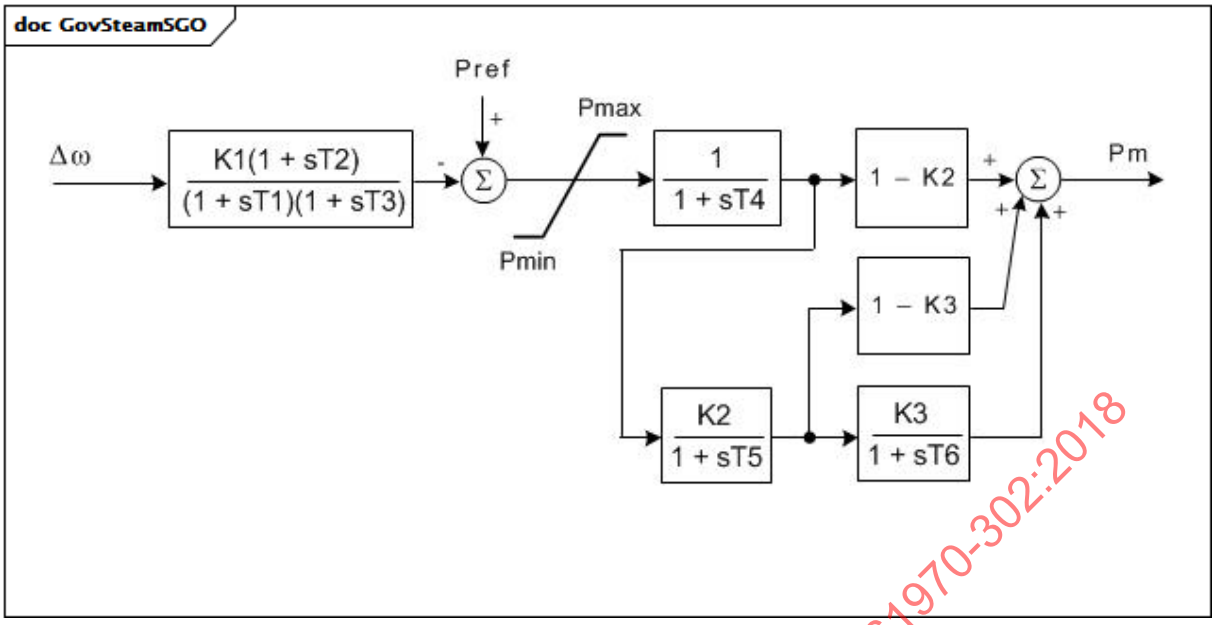

Figure 83 – GovSteamSGO

Figure 83: This diagram describes the GovSteamSGO turbine governor model.

Table 95 shows all attributes of GovSteamSGO.

Table 95 – Attributes of TurbineGovernorDynamics::GovSteamSGO

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
t1	0..1	Seconds	Controller lag (T1) (>= 0).
t2	0..1	Seconds	Controller lead compensation (T2) (>= 0).
t3	0..1	Seconds	Governor lag (T3) (> 0).
t4	0..1	Seconds	Delay due to steam inlet volumes associated with steam chest and inlet piping (T4) (>= 0).
t5	0..1	Seconds	Reheater delay including hot and cold leads (T5) (>= 0).
t6	0..1	Seconds	Delay due to IP-LP turbine, crossover pipes and LP end hoods (T6) (>= 0).
k1	0..1	PU	One / PU regulation (K1).
k2	0..1	PU	Fraction (K2).
k3	0..1	PU	Fraction (K3).
pmax	0..1	PU	Upper power limit (Pmax) (> GovSteamSGO.pmin).
pmin	0..1	Seconds	Lower power limit (Pmin) (>= 0 and < GovSteamSGO.pmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 96 shows all association ends of GovSteamSGO with other classes.

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Table 96 – Association ends of TurbineGovernorDynamics::GovSteamSGO with other classes

mult from	name	mult to	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.6.37 DroopSignalFeedbackKind enumeration

Governor droop signal feedback source.

Table 97 shows all literals of DroopSignalFeedbackKind.

Table 97 – Literals of TurbineGovernorDynamics::DroopSignalFeedbackKind

literal	value	description
electricalPower		Electrical power feedback (connection indicated as 1 in the block diagrams of models, e.g. GovCT1, GovCT2).
none		No droop signal feedback, is isochronous governor.
fuelValveStroke		Fuel valve stroke feedback (true stroke) (connection indicated as 2 in the block diagrams of model, e.g. GovCT1, GovCT2).
governorOutput		Governor output feedback (requested stroke) (connection indicated as 3 in the block diagrams of models, e.g. GovCT1, GovCT2).

5.3.6.38 FrancisGovernorControlKind enumeration

Governor control flag for Francis hydro model.

Table 98 shows all literals of FrancisGovernorControlKind.

Table 98 – Literals of TurbineGovernorDynamics::FrancisGovernorControlKind

literal	value	description
mechanicHydrolicTachoAccelerator		Mechanic-hydraulic regulator with tacho-accelerometer (Cflag = 1).
mechanicHydraulicTransientFeedback		Mechanic-hydraulic regulator with transient feedback (Cflag=2).
electromechanicalElectrohydraulic		Electromechanical and electrohydraulic regulator (Cflag=3).

5.3.6.39 GovHydro4ModelKind enumeration

Possible types of GovHydro4 models.

Table 99 shows all literals of GovHydro4ModelKind.

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Table 99 – Literals of TurbineGovernorDynamics::GovHydro4ModelKind

literal	value	description
simple		
francisPelton		
kaplan		

5.3.7 Package TurbineLoadControllerDynamics

5.3.7.1 General

A turbine load controller acts to maintain turbine power at a set value by continuous adjustment of the turbine governor speed-load reference.

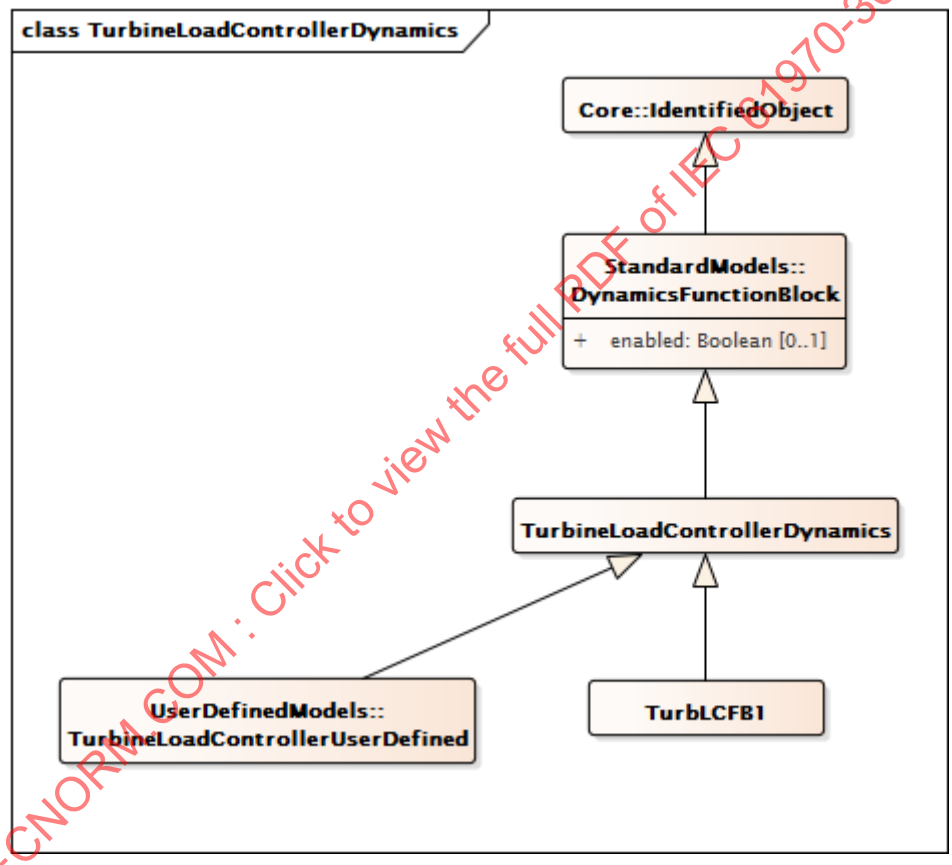

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Figure 84 – Class diagram TurbineLoadControllerDynamics::TurbineLoadControllerDynamics

Figure 84: This diagram shows dynamic standard model turbine load controller classes and their inheritance from the TurbineLoadControllerDynamics class.

5.3.7.2 TurbineLoadControllerDynamics

Turbine load controller function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 100 shows all attributes of TurbineLoadControllerDynamics.

Table 100 – Attributes of TurbineLoadControllerDynamics::TurbineLoadControllerDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 101 shows all association ends of TurbineLoadControllerDynamics with other classes.

Table 101 – Association ends of TurbineLoadControllerDynamics::TurbineLoadControllerDynamics with other classes

mult from	name	mult to	type	description
0..1	TurbineGovernorDynamics	1..1	TurbineGovernorDynamics	Turbine governor controlled by this turbine load controller.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.7.3 TurbLCFB1

Turbine load controller model developed by WECC. This model represents a supervisory turbine load controller that acts to maintain turbine power at a set value by continuous adjustment of the turbine governor speed-load reference. This model is intended to represent slow reset 'outer loop' controllers managing the action of the turbine governor.

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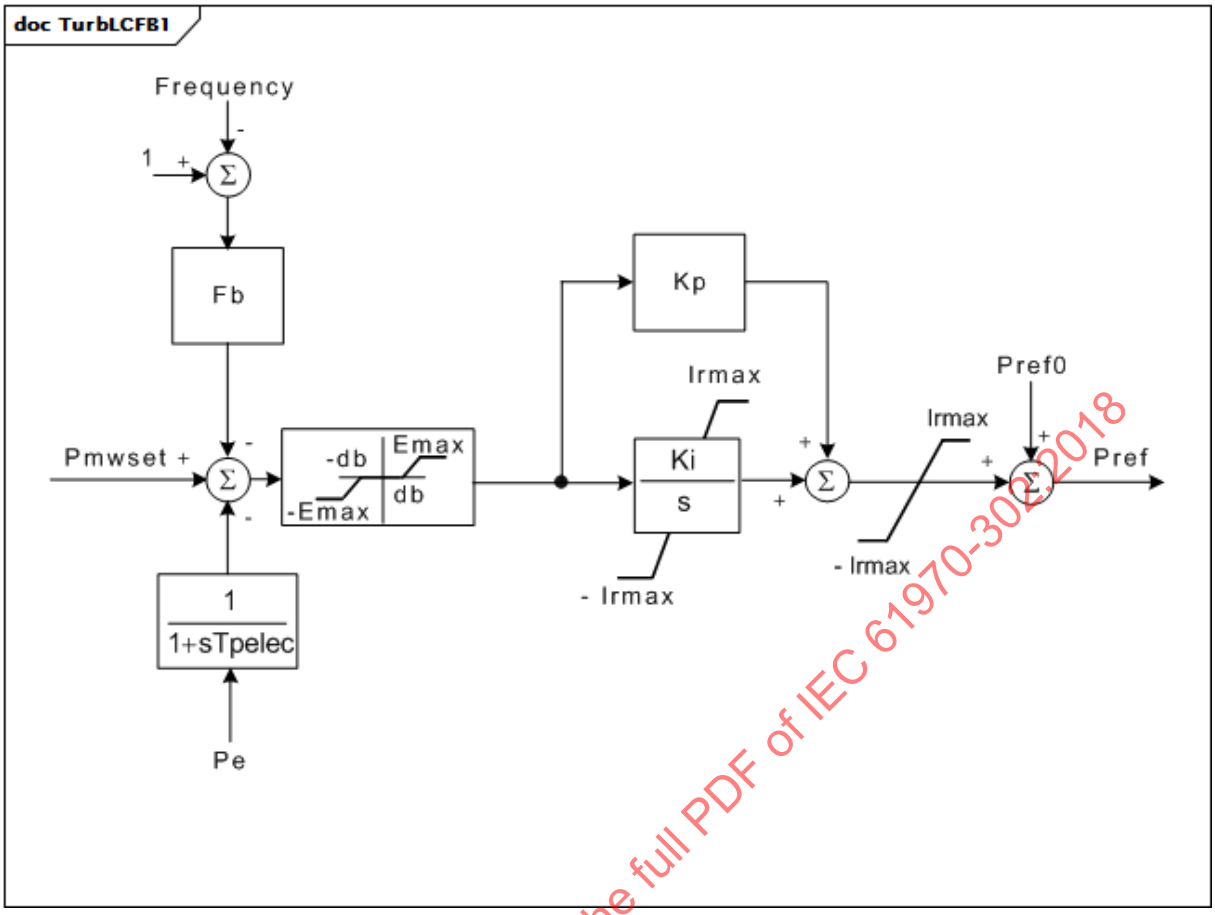

Figure 85 – TurbLCFB1

Figure 85: This diagram describes the TurbLCFB1 turbine load controller model.

Parameter details:

1) The load reference of this supervisory load control loop is accessible as the parameter, Pmwset. Pmwset is given a value automatically when the model is initialized. This value overwrites any value entered prior to initialization.
2) The controller acts by applying a bias to the turbine-governor speed load reference, Pref. This reference is initialized in the normal manner by the turbine-governor model.
3) The output of the controller is limited to plus or minus Irmax. To prevent the controller from adjusting the turbine power excessively, Irmax should not exceed approximately one half of the governor droop or approximately 0,025 PU.
4) The error limit, Emax, is intended to set a maximum rate of change of turbine power. If limitation of load change rate is desired, Emax should be set such that Emax = (max rate, PU / s) x (droop of governor in PU) / Ki. Note that governor droop used in this calculation shall be in PU relative to the base power, MWbase, of the turbine. Note, also, that some governor models (such as GovSteamIEEE1) have their droop specified by the value of a gain whose value is the reciprocal of the droop. For example, in GovSteamIEEE1 the droop is specified by the gain, K, whose typical value is 1 / 0,04 = 25.
5) This model recognizes the two alternative ways of specifying the turbine-governor load reference. In models such as GovCT1 and GovHydro1, the reference is a speed setpoint. In other models such as GovSteamIEEE1, the reference is a PU load value. The references are generally as follows: 1) speed reference (1 + (initial power or valve position) x (droop)), 2) load reference (0 + (initial power or valve position)). The parameters of TurbLCFB1 shall always be set on the basis of a governor speed reference.

Table 102 shows all attributes of TurbLCFB1.

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Table 102 – Attributes of TurbineLoadControllerDynamics::TurbLCFB1

name	mult	type	description
mwbase	0..1	ActivePower	Base for power values (MWbase) (> 0). Unit = MW.
speedReferenceGovernor	0..1	Boolean	Type of turbine governor reference (Type). true = speed reference governor false = load reference governor. Typical value = true.
db	0..1	PU	Controller deadband (db). Typical value = 0.
emax	0..1	PU	Maximum control error (Emax) (see parameter detail 4). Typical value = 0,02.
fb	0..1	PU	Frequency bias gain (Fb). Typical value = 0.
kp	0..1	PU	Proportional gain (Kp). Typical value = 0.
ki	0..1	PU	Integral gain (Ki). Typical value = 0.
fbf	0..1	Boolean	Frequency bias flag (Fbf). true = enable frequency bias false = disable frequency bias. Typical value = false.
pbf	0..1	Boolean	Power controller flag (Pbf). true = enable load controller false = disable load controller. Typical value = false.
tpelec	0..1	Seconds	Power transducer time constant (Tpelec) (>= 0). Typical value = 0.
irmax	0..1	PU	Maximum turbine speed/load reference bias (Irmax) (see parameter detail 3). Typical value = 0.
pmwset	0..1	ActivePower	Power controller setpoint (Pmwset) (see parameter detail 1). Unit = MW. Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 103 shows all association ends of TurbLCFB1 with other classes.

Table 103 – Association ends of TurbineLoadControllerDynamics::TurbLCFB1 with other classes

mult from	name	mult to	type	description
0..1	TurbineGovernorDynamics	1..1	TurbineGovernorDynamics	inherited from: TurbineLoadControllerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.8 Package MechanicalLoadDynamics

5.3.8.1 General

A mechanical load represents the variation in a motor's shaft torque or power as a function of shaft speed.

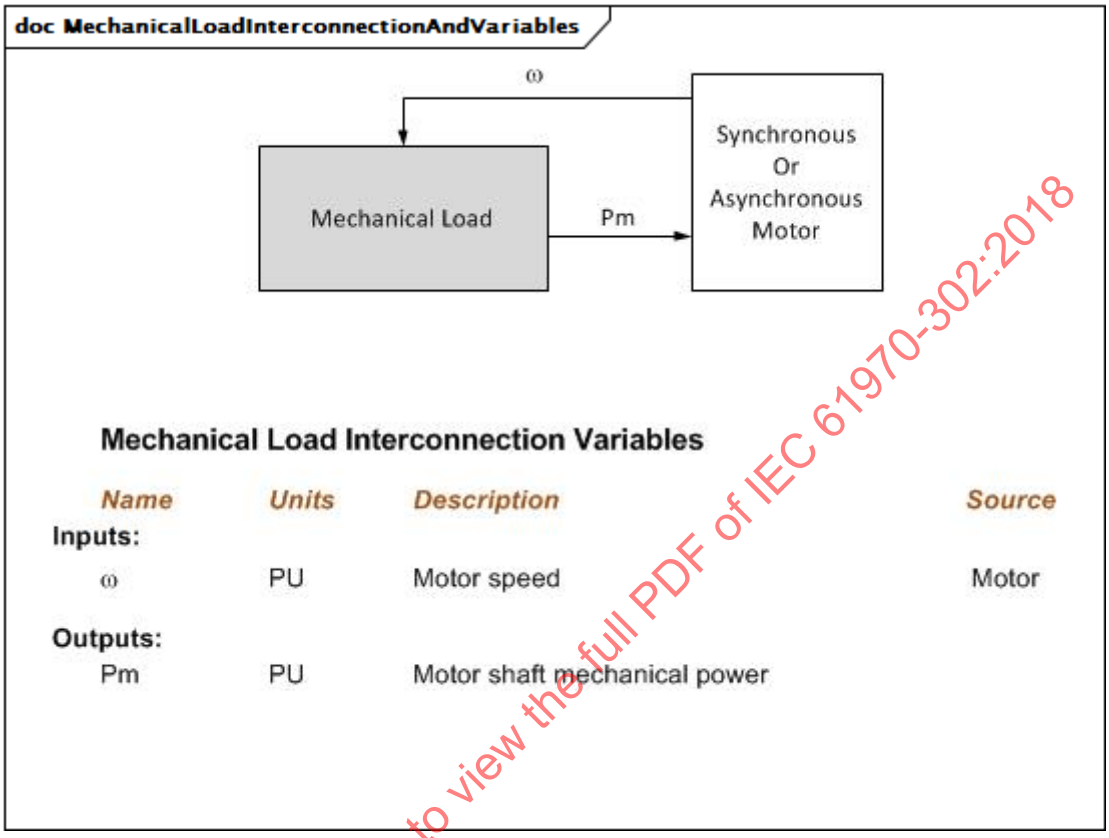

Figure 86 – MechanicalLoadInterconnectionAndVariables

Figure 86: This diagram illustrates the inputs and outputs for a mechanical load.

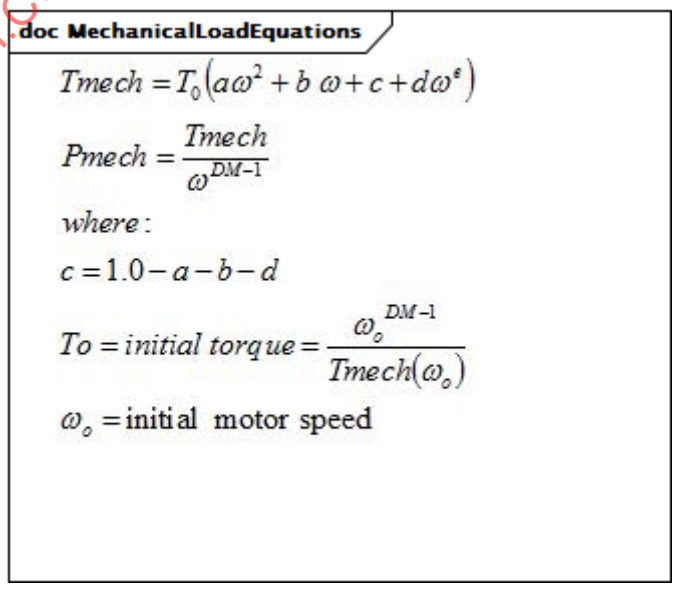

Figure 87 – MechanicalLoadEquations

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Figure 87: This diagram illustrates the equations for a mechanical load.

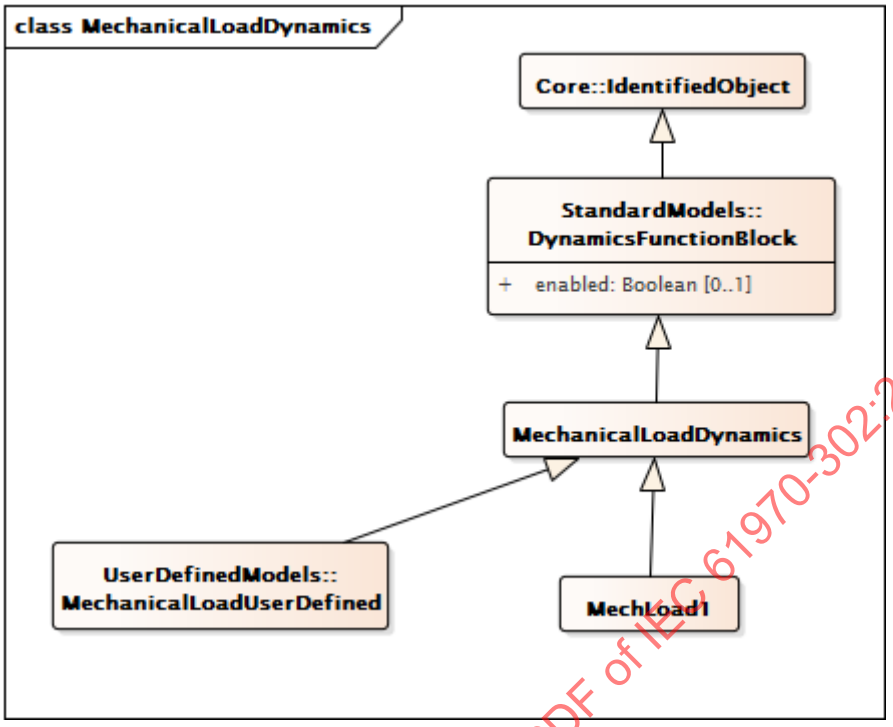

Figure 88 – Class diagram MechanicalLoadDynamics::MechanicalLoadDynamics

Figure 88: This diagram shows dynamic standard model mechanical load classes and their inheritance from the MechanicalLoadDynamics class.

5.3.8.2 MechanicalLoadDynamics

Mechanical load function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 104 shows all attributes of MechanicalLoadDynamics.

Table 104 – Attributes of MechanicalLoadDynamics::MechanicalLoadDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 105 shows all association ends of MechanicalLoadDynamics with other classes.

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Table 105 – Association ends of MechanicalLoadDynamics::MechanicalLoadDynamics with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	Synchronous machine model with which this mechanical load model is associated. MechanicalLoadDynamics shall have either an association to SynchronousMachineDynamics or AsynchronousMachineDyanmics.
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	Asynchronous machine model with which this mechanical load model is associated. MechanicalLoadDynamics shall have either an association to SynchronousMachineDynamics or to AsynchronousMachineDynamics.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.8.3 MechLoad1

Mechanical load model type 1.

Table 106 shows all attributes of MechLoad1.

Table 106 – Attributes of MechanicalLoadDynamics::MechLoad1

name	mult	type	description
a	0..1	Float	Speed squared coefficient (a).
b	0..1	Float	Speed coefficient (b).
d	0..1	Float	Speed to the exponent coefficient (d).
e	0..1	Float	Exponent (e).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 107 shows all association ends of MechLoad1 with other classes.

Table 107 – Association ends of MechanicalLoadDynamics::MechLoad1 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: MechanicalLoadDynamics
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: MechanicalLoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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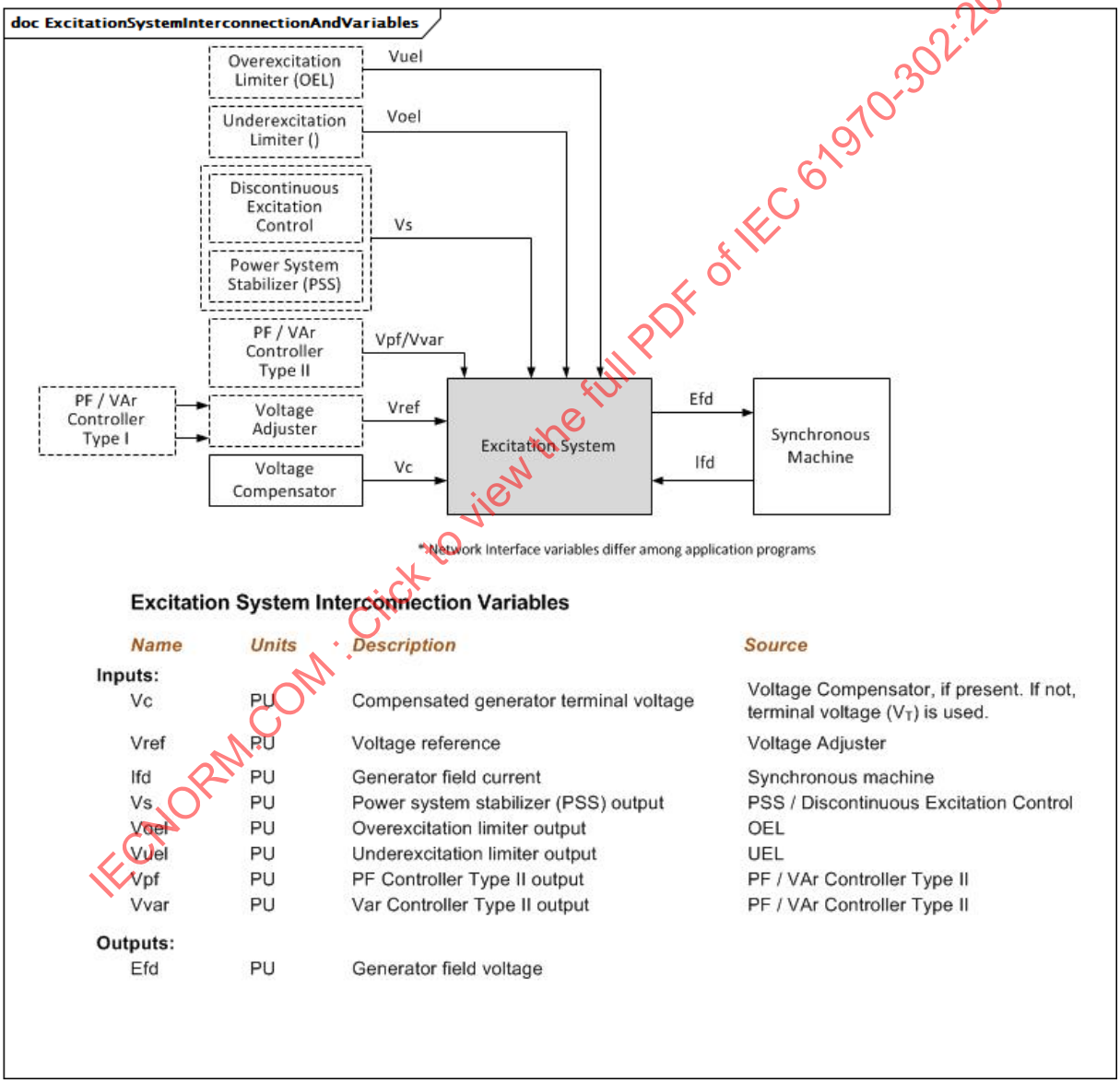
5.3.9 Package ExcitationSystemDynamics

5.3.9.1 General

The excitation system model provides the field voltage (Efd) for a synchronous machine model. It is linked to a specific generator (synchronous machine).

The representation of all limits used by the models (not including IEEE standard models) shall comply with the representation defined in the Annex E of the IEEE 421.5-2005, unless specified differently in the documentation of the model.

The parameters are different for each excitation system model; the same parameter name can have different meaning in different models.



Excitation System Interconnection Variables

Name	Units	Description	Source
Inputs:			
Vc	PU	Compensated generator terminal voltage	Voltage Compensator, if present. If not, terminal voltage (V_T) is used.
Vref	PU	Voltage reference	Voltage Adjuster
Ifd	PU	Generator field current	Synchronous machine
Vs	PU	Power system stabilizer (PSS) output	PSS / Discontinuous Excitation Control
Voel	PU	Overexcitation limiter output	OEL
Vuel	PU	Underexcitation limiter output	UEL
Vpf	PU	PF Controller Type II output	PF / VAr Controller Type II
Vvar	PU	Var Controller Type II output	PF / VAr Controller Type II
Outputs:			
Efd	PU	Generator field voltage	

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Figure 89 – ExcitationSystemInterconnectionAndVariables

Figure 89: This diagram illustrates the inputs and outputs for an excitation system model.

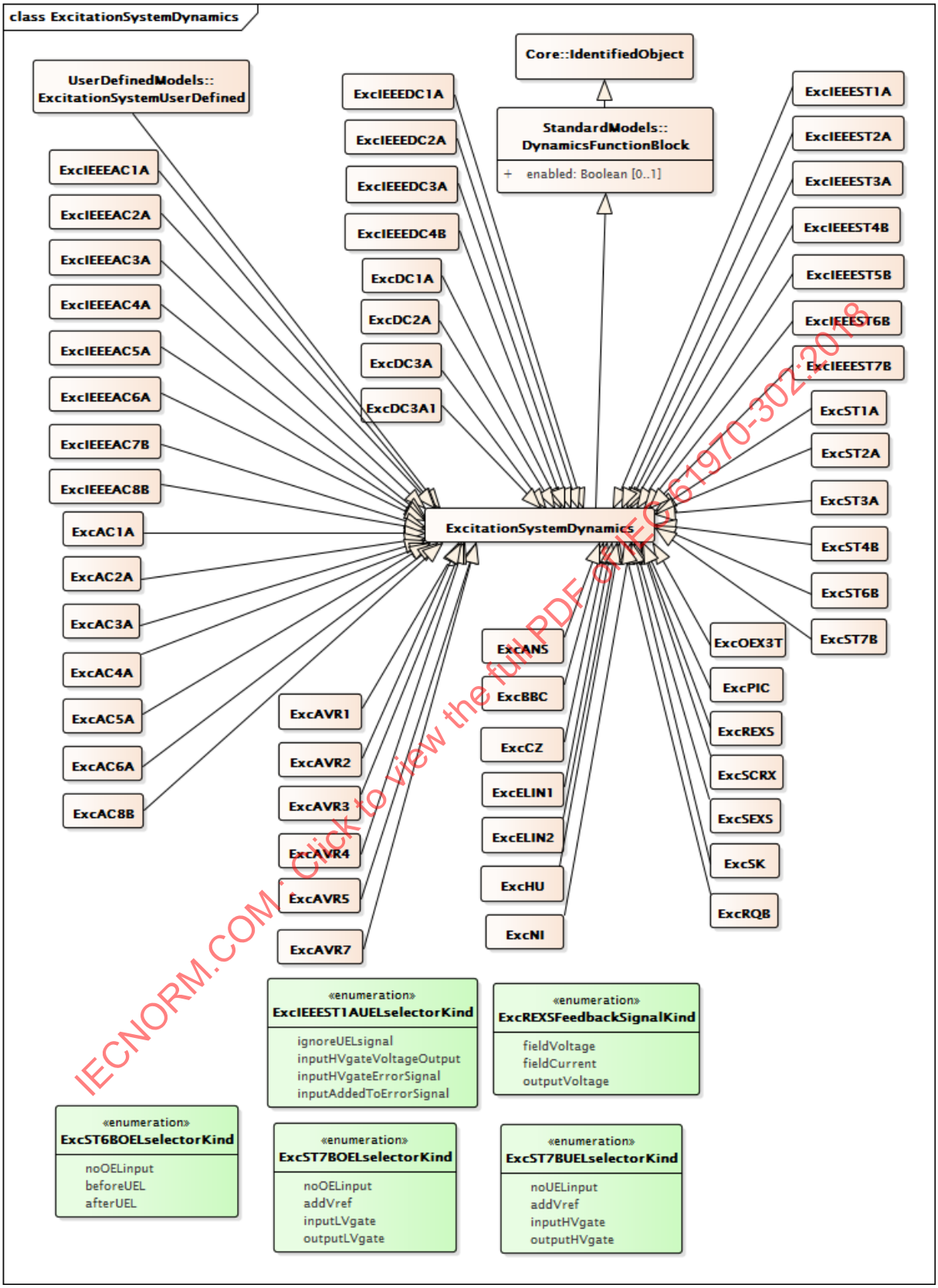

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Figure 90 – Class diagram ExcitationSystemDynamics::ExcitationSystemDynamics

Figure 90: This diagram shows dynamic standard model excitation system classes and their inheritance from the ExcitationSystemDynamics class.

5.3.9.2 ExcitationSystemDynamics

Excitation system function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 108 shows all attributes of ExcitationSystemDynamics.

Table 108 – Attributes of ExcitationSystemDynamics::ExcitationSystemDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 109 shows all association ends of ExcitationSystemDynamics with other classes.

Table 109 – Association ends of ExcitationSystemDynamics::ExcitationSystemDynamics with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	Synchronous machine model with which this excitation system model is associated.
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	Power system stabilizer model associated with this excitation system model.
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	Power factor or VAr controller type 1 model associated with this excitation system model.
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	Overexcitation limiter model associated with this excitation system model.
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	Discontinuous excitation control model associated with this excitation system model.
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	Power factor or VAr controller type 2 model associated with this excitation system model.
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	Undrexcitation limiter model associated with this excitation system model.
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	Voltage compensator model associated with this excitation system model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.3 ExcIEEEAC1A

IEEE 421.5-2005 type AC1A model. The model represents the field-controlled alternator-rectifier excitation systems designated type AC1A. These excitation systems consist of an alternator main exciter with non-controlled rectifiers.

Reference: IEEE 421.5-2005, 6.1.

Table 110 shows all attributes of ExcIEEEAC1A.

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Table 110 – Attributes of ExcitationSystemDynamics::ExcIEEEAC1A

name	mult	type	description
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 400.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,02.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 14,5.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -14,5.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,8.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0,03.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,2.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 0,38.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 4,18.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 0,1.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 3,14.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 0,03.
vrmax	0..1	PU	Maximum voltage regulator outputs (VRMAX) (> 0). Typical value = 6,03.
vrmin	0..1	PU	Minimum voltage regulator outputs (VRMIN) (< 0). Typical value = -5,43.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 111 shows all association ends of ExcIEEEAC1A with other classes.

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Table 111 – Association ends of ExcitationSystemDynamics::ExcIEEEAC1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.4 ExcIEEEAC2A

IEEE 421.5-2005 type AC2A model. The model represents a high initial response field-controlled alternator-rectifier excitation system. The alternator main exciter is used with non-controlled rectifiers. The type AC2A model is similar to that of type AC1A except for the inclusion of exciter time constant compensation and exciter field current limiting elements.

Reference: IEEE 421.5-2005, 6.2.

Table 112 shows all attributes of ExcIEEEAC2A.

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Table 112 – Attributes of ExcitationSystemDynamics::ExcIEEEAC2A

name	mult	type	description
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 400.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,02.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 8.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -8.
kb	0..1	PU	Second stage regulator gain (KB) (> 0). Typical value = 25.
vrmax	0..1	PU	Maximum voltage regulator outputs (VRMAX) (> 0). Typical value = 105.
vrmin	0..1	PU	Minimum voltage regulator outputs (VRMIN) (< 0). Typical value = -95.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,6.
vfemax	0..1	PU	Exciter field current limit reference (VFEMAX) (> 0). Typical value = 4,4.
kh	0..1	PU	Exciter field current feedback gain (KH) (>= 0). Typical value = 1.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0,03.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,28.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 0,35.
ke	0..1	PU	Exciter constant related to self-excited field (KE) (>= 0). Typical value = 1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 4,4.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 0,037.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 3,3.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 0,012.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 113 shows all association ends of ExcIEEEAC2A with other classes.

Table 113 – Association ends of ExcitationSystemDynamics::ExcIEEEAC2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.5 ExcIEEEAC3A

IEEE 421.5-2005 type AC3A model. The model represents the field-controlled alternator-rectifier excitation systems designated type AC3A. These excitation systems include an alternator main exciter with non-controlled rectifiers. The exciter employs self-excitation, and the voltage regulator power is derived from the exciter output voltage. Therefore, this system has an additional nonlinearity, simulated by the use of a multiplier whose inputs are the voltage regulator command signal, Va, and the exciter output voltage, Efd, times KR. This model is applicable to excitation systems employing static voltage regulators.

Reference: IEEE 421.5-2005, 6.3.

Table 114 shows all attributes of ExcIEEEAC3A.

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Table 114 – Attributes of ExcitationSystemDynamics::ExcIEEEAC3A

name	mult	type	description
efdn	0..1	PU	Value of Efd at which feedback gain changes (EFDN) (> 0). Typical value = 2,36.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 45,62.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,104.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 0,499.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0,143.
kn	0..1	PU	Excitation control system stabilizer gain (KN) (>= 0). Typical value = 0,05.
kr	0..1	PU	Constant associated with regulator and alternator field power supply (KR) (> 0). Typical value = 3,77.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 1,143.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 0,1.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,013.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 1,17.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 1.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 1.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -0,95.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 6,24.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 4,68.
vemin	0..1	PU	Minimum exciter voltage output (VEMIN) (<= 0). Typical value = 0.
vfemax	0..1	PU	Exciter field current limit reference (VFEMAX) (>= 0). Typical value = 16.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 115 shows all association ends of ExcIEEEAC3A with other classes.

Table 115 – Association ends of ExcitationSystemDynamics::ExcIEEEAC3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.6 ExcIEEEAC4A

IEEE 421.5-2005 type AC4A model. The model represents type AC4A alternator-supplied controlled-rectifier excitation system which is quite different from the other types of AC systems. This high initial response excitation system utilizes a full thyristor bridge in the exciter output circuit. The voltage regulator controls the firing of the thyristor bridges. The exciter alternator uses an independent voltage regulator to control its output voltage to a constant value. These effects are not modelled; however, transient loading effects on the exciter alternator are included.

Reference: IEEE 421.5-2005, 6.4.

Table 116 shows all attributes of ExcIEEEAC4A.

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Table 116 – Attributes of ExcitationSystemDynamics::ExcIEEEAC4A

name	mult	type	description
vimax	0..1	PU	Maximum voltage regulator input limit (VIMAX) (> 0). Typical value = 10.
vimin	0..1	PU	Minimum voltage regulator input limit (VIMIN) (< 0). Typical value = -10.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 1.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 10.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 200.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,015.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 5,64.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -4,53.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 117 shows all association ends of ExcIEEEAC4A with other classes.

Table 117 – Association ends of ExcitationSystemDynamics::ExcIEEEAC4A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.7 ExcIEEEAC5A

IEEE 421.5-2005 type AC5A model. The model represents a simplified model for brushless excitation systems. The regulator is supplied from a source, such as a permanent magnet generator, which is not affected by system disturbances. Unlike other AC models, this model uses loaded rather than open circuit exciter saturation data in the same way as it is used for the DC models. Because the model has been widely implemented by the industry, it is sometimes used to represent other types of systems when either detailed data for them are not available or simplified models are required.

Reference: IEEE 421.5-2005, 6.5.

Table 118 shows all attributes of ExcIEEEAC5A.

Table 118 – Attributes of ExcitationSystemDynamics::ExcIEEEAC5A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 400.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 7,3.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -7,3.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,8.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0,03.
tf1	0..1	Seconds	Excitation control system stabilizer time constant (TF1) (> 0). Typical value = 1.
tf2	0..1	Seconds	Excitation control system stabilizer time constant (TF2) (>= 0). Typical value = 1.
tf3	0..1	Seconds	Excitation control system stabilizer time constant (TF3) (>= 0). Typical value = 1.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD1) (> 0). Typical value = 5,6.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD1 (SE[EFD1]) (>= 0). Typical value = 0,86.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD2) (> 0). Typical value = 4,2.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD2 (SE[EFD2]) (>= 0). Typical value = 0,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 119 shows all association ends of ExcIEEEAC5A with other classes.

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Table 119 – Association ends of ExcitationSystemDynamics::ExcIEEEAC5A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.8 ExcIEEEAC6A

IEEE 421.5-2005 type AC6A model. The model represents field-controlled alternator-rectifier excitation systems with system-supplied electronic voltage regulators. The maximum output of the regulator, VR, is a function of terminal voltage, VT. The field current limiter included in the original model AC6A remains in the 2005 update.

Reference: IEEE 421.5-2005, 6.6.

Table 120 shows all attributes of ExcIEEEAC6A.

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Table 120 – Attributes of ExcitationSystemDynamics::ExcIEEEAC6A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 536.
ta	0..1	Seconds	Voltage regulator time constant (TA) (>= 0). Typical value = 0,086.
tk	0..1	Seconds	Voltage regulator time constant (TK) (>= 0). Typical value = 0,18.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 9.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 3.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 75.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -75.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 44.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -36.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 1.
kh	0..1	PU	Exciter field current limiter gain (KH) (>= 0). Typical value = 92.
tj	0..1	Seconds	Exciter field current limiter time constant (TJ) (>= 0). Typical value = 0,02.
th	0..1	Seconds	Exciter field current limiter time constant (TH) (> 0). Typical value = 0,08.
vfelim	0..1	PU	Exciter field current limit reference (VFELIM) (> 0). Typical value = 19.
vhmax	0..1	PU	Maximum field current limiter signal reference (VHMAX) (> 0). Typical value = 75.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,173.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 1,91.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1,6.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 7,4.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 0,214.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 5,55.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 0,044.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 121 shows all association ends of ExcIEEEAC6A with other classes.

Table 121 – Association ends of ExcitationSystemDynamics::ExcIEEEAC6A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.9 ExcIEEEAC7B

IEEE 421.5-2005 type AC7B model. The model represents excitation systems which consist of an AC alternator with either stationary or rotating rectifiers to produce the DC field requirements. It is an upgrade to earlier AC excitation systems, which replace only the controls but retain the AC alternator and diode rectifier bridge.

Reference: IEEE 421.5-2005, 6.7. Note, however, that in IEEE 421.5-2005, the [1 / sTE] block is shown as [1 / (1 + sTE)], which is incorrect.

Table 122 shows all attributes of ExcIEEEAC7B.

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Table 122 – Attributes of ExcitationSystemDynamics::ExcIEEEAC7B

name	mult	type	description
kpr	0..1	PU	Voltage regulator proportional gain (KPR) (> 0 if ExcIEEEAC7B.kir = 0). Typical value = 4,24.
kir	0..1	PU	Voltage regulator integral gain (KIR) (>= 0). Typical value = 4,24.
kdr	0..1	PU	Voltage regulator derivative gain (KDR) (>= 0). Typical value = 0.
tdr	0..1	Seconds	Lag time constant (TDR) (>= 0). Typical value = 0.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 5,79.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -5,79.
kpa	0..1	PU	Voltage regulator proportional gain (KPA) (> 0 if ExcIEEEAC7B.kia = 0). Typical value = 65,36.
kia	0..1	PU	Voltage regulator integral gain (KIA) (>= 0). Typical value = 59,69.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 1.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -0,95.
kp	0..1	PU	Potential circuit gain coefficient (KP) (> 0). Typical value = 4,96.
kl	0..1	PU	Exciter field voltage lower limit parameter (KL). Typical value = 10.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 1,1.
vfemax	0..1	PU	Exciter field current limit reference (VFEMAX). Typical value = 6,9.
vemin	0..1	PU	Minimum exciter voltage output (VEMIN) (<= 0). Typical value = 0.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,18.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 0,02.
kf1	0..1	PU	Excitation control system stabilizer gain (KF1) (>= 0). Typical value = 0,212.
kf2	0..1	PU	Excitation control system stabilizer gain (KF2) (>= 0). Typical value = 0.
kf3	0..1	PU	Excitation control system stabilizer gain (KF3) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 6,3.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 0,44.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 3,02.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 0,075.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 123 shows all association ends of ExcIEEEAC7B with other classes.

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Table 123 – Association ends of ExcitationSystemDynamics::ExcIEEEAC7B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.10 ExcIEEEAC8B

IEEE 421.5-2005 type AC8B model. This model represents a PID voltage regulator with either a brushless exciter or DC exciter. The AVR in this model consists of PID control, with separate constants for the proportional (KPR), integral (KIR), and derivative (KDR) gains. The representation of the brushless exciter (TE, KE, SE, KC, KD) is similar to the model type AC2A. The type AC8B model can be used to represent static voltage regulators applied to brushless excitation systems. Digitally based voltage regulators feeding DC rotating main exciters can be represented with the AC type AC8B model with the parameters KC and KD set to 0. For thyristor power stages fed from the generator terminals, the limits VRMAX and VRMIN should be a function of terminal voltage: VT x VRMAX and VT x VRMIN.

Reference: IEEE 421.5-2005, 6.8.

Table 124 shows all attributes of ExcIEEEAC8B.

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Table 124 – Attributes of ExcitationSystemDynamics::ExcIEEEAC8B

name	mult	type	description
kpr	0..1	PU	Voltage regulator proportional gain (KPR) (> 0 if ExcIEEEAC8B.kir = 0). Typical value = 80.
kir	0..1	PU	Voltage regulator integral gain (KIR) (>= 0). Typical value = 5.
kdr	0..1	PU	Voltage regulator derivative gain (KDR) (>= 0). Typical value = 10.
tdr	0..1	Seconds	Lag time constant (TDR) (> 0). Typical value = 0,1.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 35.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (<= 0). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 1.
ta	0..1	Seconds	Voltage regulator time constant (TA) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 1,2.
vfemax	0..1	PU	Exciter field current limit reference (VFEMAX). Typical value = 6.
vemin	0..1	PU	Minimum exciter voltage output (VEMIN) (<= 0). Typical value = 0.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,55.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (KD) (>= 0). Typical value = 1,1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE1) (> 0). Typical value = 6,5.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance (SE[VE1]) (>= 0). Typical value = 0,3.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (VE2) (> 0). Typical value = 9.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, VE2, back of commutating reactance (SE[VE2]) (>= 0). Typical value = 3.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 125 shows all association ends of ExcIEEEAC8B with other classes.

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Table 125 – Association ends of ExcitationSystemDynamics::ExcIEEEAC8B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.11 ExcIEEEDC1A

IEEE 421.5-2005 type DC1A model. This model represents field-controlled DC commutator exciters with continuously acting voltage regulators (especially the direct-acting rheostatic, rotating amplifier, and magnetic amplifier types). Because this model has been widely implemented by the industry, it is sometimes used to represent other types of systems when detailed data for them are not available or when a simplified model is required.

Reference: IEEE 421.5-2005, 5.1.

Table 126 shows all attributes of ExcIEEEDC1A.

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Table 126 – Attributes of ExcitationSystemDynamics::ExcIEEEDC1A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 46.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,06.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 0.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> ExcIEEEDC1A.vrmin). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0 and < ExcIEEEDC1A.vrmax). Typical value = -0,9.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,46.
kf	0..1	PU	Excitation control system stabilizer gain (KF) (>= 0). Typical value = 0.1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 1.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD1) (> 0). Typical value = 3,1.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD1 (SE[EFD1]) (>= 0). Typical value = 0,33.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD2) (> 0). Typical value = 2,3.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD2 (SE[EFD2]) (>= 0). Typical value = 0,1.
uelin	0..1	Boolean	UEL input (uelin). true = input is connected to the HV gate false = input connects to the error signal. Typical value = true.
exclim	0..1	Boolean	(exclim). IEEE standard is ambiguous about lower limit on exciter output. true = a lower limit of zero is applied to integrator output false = a lower limit of zero is not applied to integrator output. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 127 shows all association ends of ExcIEEEDC1A with other classes.

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Table 127 – Association ends of ExcitationSystemDynamics::ExcIEEEDC1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.12 ExcIEEEDC2A

IEEE 421.5-2005 type DC2A model. This model represents field-controlled DC commutator exciters with continuously acting voltage regulators having supplies obtained from the generator or auxiliary bus. It differs from the type DC1A model only in the voltage regulator output limits, which are now proportional to terminal voltage VT.

It is representative of solid-state replacements for various forms of older mechanical and rotating amplifier regulating equipment connected to DC commutator exciters.

Reference: IEEE 421.5-2005, 5.2.

Table 128 shows all attributes of ExcIEEEDC2A.

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Table 128 – Attributes of ExcitationSystemDynamics::ExcIEEEDC2A

name	mult	type	description
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD1) (> 0). Typical value = 3,05.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD2) (> 0). Typical value = 2,29.
exclim	0..1	PU	(exclim). IEEE standard is ambiguous about lower limit on exciter output. Typical value = – 999 which means that there is no limit applied.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 300.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
kf	0..1	PU	Excitation control system stabilizer gain (KF) (>= 0). Typical value = 0,1.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD1 (SE[EFD1]) (>= 0). Typical value = 0,279.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD2 (SE[EFD2]) (>= 0). Typical value = 0,117.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,01.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 1,33.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (> 0). Typical value = 0,675.
uelin	0..1	Boolean	UEL input (uelin). true = input is connected to the HV gate false = input connects to the error signal. Typical value = true.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX)(> ExcIEEEDC2A.vrmin). Typical value = 4,95.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0 and < ExcIEEEDC2A.vrmax). Typical value = -4,9.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 129 shows all association ends of ExcIEEEDC2A with other classes.

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Table 129 – Association ends of ExcitationSystemDynamics::ExcIEEEDC2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.13 ExcIEEEDC3A

IEEE 421.5-2005 type DC3A model. This model represents older systems, in particular those DC commutator exciters with non-continuously acting regulators that were commonly used before the development of the continuously acting varieties. These systems respond at basically two different rates, depending upon the magnitude of voltage error. For small errors, adjustment is made periodically with a signal to a motor-operated rheostat. Larger errors cause resistors to be quickly shorted or inserted and a strong forcing signal applied to the exciter. Continuous motion of the motor-operated rheostat occurs for these larger error signals, even though it is bypassed by contactor action.

Reference: IEEE 421.5-2005, 5.3.

Table 130 shows all attributes of ExcIEEEDC3A.

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Table 130 – Attributes of ExcitationSystemDynamics::ExcIEEEDC3A

name	mult	type	description
trh	0..1	Seconds	Rheostat travel time (TRH) (> 0). Typical value = 20.
kv	0..1	PU	Fast raise/lower contact setting (KV) (> 0). Typical value = 0,05.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (<= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,5.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 0,05.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD1) (> 0). Typical value = 3,375.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD1 (SE[EFD1]) (>= 0). Typical value = 0,267.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD2) (> 0). Typical value = 3,15.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD2 (SE[EFD2]) (>= 0). Typical value = 0,068.
exclim	0..1	Boolean	(exclim). IEEE standard is ambiguous about lower limit on exciter output. true = a lower limit of zero is applied to integrator output false = a lower limit of zero is not applied to integrator output. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 131 shows all association ends of ExcIEEEDC3A with other classes.

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Table 131 – Association ends of ExcitationSystemDynamics::ExcIEEEDC3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.14 ExcIEEEDC4B

IEEE 421.5-2005 type DC4B model. These excitation systems utilize a field-controlled DC commutator exciter with a continuously acting voltage regulator having supplies obtained from the generator or auxiliary bus.

Reference: IEEE 421.5-2005, 5.4.

Table 132 shows all attributes of ExcIEEEDC4B.

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Table 132 – Attributes of ExcitationSystemDynamics::ExcIEEEDC4B

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 1.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,2.
kp	0..1	PU	Regulator proportional gain (KP) (>= 0). Typical value = 20.
ki	0..1	PU	Regulator integral gain (KI) (>= 0). Typical value = 20.
kd	0..1	PU	Regulator derivative gain (KD) (>= 0). Typical value = 20.
td	0..1	Seconds	Regulator derivative filter time constant (TD) (> 0 if ExcIEEEDC4B.kd > 0). Typical value = 0,01.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> ExcIEEEDC4B.vrmin). Typical value = 2,7.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (<= 0 and < ExcIEEEDC4B.vrmax). Typical value = -0,9.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,8.
kf	0..1	PU	Excitation control system stabilizer gain (KF) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (>= 0). Typical value = 1.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD1) (> 0). Typical value = 1,75.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD1 (SE[EFD1]) (>= 0). Typical value = 0,08.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (EFD2) (> 0). Typical value = 2,33.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, EFD2 (SE[EFD2]) (>= 0). Typical value = 0,27.
vemin	0..1	PU	Minimum exciter voltage output (VEMIN) (<= 0). Typical value = 0.
oelin	0..1	Boolean	OEL input (OELin). true = LV gate false = subtract from error signal. Typical value = true.
uelin	0..1	Boolean	UEL input (UELin). true = HV gate false = add to error signal. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 133 shows all association ends of ExcIEEEDC4B with other classes.

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Table 133 – Association ends of ExcitationSystemDynamics::ExcIEEEDC4B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.15 ExcIEEEST1A

IEEE 421.5-2005 type ST1A model. This model represents systems in which excitation power is supplied through a transformer from the generator terminals (or the unit's auxiliary bus) and is regulated by a controlled rectifier. The maximum exciter voltage available from such systems is directly related to the generator terminal voltage.

Reference: IEEE 421.5-2005, 7.1.

Table 134 shows all attributes of ExcIEEEST1A.

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Table 134 – Attributes of ExcitationSystemDynamics::ExcIEEEST1A

name	mult	type	description
ilr	0..1	PU	Exciter output current limit reference (ILR). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 190.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,08.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0.
klr	0..1	PU	Exciter output current limiter gain (KLR). Typical value = 0.
pssin	0..1	Boolean	Selector of the Power System Stabilizer (PSS) input (PSSin). true = PSS input (Vs) added to error signal false = PSS input (Vs) added to voltage regulator output. Typical value = true.
ta	0..1	Seconds	Voltage regulator time constant (TA) (>= 0). Typical value = 0.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 10.
tb1	0..1	Seconds	Voltage regulator time constant (TB1) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 1.
tc1	0..1	Seconds	Voltage regulator time constant (TC1) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (>= 0). Typical value = 1.
uelin	0..1	ExcIEEEST1AUELselectorKind	Selector of the connection of the UEL input (UELin). Typical value = ignoreUELsignal.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 14,5.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -14,5.
vimax	0..1	PU	Maximum voltage regulator input limit (VIMAX) (> 0). Typical value = 999.
vimin	0..1	PU	Minimum voltage regulator input limit (VIMIN) (< 0). Typical value = -999.
vrmax	0..1	PU	Maximum voltage regulator outputs (VRMAX) (> 0). Typical value = 7,8.
vrmin	0..1	PU	Minimum voltage regulator outputs (VRMIN) (< 0). Typical value = -6,7.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 135 shows all association ends of ExcIEEEST1A with other classes.

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Table 135 – Association ends of ExcitationSystemDynamics::ExcIEEEST1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.16 ExcIEEEST2A

IEEE 421.5-2005 type ST2A model. Some static systems use both current and voltage sources (generator terminal quantities) to comprise the power source. The regulator controls the exciter output through controlled saturation of the power transformer components. These compound-source rectifier excitation systems are designated type ST2A and are represented by ExcIEEEST2A.

Reference: IEEE 421.5-2005, 7.2.

Table 136 shows all attributes of ExcIEEEST2A.

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Table 136 – Attributes of ExcitationSystemDynamics::ExcIEEEST2A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (KA) (> 0). Typical value = 120.
ta	0..1	Seconds	Voltage regulator time constant (TA) (> 0). Typical value = 0,15.
vrmax	0..1	PU	Maximum voltage regulator outputs (VRMAX) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator outputs (VRMIN) (<= 0). Typical value = 0.
ke	0..1	PU	Exciter constant related to self-excited field (KE). Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (TE) (> 0). Typical value = 0,5.
kf	0..1	PU	Excitation control system stabilizer gains (KF) (>= 0). Typical value = 0,05.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (>= 0). Typical value = 1.
kp	0..1	PU	Potential circuit gain coefficient (KP) (>= 0). Typical value = 4,88.
ki	0..1	PU	Potential circuit gain coefficient (KI) (>= 0). Typical value = 8.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 1,82.
efdmax	0..1	PU	Maximum field voltage (EFDMax) (>= 0). Typical value = 99.
uelin	0..1	Boolean	UEL input (UELin). true = HV gate false = add to error signal. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 137 shows all association ends of ExcIEEEST2A with other classes.

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Table 137 – Association ends of ExcitationSystemDynamics::ExcIEEEST2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.17 ExcIEEEST3A

IEEE 421.5-2005 type ST3A model. Some static systems utilize a field voltage control loop to linearize the exciter control characteristic. This also makes the output independent of supply source variations until supply limitations are reached. These systems utilize a variety of controlled-rectifier designs: full thyristor complements or hybrid bridges in either series or shunt configurations. The power source can consist of only a potential source, either fed from the machine terminals or from internal windings. Some designs can have compound power sources utilizing both machine potential and current. These power sources are represented as phasor combinations of machine terminal current and voltage and are accommodated by suitable parameters in model type ST3A which is represented by ExcIEEEST3A.

Reference: IEEE 421.5-2005, 7.3.

Table 138 shows all attributes of ExcIEEEST3A.

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Table 138 – Attributes of ExcitationSystemDynamics::ExcIEEEST3A

name	mult	type	description
vimax	0..1	PU	Maximum voltage regulator input limit (VIMAX) (> 0). Typical value = 0,2.
vimin	0..1	PU	Minimum voltage regulator input limit (VIMIN) (< 0). Typical value = -0,2.
ka	0..1	PU	Voltage regulator gain (KA) (> 0). This is parameter K in the IEEE standard. Typical value = 200.
ta	0..1	Seconds	Voltage regulator time constant (TA) (>= 0). Typical value = 0.
tb	0..1	Seconds	Voltage regulator time constant (TB) (>= 0). Typical value = 10.
tc	0..1	Seconds	Voltage regulator time constant (TC) (>= 0). Typical value = 1.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 10.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -10.
km	0..1	PU	Forward gain constant of the inner loop field regulator (KM) (> 0). Typical value = 7,93.
tm	0..1	Seconds	Forward time constant of inner loop field regulator (TM) (> 0). Typical value = 0,4.
vmmax	0..1	PU	Maximum inner loop output (VMMax) (> 0). Typical value = 1.
vmmin	0..1	PU	Minimum inner loop output (VMMin) (<= 0). Typical value = 0.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (KG) (>= 0). Typical value = 1.
kp	0..1	PU	Potential circuit gain coefficient (KP) (> 0). Typical value = 6,15.
thetap	0..1	AngleDegrees	Potential circuit phase angle (thetap). Typical value = 0.
ki	0..1	PU	Potential circuit gain coefficient (KI) (>= 0). Typical value = 0.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,2.
xl	0..1	PU	Reactance associated with potential source (XL) (>= 0). Typical value = 0,081.
vbmax	0..1	PU	Maximum excitation voltage (VBMax) (> 0). Typical value = 6,9.
vgmax	0..1	PU	Maximum inner loop feedback voltage (VGMax) (>= 0). Typical value = 5,8.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 139 shows all association ends of ExcIEEEST3A with other classes.

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Table 139 – Association ends of ExcitationSystemDynamics::ExcIEEEST3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.18 ExcIEEEST4B

IEEE 421.5-2005 type ST4B model. This model is a variation of the type ST3A model, with a proportional plus integral (PI) regulator block replacing the lag-lead regulator characteristic that is in the ST3A model. Both potential and compound source rectifier excitation systems are modelled. The PI regulator blocks have non-windup limits that are represented. The voltage regulator of this model is typically implemented digitally.

Reference: IEEE 421.5-2005, 7.4.

Table 140 shows all attributes of ExcIEEEST4B.

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Table 140 – Attributes of ExcitationSystemDynamics::ExcIEEEST4B

name	mult	type	description
kpr	0..1	PU	Voltage regulator proportional gain (KPR). Typical value = 10,75.
kir	0..1	PU	Voltage regulator integral gain (KIR). Typical value = 10,75.
ta	0..1	Seconds	Voltage regulator time constant (TA) (>= 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -0,87.
kpm	0..1	PU	Voltage regulator proportional gain output (KPM). Typical value = 1.
kim	0..1	PU	Voltage regulator integral gain output (KIM). Typical value = 0.
vmmax	0..1	PU	Maximum inner loop output (VMMax) (> ExcIEEEST4B.vmmin). Typical value = 99.
vmmin	0..1	PU	Minimum inner loop output (VMMin) (< ExcIEEEST4B.vmmax). Typical value = -99.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (KG) (>= 0). Typical value = 0.
kp	0..1	PU	Potential circuit gain coefficient (KP) (> 0). Typical value = 9,3.
thetap	0..1	AngleDegrees	Potential circuit phase angle (thetap). Typical value = 0.
ki	0..1	PU	Potential circuit gain coefficient (KI) (>= 0). Typical value = 0.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (KC) (>= 0). Typical value = 0,113.
xl	0..1	PU	Reactance associated with potential source (XL) (>= 0). Typical value = 0,124.
vbmax	0..1	PU	Maximum excitation voltage (VBMax) (> 0). Typical value = 11,63.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 141 shows all association ends of ExcIEEEST4B with other classes.

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Table 141 – Association ends of ExcitationSystemDynamics::ExcIEEEST4B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.19 ExcIEEEST5B

IEEE 421.5-2005 type ST5B model. The type ST5B excitation system is a variation of the type ST1A model, with alternative overexcitation and underexcitation inputs and additional limits.

The block diagram in the IEEE 421.5 standard has input signal Vc and does not indicate the summation point with Vref. The implementation of the ExcIEEEST5B shall consider summation point with Vref.

Reference: IEEE 421.5-2005, 7.5.

Table 142 shows all attributes of ExcIEEEST5B.

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Table 142 – Attributes of ExcitationSystemDynamics::ExcIEEEST5B

name	mult	type	description
kr	0..1	PU	Regulator gain (KR) (> 0). Typical value = 200.
t1	0..1	Seconds	Firing circuit time constant (T1) (>= 0). Typical value = 0,004.
kc	0..1	PU	Rectifier regulation factor (KC) (>= 0). Typical value = 0,004.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 5.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -4.
tc1	0..1	Seconds	Regulator lead time constant (TC1) (>= 0). Typical value = 0,8.
tb1	0..1	Seconds	Regulator lag time constant (TB1) (>= 0). Typical value = 6.
tc2	0..1	Seconds	Regulator lead time constant (TC2) (>= 0). Typical value = 0,08.
tb2	0..1	Seconds	Regulator lag time constant (TB2) (>= 0). Typical value = 0,01.
toc1	0..1	Seconds	OEL lead time constant (TOC1) (>= 0). Typical value = 0,1.
tob1	0..1	Seconds	OEL lag time constant (TOB1) (>= 0). Typical value = 2.
toc2	0..1	Seconds	OEL lead time constant (TOC2) (>= 0). Typical value = 0,08.
tob2	0..1	Seconds	OEL lag time constant (TOB2) (>= 0). Typical value = 0,08.
tuc1	0..1	Seconds	UEL lead time constant (TUC1) (>= 0). Typical value = 2.
tub1	0..1	Seconds	UEL lag time constant (TUB1) (>= 0). Typical value = 10.
tuc2	0..1	Seconds	UEL lead time constant (TUC2) (>= 0). Typical value = 0,1.
tub2	0..1	Seconds	UEL lag time constant (TUB2) (>= 0). Typical value = 0,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 143 shows all association ends of ExcIEEEST5B with other classes.

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Table 143 – Association ends of ExcitationSystemDynamics::ExcIEEEST5B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.20 ExcIEEEST6B

IEEE 421.5-2005 type ST6B model. This model consists of a PI voltage regulator with an inner loop field voltage regulator and pre-control. The field voltage regulator implements a proportional control. The pre-control and the delay in the feedback circuit increase the dynamic response.

Reference: IEEE 421.5-2005, 7.6.

Table 144 shows all attributes of ExcIEEEST6B.

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Table 144 – Attributes of ExcitationSystemDynamics::ExcIEEEST6B

name	mult	type	description
ilr	0..1	PU	Exciter output current limit reference (ILR) (> 0). Typical value = 4,164.
kci	0..1	PU	Exciter output current limit adjustment (KCI) (> 0). Typical value = 1,0577.
kff	0..1	PU	Pre-control gain constant of the inner loop field regulator (KFF). Typical value = 1.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (KG) (>= 0). Typical value = 1.
kia	0..1	PU	Voltage regulator integral gain (KIA) (> 0). Typical value = 45,094.
klr	0..1	PU	Exciter output current limiter gain (KLR) (> 0). Typical value = 17,33.
km	0..1	PU	Forward gain constant of the inner loop field regulator (KM). Typical value = 1.
kpa	0..1	PU	Voltage regulator proportional gain (KPA) (> 0). Typical value = 18,038.
oelin	0..1	ExcST6BOELselectorKind	OEL input selector (OELin). Typical value = noOELinput.
tg	0..1	Seconds	Feedback time constant of inner loop field voltage regulator (TG) (>= 0). Typical value = 0,02.
vamax	0..1	PU	Maximum voltage regulator output (VAMAX) (> 0). Typical value = 4,81.
vamin	0..1	PU	Minimum voltage regulator output (VAMIN) (< 0). Typical value = -3,85.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 4,81.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -3,85.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 145 shows all association ends of ExcIEEEST6B with other classes.

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Table 145 – Association ends of ExcitationSystemDynamics::ExcIEEEST6B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.21 ExcIEEEST7B

IEEE 421.5-2005 type ST7B model. This model is representative of static potential-source excitation systems. In this system, the AVR consists of a PI voltage regulator. A phase lead-lag filter in series allows the introduction of a derivative function, typically used with brushless excitation systems. In that case, the regulator is of the PID type. In addition, the terminal voltage channel includes a phase lead-lag filter. The AVR includes the appropriate inputs on its reference for overexcitation limiter (OEL1), underexcitation limiter (UEL), stator current limiter (SCL), and current compensator (DROOP). All these limitations, when they work at voltage reference level, keep the PSS (VS signal from PSS) in operation. However, the UEL limitation can also be transferred to the high value (HV) gate acting on the output signal. In addition, the output signal passes through a low value (LV) gate for a ceiling overexcitation limiter (OEL2).

Reference: IEEE 421.5-2005, 7.7.

Table 146 shows all attributes of ExcIEEEST7B.

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Table 146 – Attributes of ExcitationSystemDynamics::ExcIEEEST7B

name	mult	type	description
kh	0..1	PU	High-value gate feedback gain (KH) (>= 0). Typical value = 1.
kia	0..1	PU	Voltage regulator integral gain (KIA) (>= 0). Typical value = 1.
kl	0..1	PU	Low-value gate feedback gain (KL) (>= 0). Typical value = 1.
kpa	0..1	PU	Voltage regulator proportional gain (KPA) (> 0). Typical value = 40.
oelin	0..1	ExcST7BOELselectorKind	OEL input selector (OELin). Typical value = noOELinput.
tb	0..1	Seconds	Regulator lag time constant (TB) (>= 0). Typical value = 1.
tc	0..1	Seconds	Regulator lead time constant (TC) (>= 0). Typical value = 1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (TF) (>= 0). Typical value = 1.
tg	0..1	Seconds	Feedback time constant of inner loop field voltage regulator (TG) (>= 0). Typical value = 1.
tia	0..1	Seconds	Feedback time constant (TIA) (>= 0). Typical value = 3.
uelin	0..1	ExcST7BUELselectorKind	UEL input selector (UELin). Typical value = noUELinput.
vmax	0..1	PU	Maximum voltage reference signal (VMAX) (> 0 and > ExcIEEEST7B.vmin). Typical value = 1,1.
vmin	0..1	PU	Minimum voltage reference signal (VMIN) (> 0 and < ExcIEEEST7B.vmax). Typical value = 0,9.
vrmax	0..1	PU	Maximum voltage regulator output (VRMAX) (> 0). Typical value = 5.
vrmin	0..1	PU	Minimum voltage regulator output (VRMIN) (< 0). Typical value = -4,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 147 shows all association ends of ExcIEEEST7B with other classes.

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Table 147 – Association ends of ExcitationSystemDynamics::ExcIEEEST7B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.22 ExcAC1A

Modified IEEE AC1A alternator-supplied rectifier excitation system with different rate feedback source.

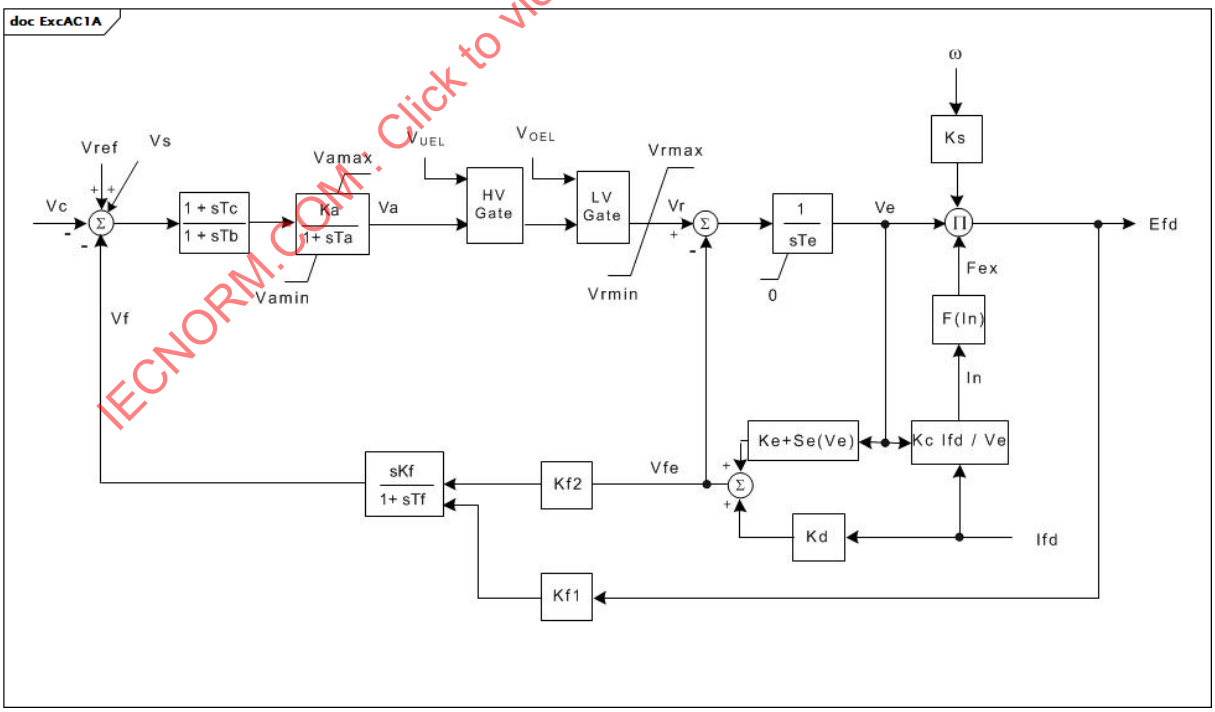

Figure 91 – ExcAC1A

Figure 91: This diagram describes the ExcAC1A excitation system model.

Parameter details:

1) If Ks is set to 1 the output (Efd) is multiplied by generator speed.

Table 148 shows all attributes of ExcAC1A.

Table 148 – Attributes of ExcitationSystemDynamics::ExcAC1A

name	mult	type	description
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 400.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,02.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 14,5.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -14,5.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 0,8.
kf	0..1	PU	Excitation control system stabilizer gains (Kf) (>= 0). Typical value = 0,03.
kf1	0..1	PU	Coefficient to allow different usage of the model (Kf1) (>= 0). Typical value = 0.
kf2	0..1	PU	Coefficient to allow different usage of the model (Kf2) (>= 0). Typical value = 1.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (> 0). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,2.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (Kd) (>= 0). Typical value = 0,38.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 4,18.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 0,1.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 3,14.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 0,03.
vrmax	0..1	PU	Maximum voltage regulator outputs (Vrmax) (> 0). Typical value = 6,03.
vrmin	0..1	PU	Minimum voltage regulator outputs (Vrmin) (< 0). Typical value = -5,43.
hvlvgates	0..1	Boolean	Indicates if both HV gate and LV gate are active (HVLVgates). true = gates are used false = gates are not used. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 149 shows all association ends of ExcAC1A with other classes.

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Table 149 – Association ends of ExcitationSystemDynamics::ExcAC1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.23 ExcAC2A

Modified IEEE AC2A alternator-supplied rectifier excitation system with different field current limit.

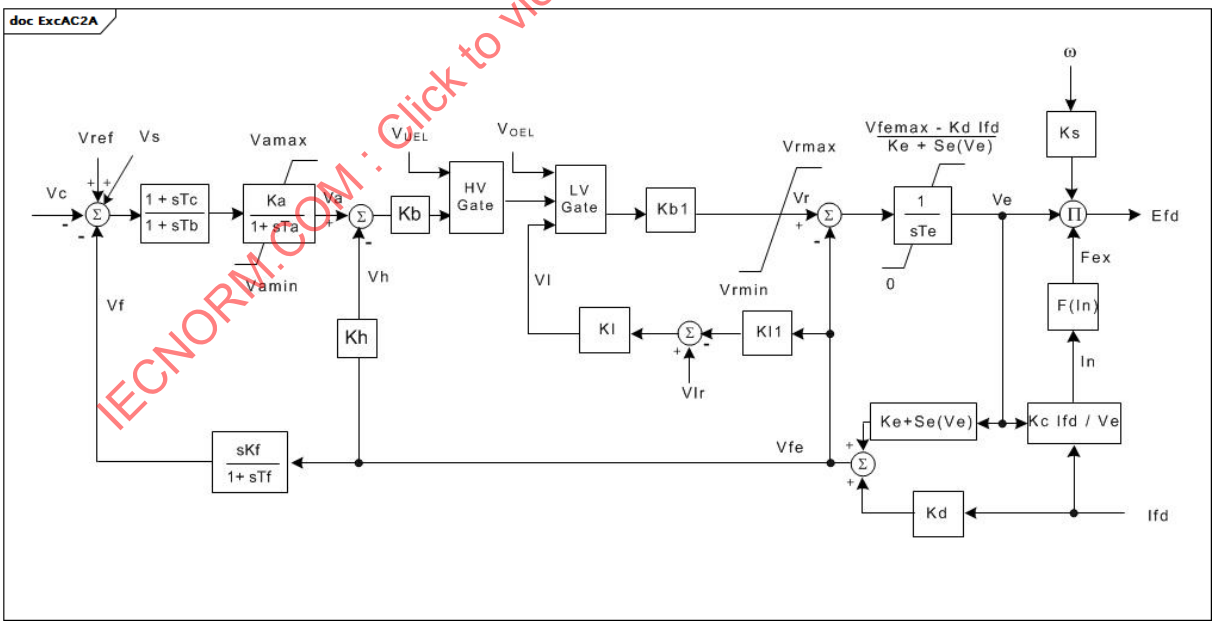

Figure 92 – ExcAC2A

Figure 92: This diagram describes the ExcAC2A excitation system model.

Parameter details:

1) If Ks is set to 1 the output (Efd) is multiplied by generator speed;

2) The upper limit on Ve represents the effect of the field current limiter. If Vfemax is zero, this limit will not be enforced. In the real system, the limiter is implemented by a low value gate just before Kb. The input to this LV gate is Kl x (Vlr – Vfe). If the values of Kl and Vlr are given, Vfemax can be calculated as Vlr x Kl x Kb / (1 + Kl x Kb).

Table 150 shows all attributes of ExcAC2A.

Table 150 – Attributes of ExcitationSystemDynamics::ExcAC2A

name	mult	type	description
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 400.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,02.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 8.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -8.
kb	0..1	PU	Second stage regulator gain (Kb) (> 0). Exciter field current controller gain. Typical value = 25.
kb1	0..1	PU	Second stage regulator gain (Kb1). It is exciter field current controller gain used as alternative to Kb to represent a variant of the ExcAC2A model. Typical value = 25.
vrmax	0..1	PU	Maximum voltage regulator outputs (Vrmax) (> 0). Typical value = 105.
vrmin	0..1	PU	Minimum voltage regulator outputs (Vrmin) (< 0). Typical value = -95.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 0,6.
vfemax	0..1	PU	Exciter field current limit reference (Vfemax) (>= 0). Typical value = 4,4.
kh	0..1	PU	Exciter field current feedback gain (Kh) (>= 0). Typical value = 1.
kf	0..1	PU	Excitation control system stabilizer gains (Kf) (>= 0). Typical value = 0,03.
kl	0..1	PU	Exciter field current limiter gain (Kl). Typical value = 10.
vlr	0..1	PU	Maximum exciter field current (Vlr) (> 0). Typical value = 4,4.
kl1	0..1	PU	Coefficient to allow different usage of the model (Kl1). Typical value = 1.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (> 0). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,28.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (Kd) (>= 0). Typical value = 0,35.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 4,4.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 0,037.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 3,3.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 0,012.
hvgate	0..1	Boolean	Indicates if HV gate is active (HVgate). true = gate is used false = gate is not used. Typical value = true.

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name	mult	type	description
lvgate	0..1	Boolean	Indicates if LV gate is active (LVgate). true = gate is used false = gate is not used. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 151 shows all association ends of ExcAC2A with other classes.

Table 151 – Association ends of ExcitationSystemDynamics::ExcAC2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.24 ExcAC3A

Modified IEEE AC3A alternator-supplied rectifier excitation system with different field current limit.

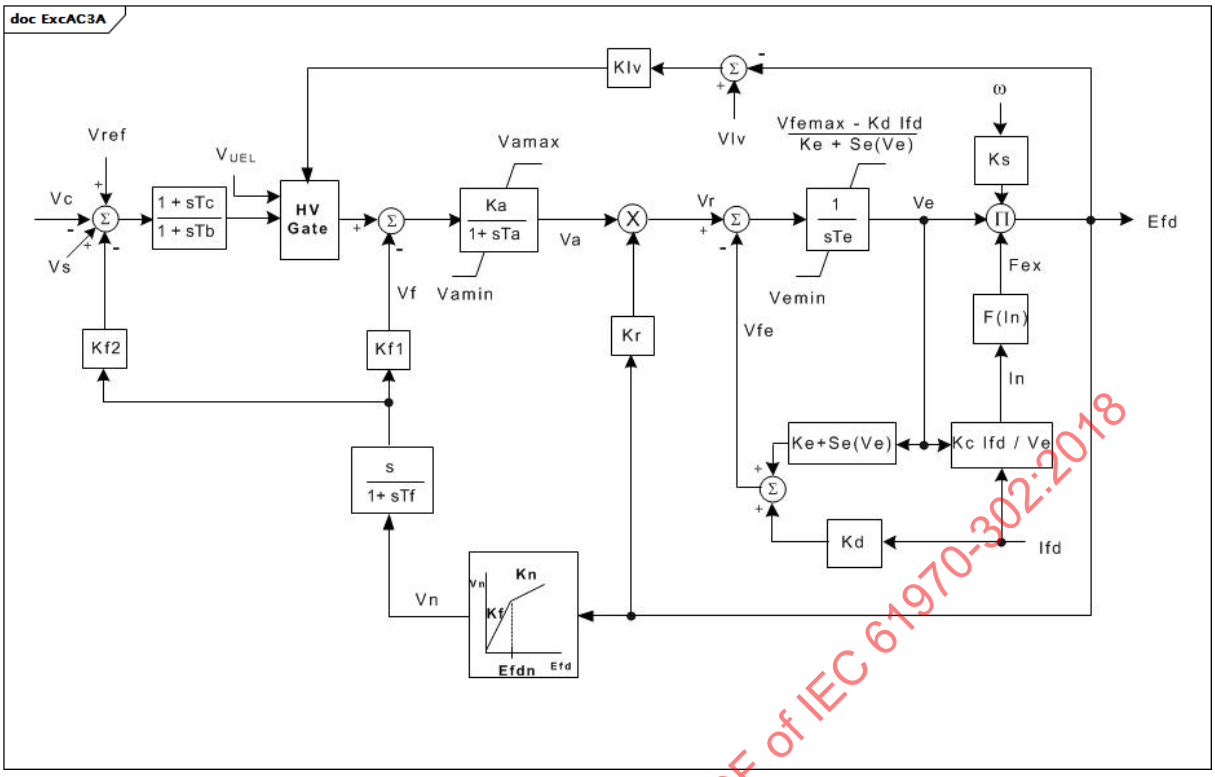

Figure 93 – ExcAC3A

Figure 93: This diagram describes the ExcAC3A excitation system model.

Parameter details:

1) If Ks is set to 1, the output (Efd) is multiplied by generator speed.
2) The upper limit on Ve is an approximate representation of the effect of the maximum field current limiter. If Vfemax is zero, this limit will not be enforced. The lower limit (Vemin) on Ve is an approximate representation of the minimum field voltage limiter.

Table 152 shows all attributes of ExcAC3A.

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Table 152 – Attributes of ExcitationSystemDynamics::ExcAC3A

name	mult	type	description
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
ka	0..1	Seconds	Voltage regulator gain (Ka) (> 0). Typical value = 45,62.
ta	0..1	PU	Voltage regulator time constant (Ta) (> 0). Typical value = 0,013.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 1.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -0,95.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1,17.
vemin	0..1	PU	Minimum exciter voltage output (Vemin) (<= 0). Typical value = 0.
kr	0..1	PU	Constant associated with regulator and alternator field power supply (Kr) (> 0). Typical value =3,77.
kf	0..1	PU	Excitation control system stabilizer gains (Kf) (>= 0). Typical value = 0,143.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (> 0). Typical value = 1.
kn	0..1	PU	Excitation control system stabilizer gain (Kn) (>= 0). Typical value =0,05.
efdn	0..1	PU	Value of Efd at which feedback gain changes (Efdn) (> 0). Typical value = 2,36.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,104.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (Kd) (>= 0). Typical value = 0,499.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
klv	0..1	PU	Gain used in the minimum field voltage limiter loop (Klv). Typical value = 0,194.
kf1	0..1	PU	Coefficient to allow different usage of the model (Kf1). Typical value = 1.
kf2	0..1	PU	Coefficient to allow different usage of the model (Kf2). Typical value = 0.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
vfemax	0..1	PU	Exciter field current limit reference (Vfemax) (>= 0). Typical value = 16.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 6.24.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 1,143.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 4,68.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 0,1.
vlv	0..1	PU	Field voltage used in the minimum field voltage limiter loop (Vlv). Typical value = 0,79.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 153 shows all association ends of ExcAC3A with other classes.

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Table 153 – Association ends of ExcitationSystemDynamics::ExcAC3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.25 ExcAC4A

Modified IEEE AC4A alternator-supplied rectifier excitation system with different minimum controller output.

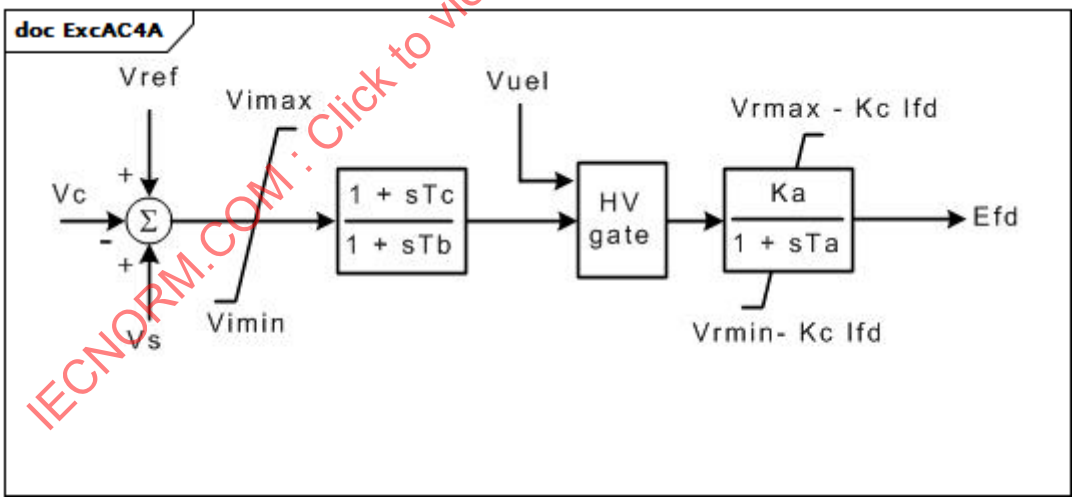

Figure 94 – ExcAC4A

Figure 94: This diagram describes the ExcAC4A excitation system model.

Table 154 shows all attributes of ExcAC4A.

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Table 154 – Attributes of ExcitationSystemDynamics::ExcAC4A

name	mult	type	description
vimax	0..1	PU	Maximum voltage regulator input limit (Vimax) (> 0). Typical value = 10.
vimin	0..1	PU	Minimum voltage regulator input limit (Vimin) (< 0). Typical value = -10.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 1.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 10.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 200.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,015.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 5,64.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -4,53.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 155 shows all association ends of ExcAC4A with other classes.

Table 155 – Association ends of ExcitationSystemDynamics::ExcAC4A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.26 ExcAC5A

Modified IEEE AC5A alternator-supplied rectifier excitation system with different minimum controller output.

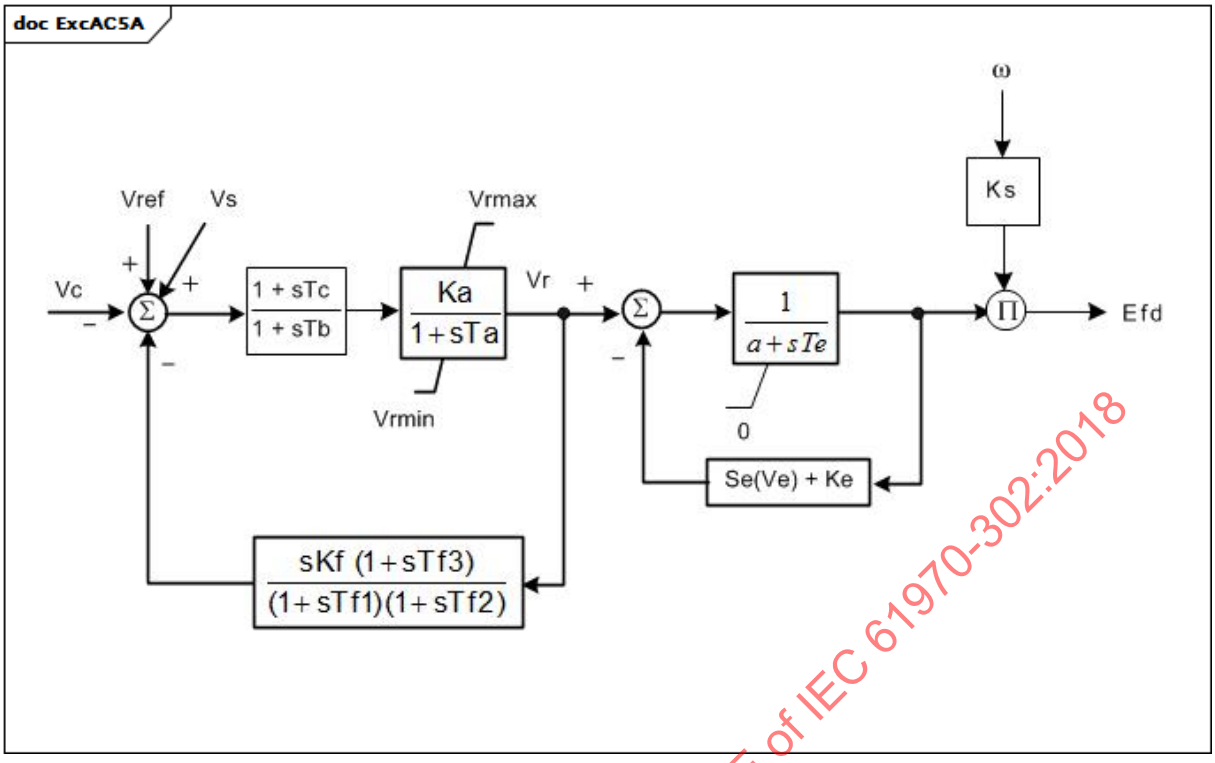

Figure 95 – ExcAC5A

Figure 95: This diagram describes the ExcAC5A excitation system model.

Parameter details:

1) If Ks is set to 1, the output (Efd) is multiplied by generator speed.

Table 156 shows all attributes of ExcAC5A.

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Table 156 – Attributes of ExcitationSystemDynamics::ExcAC5A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 400.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 7,3.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value =-7,3.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 0,8.
kf	0..1	PU	Excitation control system stabilizer gains (Kf) (>= 0). Typical value = 0,03.
tf1	0..1	Seconds	Excitation control system stabilizer time constant (Tf1) (> 0). Typical value = 1.
tf2	0..1	Seconds	Excitation control system stabilizer time constant (Tf2) (>= 0). Typical value = 0,8.
tf3	0..1	Seconds	Excitation control system stabilizer time constant (Tf3) (>= 0). Typical value = 0.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd1) (> 0). Typical value = 5,6.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd1 (Se[Efd1]) (>= 0). Typical value = 0,86.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd2) (> 0). Typical value = 4,2.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd2 (Se[Efd2]) (>= 0). Typical value = 0,5.
a	0..1	Float	Coefficient to allow different usage of the model (a). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 157 shows all association ends of ExcAC5A with other classes.

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Table 157 – Association ends of ExcitationSystemDynamics::ExcAC5A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.27 ExcAC6A

Modified IEEE AC6A alternator-supplied rectifier excitation system with speed input.

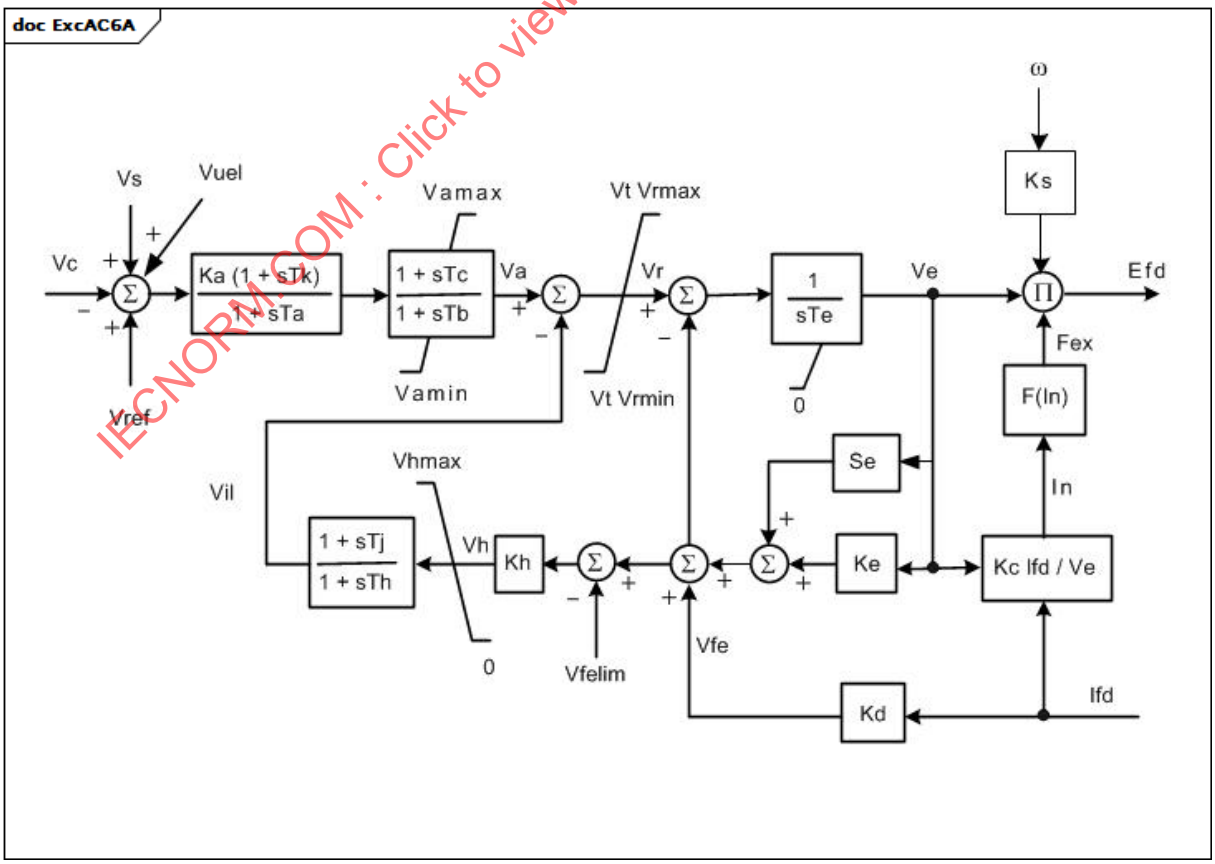

Figure 96 – ExcAC6A

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Figure 96: This diagram describes the ExcAC6A excitation system model.

Parameter details:

1) If Ks is set to 1 the output (Efd) is multiplied by generator speed.

Table 158 shows all attributes of ExcAC6A.

Table 158 – Attributes of ExcitationSystemDynamics::ExcAC6A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 536.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (>= 0). Typical value = 0,086.
tk	0..1	Seconds	Voltage regulator time constant (Tk) (>= 0). Typical value = 0,18.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 9.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 3.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 75.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -75.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 44.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -36.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1.
kh	0..1	PU	Exciter field current limiter gain (Kh) (>= 0). Typical value = 92.
tj	0..1	Seconds	Exciter field current limiter time constant (Tj) (>= 0). Typical value = 0,02.
th	0..1	Seconds	Exciter field current limiter time constant (Th) (> 0). Typical value = 0,08.
vfelim	0..1	PU	Exciter field current limit reference (Vfelim) (> 0). Typical value = 19.
vhmax	0..1	PU	Maximum field current limiter signal reference (Vhmax) (> 0). Typical value = 75.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,173.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (Kd) (>= 0). Typical value = 1,91.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1,6.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 7,4.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 0,214.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 5,55.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 0,044.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 159 shows all association ends of ExcAC6A with other classes.

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Table 159 – Association ends of ExcitationSystemDynamics::ExcAC6A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.28 ExcAC8B

Modified IEEE AC8B alternator-supplied rectifier excitation system with speed input and input limiter.

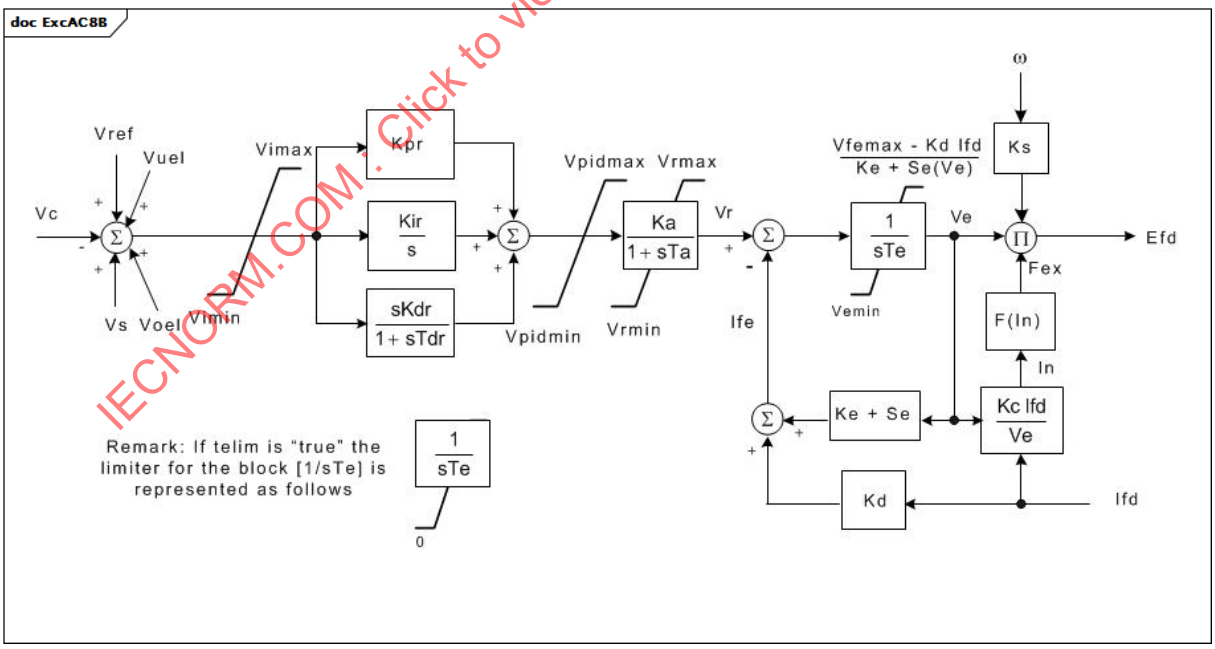

Figure 97 – ExcAC8B

Figure 97: This diagram describes the ExcAC8A excitation system model.

Parameter details:

1) The upper limit on Ve represents the effect of the field current limiter. If Vfemax is zero, this limit will not be enforced.
2) The non-windup limits are defined as in Annex E of the IEEE 421.5-2005.
3) If Ks is set to 1, the output (Efd) is multiplied by generator speed.

Table 160 shows all attributes of ExcAC8B.

Table 160 – Attributes of ExcitationSystemDynamics::ExcAC8B

name	mult	type	description
inlim	0..1	Boolean	Input limiter indicator. true = input limiter Vimax and Vimin is considered false = input limiter Vimax and Vimin is not considered. Typical value = true.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 1.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,55.
kd	0..1	PU	Demagnetizing factor, a function of exciter alternator reactances (Kd) (>= 0). Typical value = 1,1.
kdr	0..1	PU	Voltage regulator derivative gain (Kdr) (>= 0). Typical value = 10.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
kir	0..1	PU	Voltage regulator integral gain (Kir) (>= 0). Typical value = 5.
kpr	0..1	PU	Voltage regulator proportional gain (Kpr) (> 0 if ExcAC8B.kir = 0). Typical value = 80.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
pidlim	0..1	Boolean	PID limiter indicator. true = input limiter Vpidmax and Vpidmin is considered false = input limiter Vpidmax and Vpidmin is not considered. Typical value = true.
seve1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 0,3.
seve2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 3.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (>= 0). Typical value = 0.
tdr	0..1	Seconds	Lag time constant (Tdr) (> 0 if ExcAC8B.kdr > 0). Typical value = 0,1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1,2.
telim	0..1	Boolean	Selector for the limiter on the block (1/sTe). See diagram for meaning of true and false. Typical value = false.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 6,5.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 9.
vemin	0..1	PU	Minimum exciter voltage output (Vemin) (<= 0). Typical value = 0.
vfemax	0..1	PU	Exciter field current limit reference (Vfemax). Typical value = 6.
vimax	0..1	PU	Input signal maximum (Vimax) (> ExcAC8B.vimin). Typical value = 35.
vimin	0..1	PU	Input signal minimum (Vimin) (< ExcAC8B.vimax). Typical value = -10.
vpidmax	0..1	PU	PID maximum controller output (Vpidmax) (> ExcAC8B.vpidmin). Typical value = 35.
vpidmin	0..1	PU	PID minimum controller output (Vpidmin) (< ExcAC8B.vpidmax). Typical value = -10.

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name	mult	type	description
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 35.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = 0.
vtmult	0..1	Boolean	Multiply by generator's terminal voltage indicator. true =the limits Vrmax and Vrmin are multiplied by the generator's terminal voltage to represent a thyristor power stage fed from the generator terminals false = limits are not multiplied by generator's terminal voltage. Typical value = false.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 161 shows all association ends of ExcAC8B with other classes.

Table 161 – Association ends of ExcitationSystemDynamics::ExcAC8B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.29 ExcANS

Italian excitation system. It represents static field voltage or excitation current feedback excitation system.

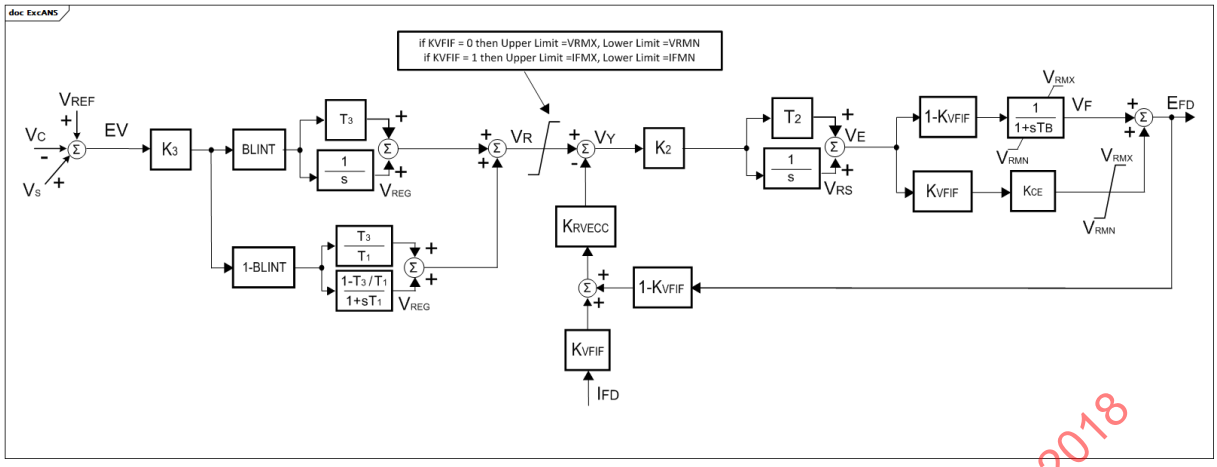

Figure 98 – ExcANS

Figure 98: This diagram describes the ExcANS excitation system model.

Parameter details:

1) Limits on VR signal are modelled as follows:
   – If KVFIF = 0, then upper limit = VRMX and lower limit = VRMN;
   – If KVFIF = 1 ,then upper limit = IFMX and lower limit = IFMN.

Table 162 shows all attributes of ExcANS.

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Table 162 – Attributes of ExcitationSystemDynamics::ExcANS

name	mult	type	description
blint	0..1	Integer	Governor control flag (BLINT). 0 = lead-lag regulator 1 = proportional integral regulator. Typical value = 0.
ifmn	0..1	PU	Minimum exciter current (IFMN). Typical value = -5,2.
ifmx	0..1	PU	Maximum exciter current (IFMX). Typical value = 6,5.
k2	0..1	Float	Exciter gain (K2). Typical value = 20.
k3	0..1	Float	AVR gain (K3). Typical value = 1000.
kce	0..1	Float	Ceiling factor (KCE). Typical value = 1.
krvecc	0..1	Integer	Feedback enabling (KRVECC). 0 = open loop control 1 = closed loop control. Typical value = 1.
kvfif	0..1	Integer	Rate feedback signal flag (KVFIF). 0 = output voltage of the exciter 1 = exciter field current. Typical value = 0.
t1	0..1	Seconds	Time constant (T1) (>= 0). Typical value = 20.
t2	0..1	Seconds	Time constant (T2) (>= 0). Typical value = 0,05.
t3	0..1	Seconds	Time constant (T3) (>= 0). Typical value = 1,6.
tb	0..1	Seconds	Exciter time constant (TB) (>= 0). Typical value = 0,04.
vrmn	0..1	PU	Minimum AVR output (VRMN). Typical value = -5,2.
vrmx	0..1	PU	Maximum AVR output (VRMX). Typical value = 6,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 163 shows all association ends of ExcANS with other classes.

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Table 163 – Association ends of ExcitationSystemDynamics::ExcANS with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.30 ExcAVR1

Italian excitation system corresponding to IEEE (1968) type 1 model. It represents an exciter dynamo and electromechanical regulator.

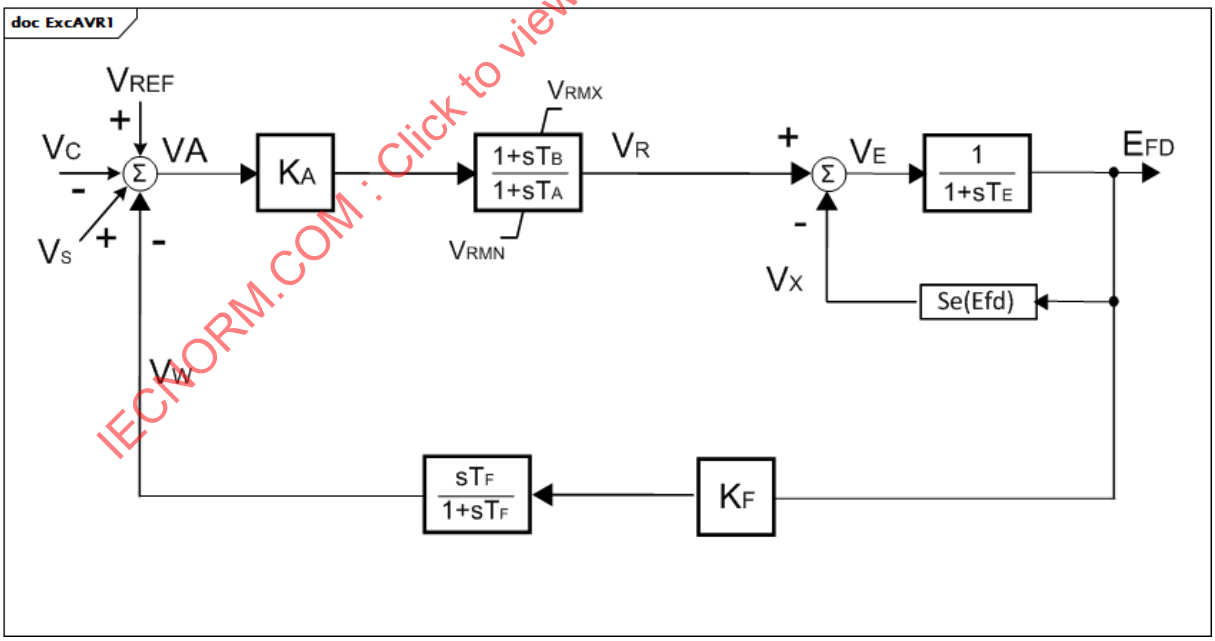

Figure 99 – ExcAVR1

Figure 99: This diagram describes the ExcAVR1 excitation system model.

Table 164 shows all attributes of ExcAVR1.

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Table 164 – Attributes of ExcitationSystemDynamics::ExcAVR1

name	mult	type	description
ka	0..1	Float	AVR gain (KA). Typical value = 500.
vrmn	0..1	PU	Minimum AVR output (VRMN). Typical value = -6.
vrmx	0..1	PU	Maximum AVR output (VRMX). Typical value = 7.
ta	0..1	Seconds	AVR time constant (TA) (>= 0). Typical value = 0,2.
tb	0..1	Seconds	AVR time constant (TB) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant (TE) (>= 0). Typical value = 1.
e1	0..1	PU	Field voltage value 1 (E1). Typical value = 4.18.
se1	0..1	Float	Saturation factor at E1 (S[E1]). Typical value = 0,1.
e2	0..1	PU	Field voltage value 2 (E2). Typical value = 3,14.
se2	0..1	Float	Saturation factor at E2 (S[E2]). Typical value = 0,03.
kf	0..1	Float	Rate feedback gain (KF). Typical value = 0,12.
tf	0..1	Seconds	Rate feedback time constant (TF) (>= 0). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 165 shows all association ends of ExcAVR1 with other classes.

Table 165 – Association ends of ExcitationSystemDynamics::ExcAVR1 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.31 ExcAVR2

Italian excitation system corresponding to IEEE (1968) type 2 model. It represents an alternator and rotating diodes and electromechanic voltage regulators.

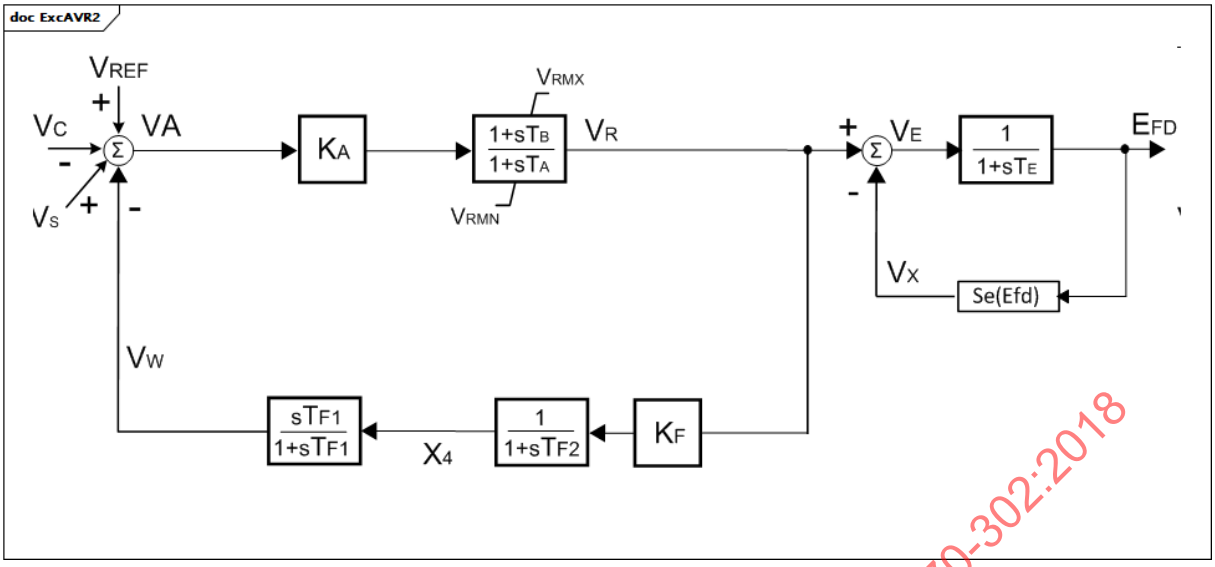

Figure 100 – ExcAVR2

Figure 100: This diagram describes the ExcAVR2 excitation system model.

Table 166 shows all attributes of ExcAVR2.

Table 166 – Attributes of ExcitationSystemDynamics::ExcAVR2

name	mult	type	description
ka	0..1	Float	AVR gain (KA). Typical value = 500.
vrmn	0..1	PU	Minimum AVR output (VRMN). Typical value = -6.
vrmx	0..1	PU	Maximum AVR output (VRMX). Typical value = 7.
ta	0..1	Seconds	AVR time constant (TA) (>= 0). Typical value = 0,02.
tb	0..1	Seconds	AVR time constant (TB) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant (TE) (>= 0). Typical value = 1.
e1	0..1	PU	Field voltage value 1 (E1). Typical value = 4,18.
se1	0..1	Float	Saturation factor at E1 (S[E1]). Typical value = 0.1.
e2	0..1	PU	Field voltage value 2 (E2). Typical value = 3,14.
se2	0..1	Float	Saturation factor at E2 (S[E2]). Typical value = 0,03.
kf	0..1	Float	Rate feedback gain (KF). Typical value = 0,12.
tf1	0..1	Seconds	Rate feedback time constant (TF1) (>= 0). Typical value = 1.
tf2	0..1	Seconds	Rate feedback time constant (TF2) (>= 0). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 167 shows all association ends of ExcAVR2 with other classes.

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Table 167 – Association ends of ExcitationSystemDynamics::ExcAVR2 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.32 ExcAVR3

Italian excitation system. It represents an exciter dynamo and electric regulator.

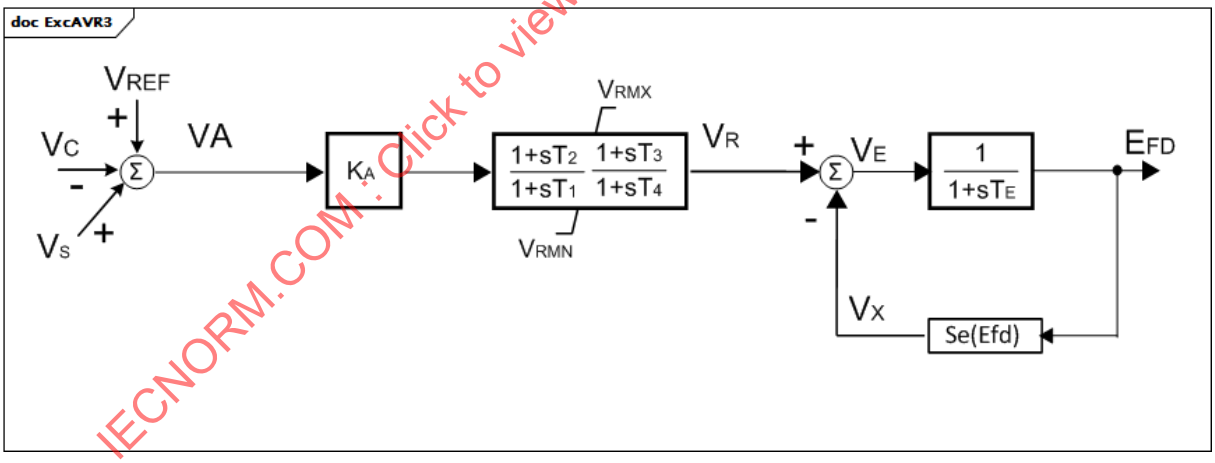

Figure 101 – ExcAVR3

Figure 101: This diagram describes the ExcAVR3 excitation system model.

Parameter details:

1) The non-windup limit is defined as in Annex E of the IEEE 421.5-2005.

Table 168 shows all attributes of ExcAVR3.

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Table 168 – Attributes of ExcitationSystemDynamics::ExcAVR3

name	mult	type	description
ka	0..1	Float	AVR gain (KA). Typical value = 100.
vrmn	0..1	PU	Minimum AVR output (VRMN). Typical value = -7,5.
vrmx	0..1	PU	Maximum AVR output (VRMX). Typical value = 7,5.
t1	0..1	Seconds	AVR time constant (T1) (>= 0). Typical value = 20.
t2	0..1	Seconds	AVR time constant (T2) (>= 0). Typical value = 1,6.
t3	0..1	Seconds	AVR time constant (T3) (>= 0). Typical value = 0,66.
t4	0..1	Seconds	AVR time constant (T4) (>= 0). Typical value = 0,07.
te	0..1	Seconds	Exciter time constant (TE) (>= 0). Typical value = 1.
e1	0..1	PU	Field voltage value 1 (E1). Typical value = 4,18.
se1	0..1	Float	Saturation factor at E1 (S[E1]). Typical value = 0,1.
e2	0..1	PU	Field voltage value 2 (E2). Typical value = 3,14.
se2	0..1	Float	Saturation factor at E2 (S[E2]). Typical value = 0,03.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 169 shows all association ends of ExcAVR3 with other classes.

Table 169 – Association ends of ExcitationSystemDynamics::ExcAVR3 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.33 ExcAVR4

Italian excitation system. It represents a static exciter and electric voltage regulator.

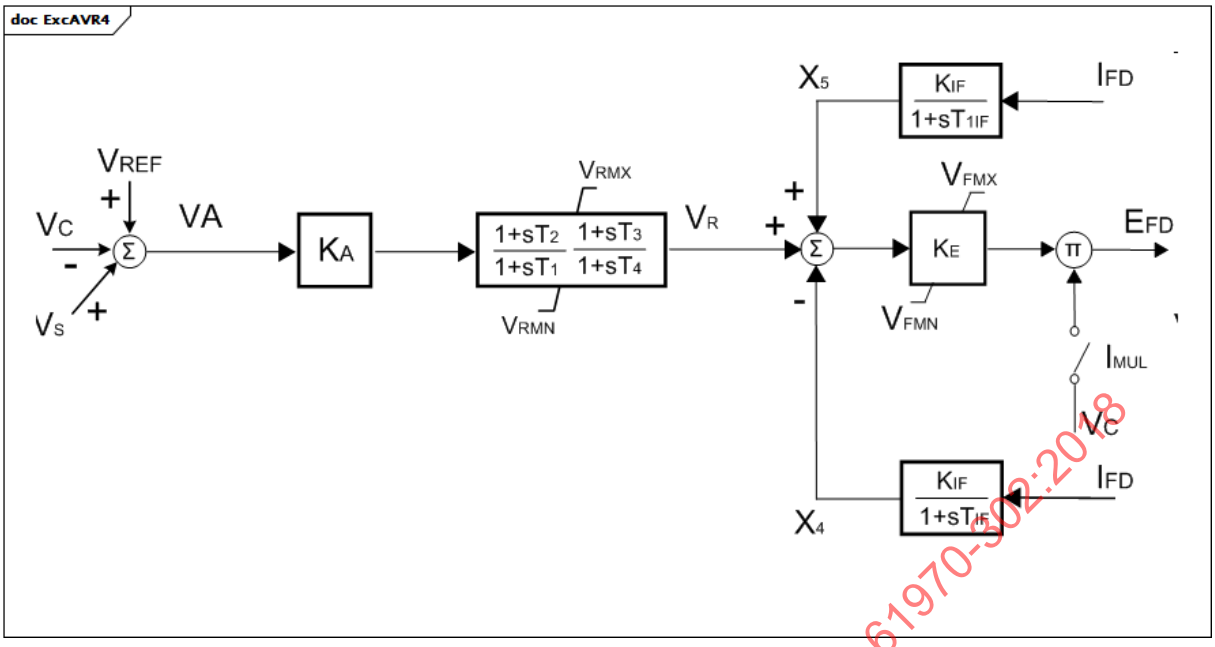

Figure 102 – ExcAVR4

Figure 102: This diagram describes the ExcAVR4 excitation system model.

Table 170 shows all attributes of ExcAVR4.

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Table 170 – Attributes of ExcitationSystemDynamics::ExcAVR4

name	mult	type	description
ka	0..1	Float	AVR gain (KA). Typical value = 300.
vrmn	0..1	PU	Minimum AVR output (VRMN). Typical value = 0.
vrmx	0..1	PU	Maximum AVR output (VRMX). Typical value = 5.
t1	0..1	Seconds	AVR time constant (T1) (>= 0). Typical value = 4,8.
t2	0..1	Seconds	AVR time constant (T2) (>= 0). Typical value = 1,5.
t3	0..1	Seconds	AVR time constant (T3) (>= 0). Typical value = 0.
t4	0..1	Seconds	AVR time constant (T4) (>= 0). Typical value = 0.
ke	0..1	Float	Exciter gain (KE). Typical value = 1.
vfmx	0..1	PU	Maximum exciter output (VFMX). Typical value = 5.
vfmn	0..1	PU	Minimum exciter output (VFMN). Typical value = 0.
kif	0..1	Float	Exciter internal reactance (KIF). Typical value = 0.
tif	0..1	Seconds	Exciter current feedback time constant (TIF) (>= 0). Typical value = 0.
t1if	0..1	Seconds	Exciter current feedback time constant (T1IF) (>= 0). Typical value = 60.
imul	0..1	Boolean	AVR output voltage dependency selector (IMUL). true = selector is connected false = selector is not connected. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 171 shows all association ends of ExcAVR4 with other classes.

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Table 171 – Association ends of ExcitationSystemDynamics::ExcAVR4 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.34 ExcAVR5

Manual excitation control with field circuit resistance. This model can be used as a very simple representation of manual voltage control.

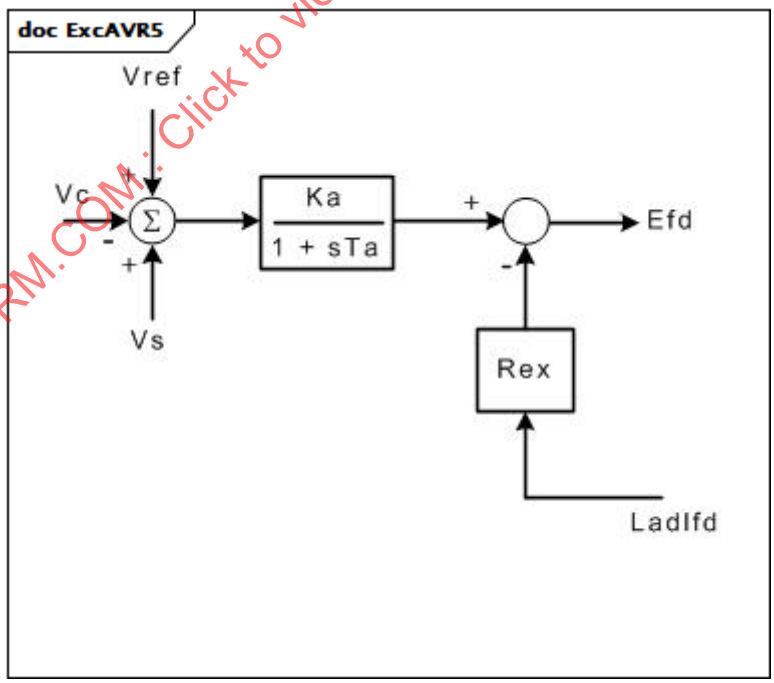

Figure 103 – ExcAVR5

Figure 103: This diagram describes the ExcAVR5 excitation system model.

Table 172 shows all attributes of ExcAVR5.

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Table 172 – Attributes of ExcitationSystemDynamics::ExcAVR5

name	mult	type	description
ka	0..1	PU	Gain (Ka).
ta	0..1	Seconds	Time constant (Ta) (>= 0).
rex	0..1	PU	Effective output resistance (Rex). Rex represents the effective output resistance seen by the excitation system.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 173 shows all association ends of ExcAVR5 with other classes.

Table 173 – Association ends of ExcitationSystemDynamics::ExcAVR5 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.35 ExcAVR7

IVO excitation system.

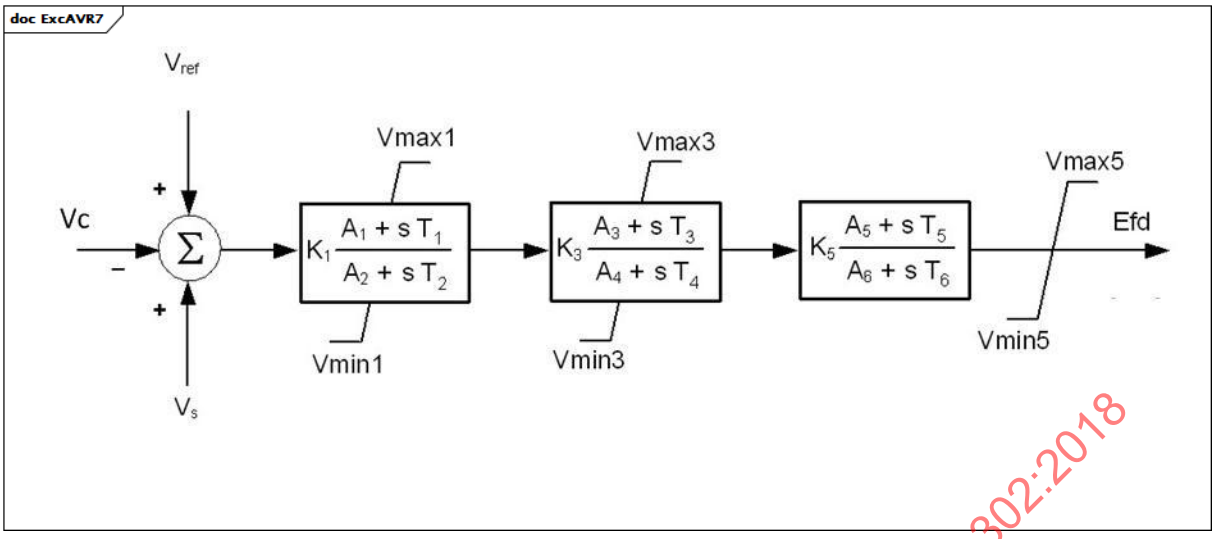

Figure 104 – ExcAVR7

Figure 104: This diagram describes the ExcAVR7 excitation system model.

Table 174 shows all attributes of ExcAVR7.

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Table 174 – Attributes of ExcitationSystemDynamics::ExcAVR7

name	mult	type	description
k1	0..1	PU	Gain (K1). Typical value = 1.
a1	0..1	PU	Lead coefficient (A1). Typical value = 0,5.
a2	0..1	PU	Lag coefficient (A2). Typical value = 0,5.
t1	0..1	Seconds	Lead time constant (T1) (>= 0). Typical value = 0,05.
t2	0..1	Seconds	Lag time constant (T2) (>= 0). Typical value = 0,1.
vmax1	0..1	PU	Lead-lag maximum limit (Vmax1) (> ExcAVR7.vmin1). Typical value = 5.
vmin1	0..1	PU	Lead-lag minimum limit (Vmin1) (< ExcAVR7.vmax1). Typical value = -5.
k3	0..1	PU	Gain (K3). Typical value = 3.
a3	0..1	PU	Lead coefficient (A3). Typical value = 0,5.
a4	0..1	PU	Lag coefficient (A4). Typical value = 0,5.
t3	0..1	Seconds	Lead time constant (T3) (>= 0). Typical value = 0,1.
t4	0..1	Seconds	Lag time constant (T4) (>= 0). Typical value = 0,1.
vmax3	0..1	PU	Lead-lag maximum limit (Vmax3) (> ExcAVR7.vmin3). Typical value = 5.
vmin3	0..1	PU	Lead-lag minimum limit (Vmin3) (< ExcAVR7.vmax3). Typical value = -5.
k5	0..1	PU	Gain (K5). Typical value = 1.
a5	0..1	PU	Lead coefficient (A5). Typical value = 0,5.
a6	0..1	PU	Lag coefficient (A6). Typical value = 0,5.
t5	0..1	Seconds	Lead time constant (T5) (>= 0). Typical value = 0,1.
t6	0..1	Seconds	Lag time constant (T6) (>= 0). Typical value = 0,1.
vmax5	0..1	PU	Lead-lag maximum limit (Vmax5) (> ExcAVR7.vmin5). Typical value = 5.
vmin5	0..1	PU	Lead-lag minimum limit (Vmin5) (< ExcAVR7.vmax5). Typical value = -2.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 175 shows all association ends of ExcAVR7 with other classes.

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Table 175 – Association ends of ExcitationSystemDynamics::ExcAVR7 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.36 ExcBBC

Transformer fed static excitation system (static with ABB regulator). This model represents a static excitation system in which a gated thyristor bridge fed by a transformer at the main generator terminals feeds the main generator directly.

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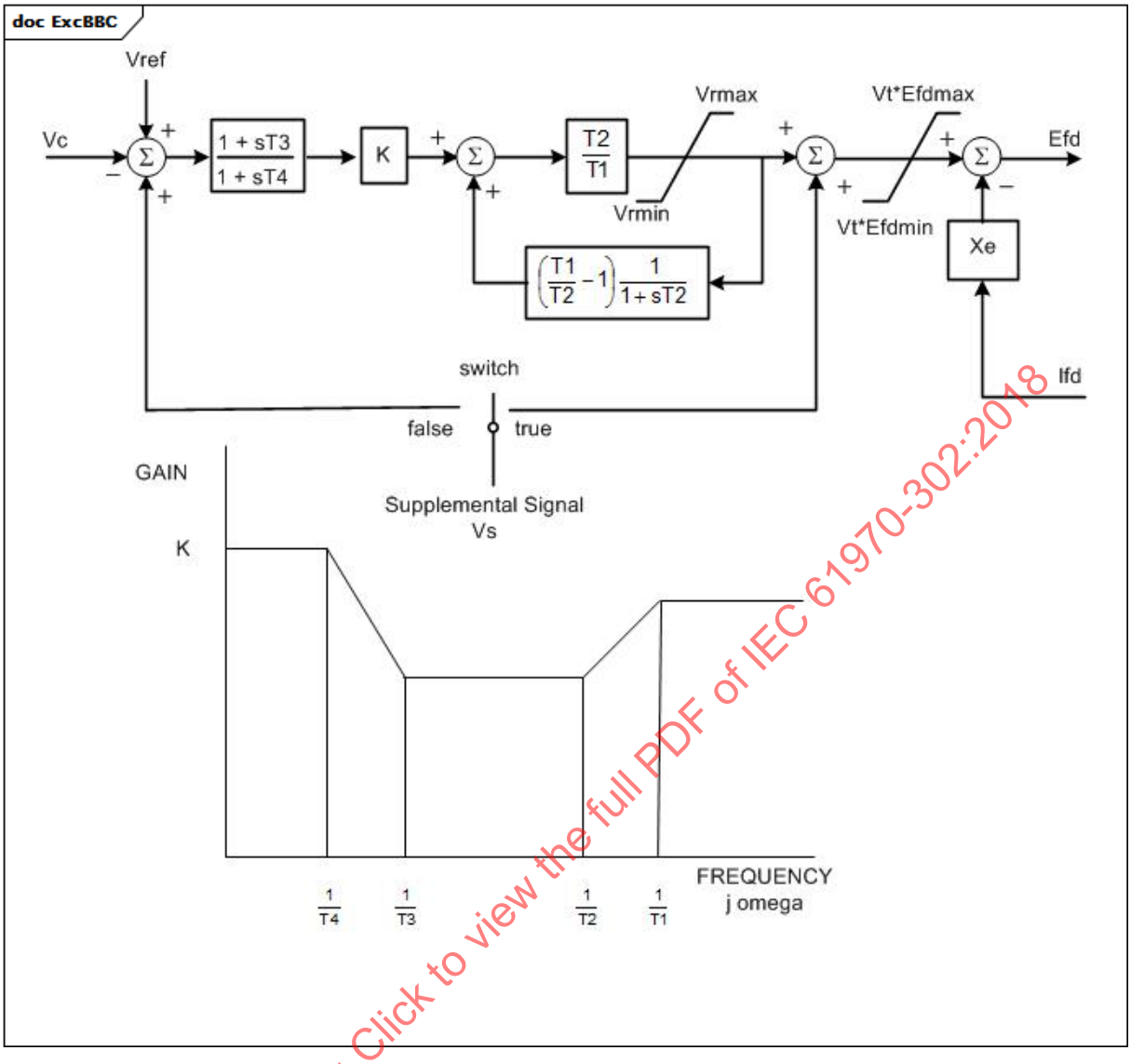

Figure 105 – ExcBBC

Figure 105: This diagram describes the ExcBBC excitation system model.

Table 176 shows all attributes of ExcBBC.

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Table 176 – Attributes of ExcitationSystemDynamics::ExcBBC

name	mult	type	description
t1	0..1	Seconds	Controller time constant (T1) (>= 0). Typical value = 6.
t2	0..1	Seconds	Controller time constant (T2) (>= 0). Typical value = 1.
t3	0..1	Seconds	Lead/lag time constant (T3) (>= 0). If = 0, block is bypassed. Typical value = 0,05.
t4	0..1	Seconds	Lead/lag time constant (T4) (>= 0). If = 0, block is bypassed. Typical value = 0,01.
k	0..1	PU	Steady state gain (K) (not = 0). Typical value = 300.
vrmin	0..1	PU	Minimum control element output (Vrmin) (< ExcBBC.vrmax). Typical value = -5.
vrmax	0..1	PU	Maximum control element output (Vrmax) (> ExcBBC.vrmin). Typical value = 5.
efdmin	0..1	PU	Minimum open circuit exciter voltage (Efdmin) (< ExcBBC.efdmax). Typical value = -5.
efdmax	0..1	PU	Maximum open circuit exciter voltage (Efdmax) (> ExcBBC.efdmin). Typical value = 5.
xe	0..1	PU	Effective excitation transformer reactance (Xe) (>= 0). Xe models the regulation of the transformer/rectifier unit. Typical value = 0,05.
switch	0..1	Boolean	Supplementary signal routing selector (switch). true = Vs connected to 3rd summing point false = Vs connected to 1st summing point (see diagram). Typical value = false.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 177 shows all association ends of ExcBBC with other classes.

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Table 177 – Association ends of ExcitationSystemDynamics::ExcBBC with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.37 ExcCZ

Czech proportion/integral exciter.

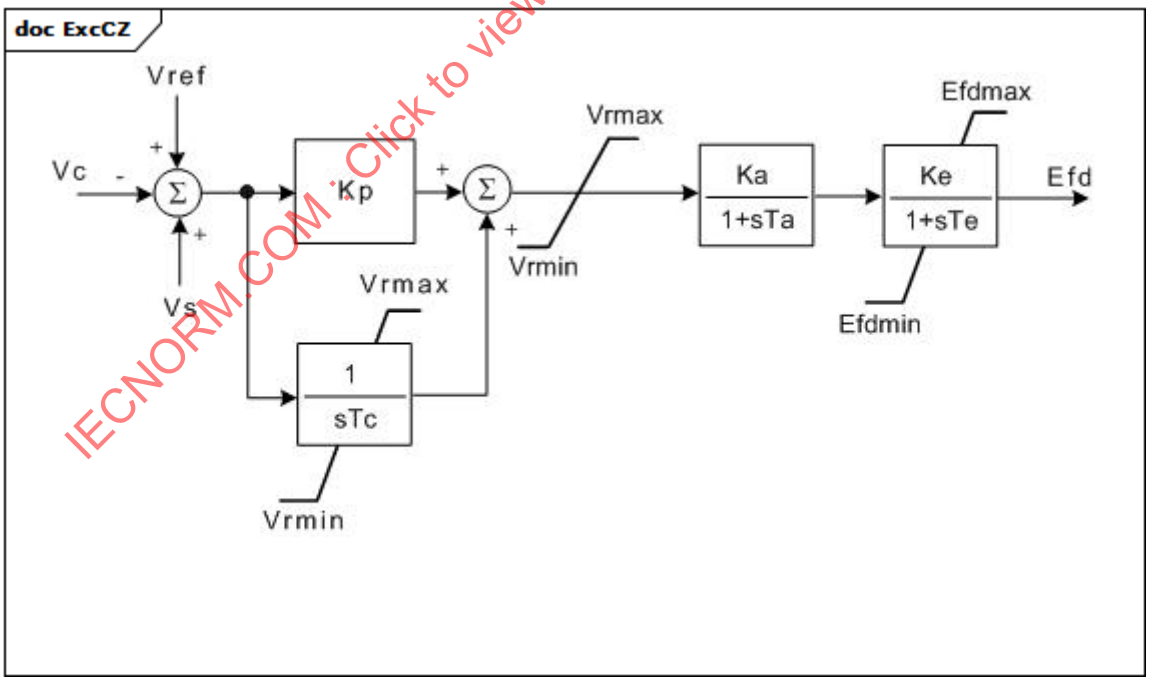

Figure 106 – ExcCZ

Figure 106: This diagram describes the ExcCZ excitation system model.

Table 178 shows all attributes of ExcCZ.

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Table 178 – Attributes of ExcitationSystemDynamics::ExcCZ

name	mult	type	description
kp	0..1	PU	Regulator proportional gain (Kp).
tc	0..1	Seconds	Regulator integral time constant (Tc) (>= 0).
vrmax	0..1	PU	Voltage regulator maximum limit (Vrmax) (> ExcCZ.vrmin).
vrmin	0..1	PU	Voltage regulator minimum limit (Vrmin) (< ExcCZ.vrmax).
ka	0..1	PU	Regulator gain (Ka).
ta	0..1	Seconds	Regulator time constant (Ta) (>= 0).
ke	0..1	PU	Exciter constant related to self-excited field (Ke).
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (>= 0).
efdmax	0..1	PU	Exciter output maximum limit (Efdmax) (> ExcCZ.efdmin).
efdmin	0..1	PU	Exciter output minimum limit (Efdmin) (< ExcCZ.efdmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 179 shows all association ends of ExcCZ with other classes.

Table 179 – Association ends of ExcitationSystemDynamics::ExcCZ with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.38 ExcDC1A

Modified IEEE DC1A direct current commutator exciter with speed input and without underexcitation limiters (UEL) inputs.

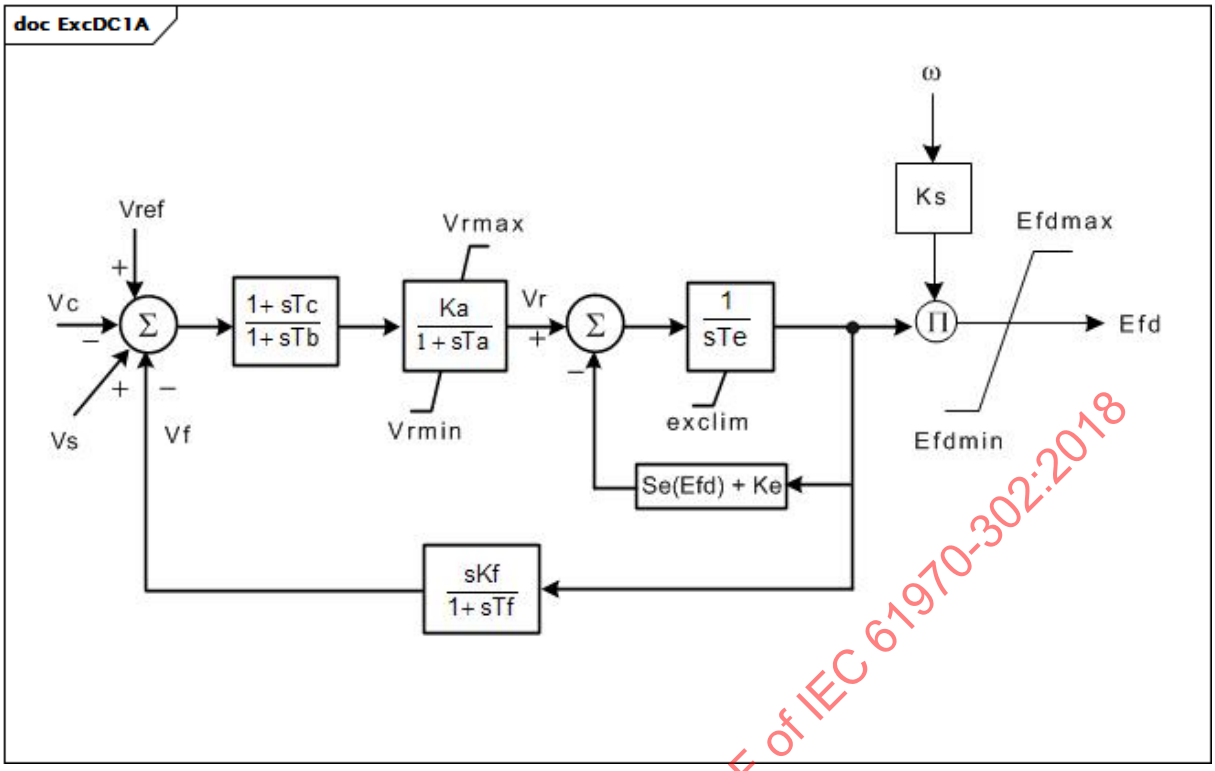

Figure 107 – ExcDC1A

Figure 107: This diagram describes the ExcDC1A excitation system model.

Parameter details:

1) If Ks is set to 1, the output (Efd) is multiplied by generator speed.

Table 180 shows all attributes of ExcDC1A.

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Table 180 – Attributes of ExcitationSystemDynamics::ExcDC1A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 46.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,06.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> ExcDC1A.vrmin). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0 and < ExcDC1A.vrmax). Typical value = -0,9.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 0,46.
kf	0..1	PU	Excitation control system stabilizer gain (Kf) (>= 0). Typical value = 0,1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (> 0). Typical value = 1.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd1) (> 0). Typical value = 3,1.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd1 (Se[Eefd1]) (>= 0). Typical value = 0,33.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd2) (> 0). Typical value = 2,3.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd2 (Se[Eefd2]) (>= 0). Typical value = 0,1.
exclim	0..1	Boolean	(exclim). IEEE standard is ambiguous about lower limit on exciter output. true = a lower limit of zero is applied to integrator output false = a lower limit of zero is not applied to integrator output. Typical value = true.
efdmin	0..1	PU	Minimum voltage exciter output limiter (Efdmin) (< ExcDC1A.edfmax). Typical value = -99.
efdmax	0..1	PU	Maximum voltage exciter output limiter (Efdmax) (> ExcDC1A.efdmin). Typical value = 99.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 181 shows all association ends of ExcDC1A with other classes.

Table 181 – Association ends of ExcitationSystemDynamics::ExcDC1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.39 ExcDC2A

Modified IEEE DC2A direct current commutator exciter with speed input, one more leg block in feedback loop and without underexcitation limiters (UEL) inputs. DC type 2 excitation system model with added speed multiplier, added lead-lag, and voltage-dependent limits.

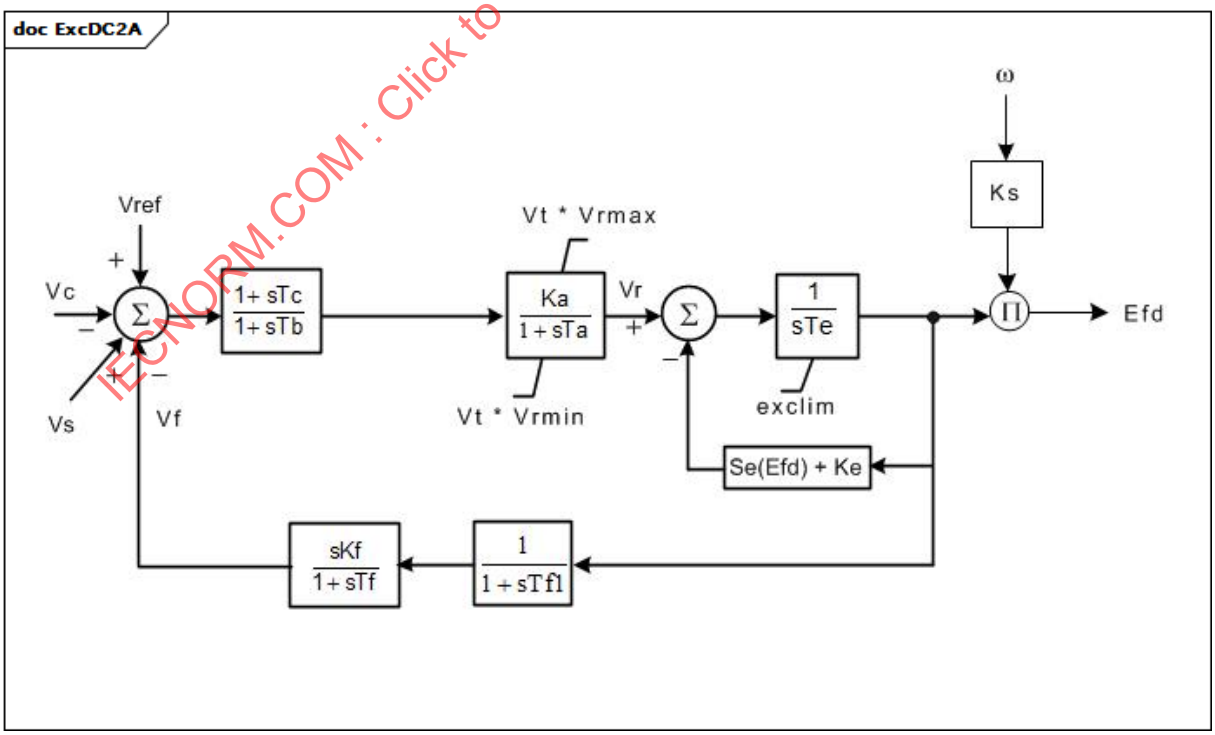

Figure 108 – ExcDC2A

Figure 108: This diagram describes the ExcDC2A excitation system model.

Parameter details:

1) If Ks is set to 1, the output (Efd) is multiplied by generator speed.

Table 182 shows all attributes of ExcDC2A.

Table 182 – Attributes of ExcitationSystemDynamics::ExcDC2A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 300.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,01.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> ExcDC2A.vrmin). Typical value = 4,95.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0 and < ExcDC2A.vrmax). Typical value = -4,9.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). If Ke is entered as zero, the model calculates an effective value of Ke such that the initial condition value of Vr is zero. The zero value of Ke is not changed. If Ke is entered as non-zero, its value is used directly, without change. Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1,33.
kf	0..1	PU	Excitation control system stabilizer gain (Kf) (>= 0). Typical value = 0,1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (> 0). Typical value = 0,675.
tf1	0..1	Seconds	Excitation control system stabilizer time constant (Tf1) (>= 0). Typical value = 0.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd1) (> 0). Typical value = 3,05.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd1 (Se[Efd1]) (>= 0). Typical value = 0,279.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd2) (> 0). Typical value = 2,29.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd2 (Se[Efd2]) (>= 0). Typical value = 0,117.
exclim	0..1	Boolean	(exclim). IEEE standard is ambiguous about lower limit on exciter output. true = a lower limit of zero is applied to integrator output false = a lower limit of zero is not applied to integrator output. Typical value = true.
vtlim	0..1	Boolean	(Vtlim). true = limiter at the block (Ka / [1 + sTa]) is dependent on Vt false = limiter at the block is not dependent on Vt. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 183 shows all association ends of ExcDC2A with other classes.

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Table 183 – Association ends of ExcitationSystemDynamics::ExcDC2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.40 ExcDC3A

Modified IEEE DC3A direct current commutator exciter with speed input, and deadband. DC old type 4.

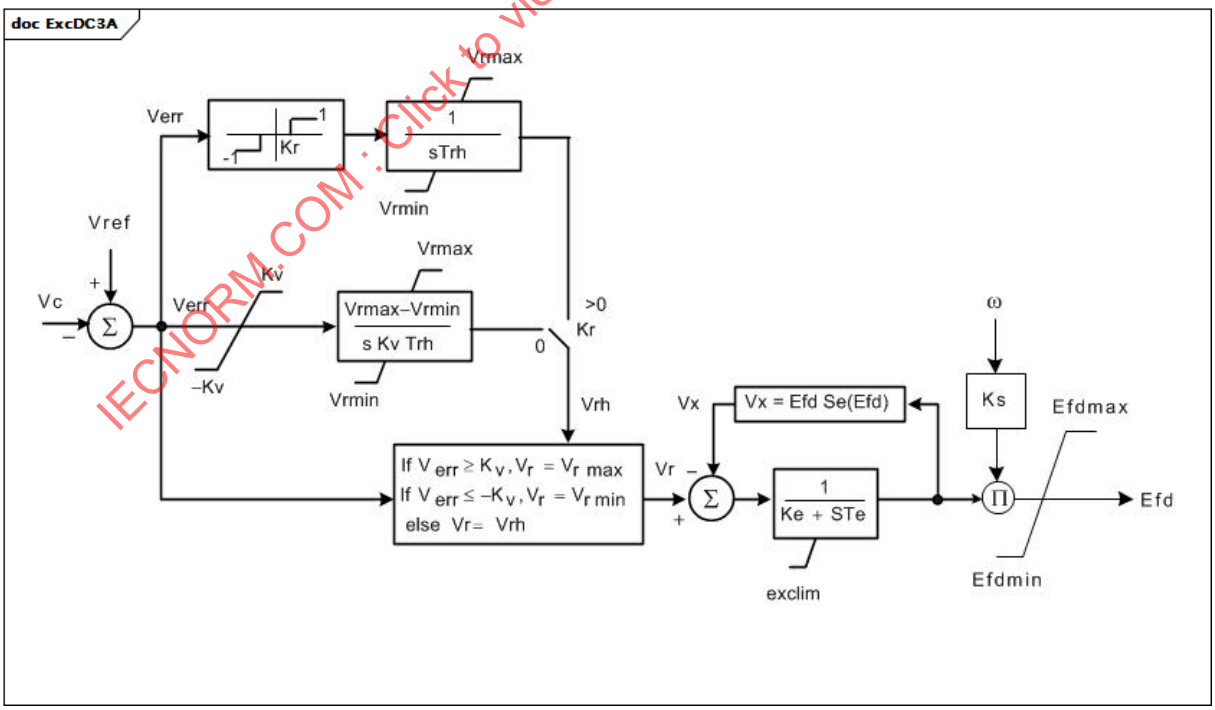

Figure 109 – ExcDC3A

Figure 109: This diagram describes the ExcDC3A excitation system model.

Parameter details:

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1) If Ks is set to 1, the output (Efd) is multiplied by generator speed.
2) If Kr is not zero, the voltage regulator input changes at a constant rate if Verr > Kr or Verr < -Kr as per the IEEE (1968) type 4 model. If Kr is zero, the error signal drives the voltage regulator continuously as per the IEEE (1980) DC3 and IEEE (1992, 2005) DC3A models.

Table 184 shows all attributes of ExcDC3A.

Table 184 – Attributes of ExcitationSystemDynamics::ExcDC3A

name	mult	type	description
trh	0..1	Seconds	Rheostat travel time (Trh) (> 0). Typical value = 20.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
kr	0..1	PU	Deadband (Kr). Typical value = 0.
kv	0..1	PU	Fast raise/lower contact setting (Kv) (> 0). Typical value = 0,05.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 5.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (<= 0). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1,83.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
efd1	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd1) (> 0). Typical value = 2,6.
seefd1	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd1 (Se[Efd1]) (>= 0). Typical value = 0,1.
efd2	0..1	PU	Exciter voltage at which exciter saturation is defined (Efd2) (> 0). Typical value = 3,45.
seefd2	0..1	Float	Exciter saturation function value at the corresponding exciter voltage, Efd2 (Se[Efd2]) (>= 0). Typical value = 0,35.
exclim	0..1	Boolean	(exclim). IEEE standard is ambiguous about lower limit on exciter output. true = a lower limit of zero is applied to integrator output false = a lower limit of zero not applied to integrator output. Typical value = true.
efdmax	0..1	PU	Maximum voltage exciter output limiter (Efdmax) (> ExcDC3A.efdmin). Typical value = 99.
efdmin	0..1	PU	Minimum voltage exciter output limiter (Efdmin) (< ExcDC3A.efdmax). Typical value = -99.
efdlim	0..1	Boolean	(Efdlim). true = exciter output limiter is active false = exciter output limiter not active. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 185 shows all association ends of ExcDC3A with other classes.

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Table 185 – Association ends of ExcitationSystemDynamics::ExcDC3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.41 ExcDC3A1

Modified old IEEE type 3 excitation system.

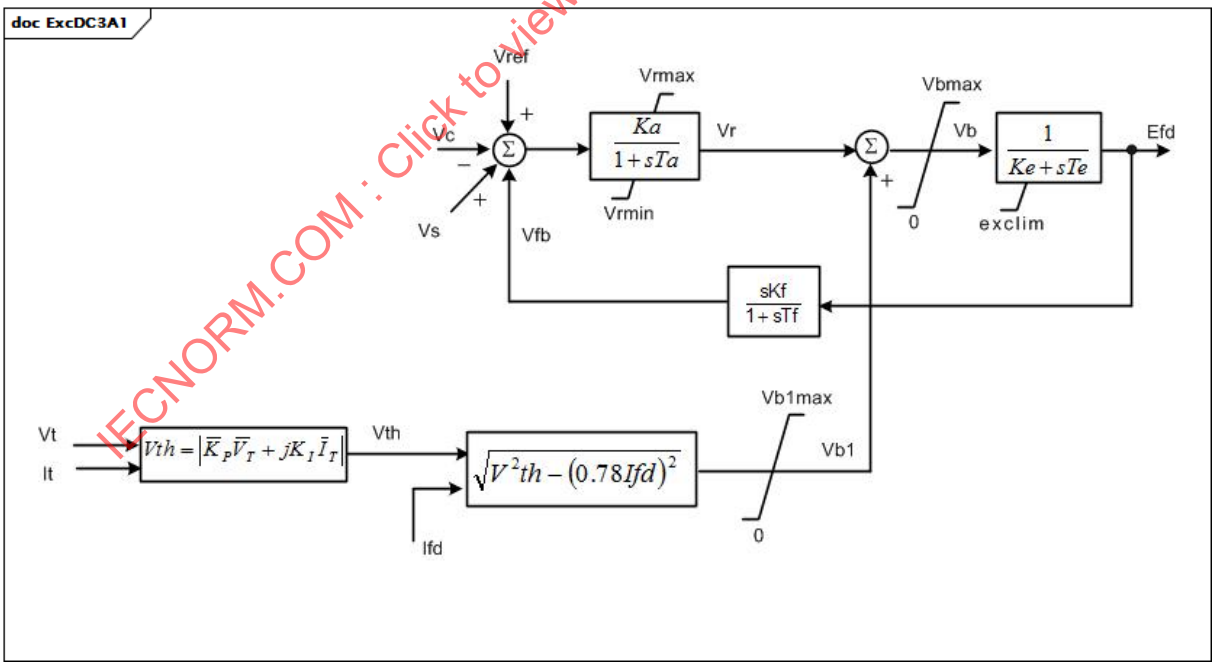

Figure 110 – ExcDC3A1

Figure 110: This diagram describes the ExcDC3A1 excitation system model.

Parameter details:

1) Ifd represents LadIfd (XadIfd) and is a voltage proportional to field current in PU (IEEE 421.5-2005, Annex B). It is equal to Efd in steady-state.

Table 186 shows all attributes of ExcDC3A1.

Table 186 – Attributes of ExcitationSystemDynamics::ExcDC3A1

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 300.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,01.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> ExcDC3A1.vrmin). Typical value = 5.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0 and < ExcDC3A1.vrmax). Typical value = 0.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 1,83.
kf	0..1	PU	Excitation control system stabilizer gain (Kf) (>= 0). Typical value = 0,1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (>= 0). Typical value = 0,675.
kp	0..1	PU	Potential circuit gain coefficient (Kp) (>= 0). Typical value = 4,37.
ki	0..1	PU	Potential circuit gain coefficient (Ki) (>= 0). Typical value = 4,83.
vbmax	0..1	PU	Available exciter voltage limiter (Vbmax) (> 0). Typical value = 11,63.
exclim	0..1	Boolean	(exclim). true = lower limit of zero is applied to integrator output false = lower limit of zero not applied to integrator output. Typical value = true.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
vb1max	0..1	PU	Available exciter voltage limiter (Vb1max) (> 0). Typical value = 11,63.
vblim	0..1	Boolean	Vb limiter indicator. true = exciter Vbmax limiter is active false = Vb1max is active. Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 187 shows all association ends of ExcDC3A1 with other classes.

Table 187 – Association ends of ExcitationSystemDynamics::ExcDC3A1 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.42 ExcELIN1

Static PI transformer fed excitation system ELIN (VATECH) – simplified model. This model represents an all-static excitation system. A PI voltage controller establishes a desired field current set point for a proportional current controller. The integrator of the PI controller has a follow-up input to match its signal to the present field current. A power system stabilizer with power input is included in the model.

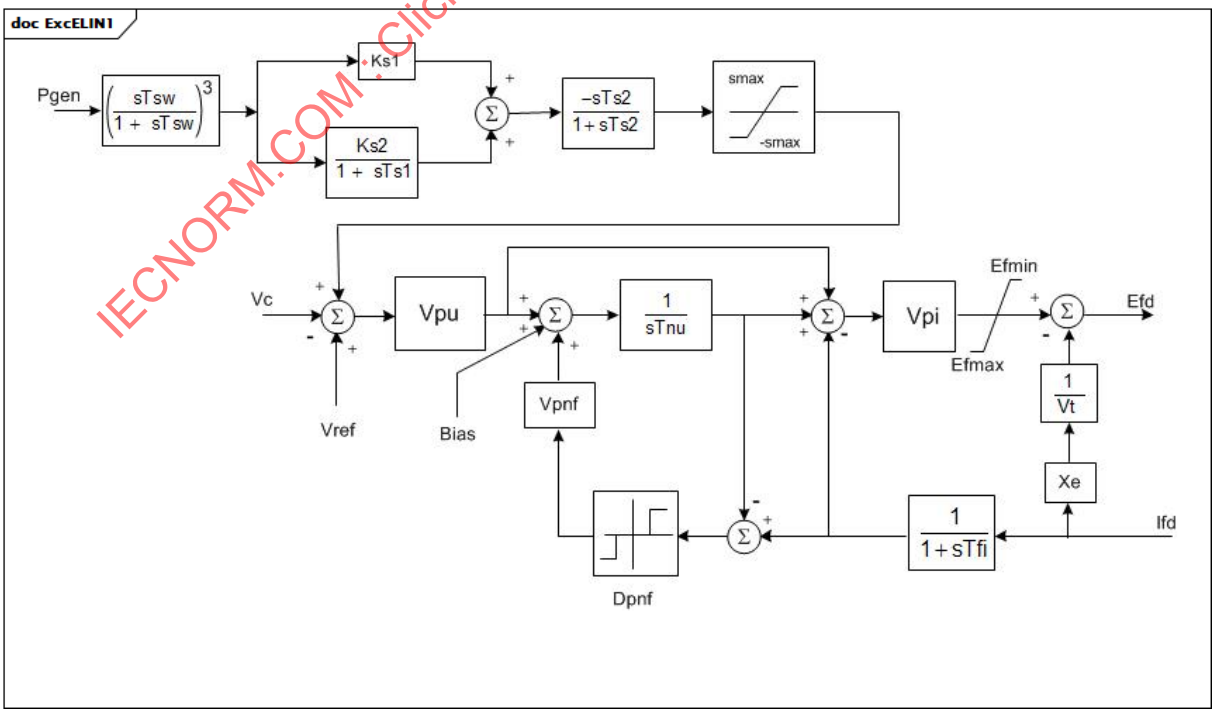

Figure 111 – ExcELIN1

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Figure 111: This diagram describes the ExcELIN1 excitation system model.

Table 188 shows all attributes of ExcELIN1.

Table 188 – Attributes of ExcitationSystemDynamics::ExcELIN1

name	mult	type	description
tfi	0..1	Seconds	Current transducer time constant (Tfi) (>= 0). Typical value = 0.
tnu	0..1	Seconds	Controller reset time constant (Tnu) (>= 0). Typical value = 2.
vpu	0..1	PU	Voltage controller proportional gain (Vpu). Typical value = 34,5.
vpi	0..1	PU	Current controller gain (Vpi). Typical value = 12,45.
vpnf	0..1	PU	Controller follow up gain (Vpnf). Typical value = 2.
dpnf	0..1	PU	Controller follow up deadband (Dpnf). Typical value = 0.
tsw	0..1	Seconds	Stabilizer parameters (Tsw) (>= 0). Typical value = 3.
efmin	0..1	PU	Minimum open circuit excitation voltage (Efmin) (< ExcELIN1.efmax). Typical value = -5.
efmax	0..1	PU	Maximum open circuit excitation voltage (Efmax) (> ExcELIN1.efmin). Typical value = 5.
xe	0..1	PU	Excitation transformer effective reactance (Xe) (>= 0). Xe represents the regulation of the transformer/rectifier unit. Typical value = 0,06.
ks1	0..1	PU	Stabilizer gain 1 (Ks1). Typical value = 0.
ks2	0..1	PU	Stabilizer gain 2 (Ks2). Typical value = 0.
ts1	0..1	Seconds	Stabilizer phase lag time constant (Ts1) (>= 0). Typical value = 1.
ts2	0..1	Seconds	Stabilizer filter time constant (Ts2) (>= 0). Typical value = 1.
smax	0..1	PU	Stabilizer limit output (smax). Typical value = 0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 189 shows all association ends of ExcELIN1 with other classes.

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Table 189 – Association ends of ExcitationSystemDynamics::ExcELIN1 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.43 ExcELIN2

Detailed excitation system ELIN (VATECH). This model represents an all-static excitation system. A PI voltage controller establishes a desired field current set point for a proportional current controller. The integrator of the PI controller has a follow-up input to match its signal to the present field current. Power system stabilizer models used in conjunction with this excitation system model: PssELIN2, PssIEEE2B, Pss2B.

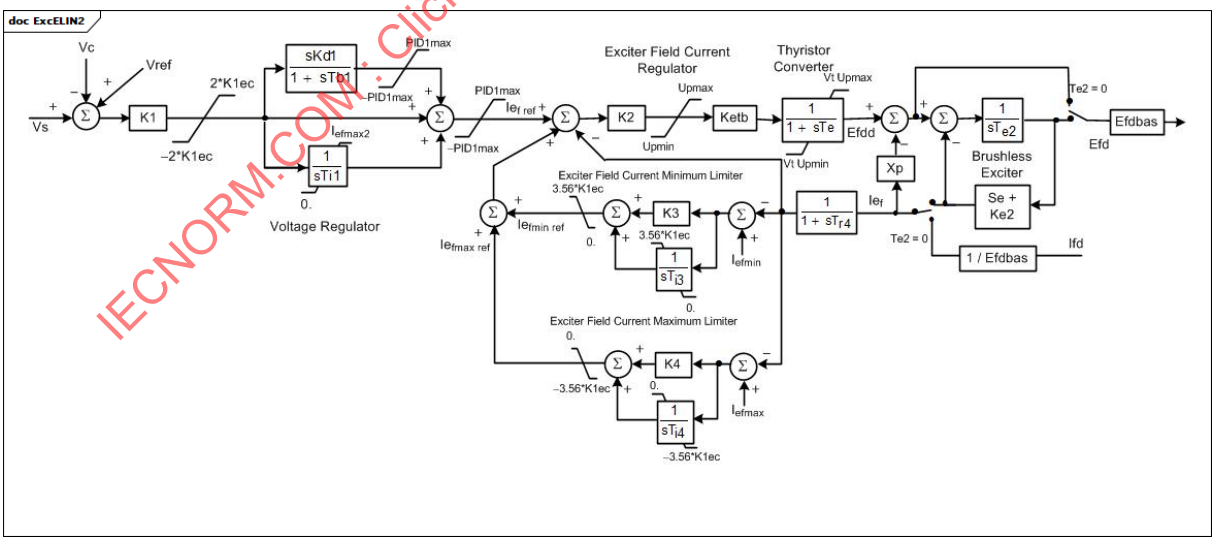

Figure 112 – ExcELIN2

Figure 112: This diagram describes the ExcELIN2 excitation system model.

Table 190 shows all attributes of ExcELIN2.

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Table 190 – Attributes of ExcitationSystemDynamics::ExcELIN2

name	mult	type	description
k1	0..1	PU	Voltage regulator input gain (K1). Typical value = 0.
k1ec	0..1	PU	Voltage regulator input limit (K1ec). Typical value = 2.
kd1	0..1	PU	Voltage controller derivative gain (Kd1). Typical value = 34,5.
tb1	0..1	Seconds	Voltage controller derivative washout time constant (Tb1) (>= 0). Typical value = 12,45.
pid1max	0..1	PU	Controller follow up gain (PID1max). Typical value = 2.
ti1	0..1	PU	Controller follow up deadband (Ti1). Typical value = 0.
iefmax2	0..1	PU	Minimum open circuit excitation voltage (Iefmax2). Typical value = -5.
k2	0..1	PU	Gain (K2). Typical value = 5.
ketb	0..1	PU	Gain (Ketb). Typical value = 0,06.
upmax	0..1	PU	Limiter (Upmax) (> ExcELIN2.upmin). Typical value = 3.
upmin	0..1	PU	Limiter (Upmin) (< ExcELIN2.upmax). Typical value = 0.
te	0..1	Seconds	Time constant (Te) (>= 0). Typical value = 0.
xp	0..1	PU	Excitation transformer effective reactance (Xp). Typical value = 1.
te2	0..1	Seconds	Time Constant (Te2) (>= 0). Typical value = 1.
ke2	0..1	PU	Gain (Ke2). Typical value = 0,1.
ve1	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve1) (> 0). Typical value = 3.
seve1	0..1	PU	Exciter saturation function value at the corresponding exciter voltage, Ve1, back of commutating reactance (Se[Ve1]) (>= 0). Typical value = 0.
ve2	0..1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined (Ve2) (> 0). Typical value = 0.
seve2	0..1	PU	Exciter saturation function value at the corresponding exciter voltage, Ve2, back of commutating reactance (Se[Ve2]) (>= 0). Typical value = 1.
tr4	0..1	Seconds	Time constant (Tr4) (>= 0). Typical value = 1.
k3	0..1	PU	Gain (K3). Typical value = 0,1.
ti3	0..1	Seconds	Time constant (Ti3) (>= 0). Typical value = 3.
k4	0..1	PU	Gain (K4). Typical value = 0.
ti4	0..1	Seconds	Time constant (Ti4) (>= 0). Typical value = 0.
iefmax	0..1	PU	Limiter (Iefmax) (> ExcELIN2.iefmin). Typical value = 1.
iefmin	0..1	PU	Limiter (Iefmin) (< ExcELIN2.iefmax). Typical value = 1.
efdbas	0..1	PU	Gain (Efdbas). Typical value = 0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 191 shows all association ends of ExcELIN2 with other classes.

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Table 191 – Association ends of ExcitationSystemDynamics::ExcELIN2 with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.44 ExcHU

Hungarian excitation system, with built-in voltage transducer.

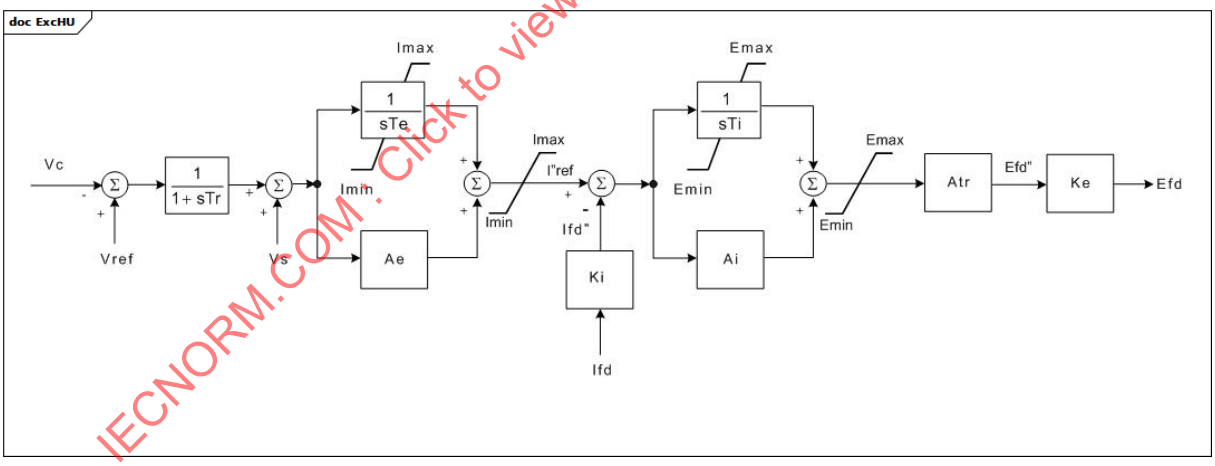

Figure 113 – ExcHU

Figure 113: This diagram describes the ExcHU excitation system model.

Table 192 shows all attributes of ExcHU.

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Table 192 – Attributes of ExcitationSystemDynamics::ExcHU

name	mult	type	description
tr	0..1	Seconds	Filter time constant (Tr) (>= 0). If a voltage compensator is used in conjunction with this excitation system model, Tr should be set to 0. Typical value = 0,01.
te	0..1	Seconds	Major loop PI tag integration time constant (Te) (>= 0). Typical value = 0,154.
imin	0..1	PU	Major loop PI tag output signal lower limit (Imin) (< ExcHU.imax). Typical value = 0,1.
imax	0..1	PU	Major loop PI tag output signal upper limit (Imax) (> ExcHU.imin). Typical value = 2,19.
ae	0..1	PU	Major loop PI tag gain factor (Ae). Typical value = 3.
emin	0..1	PU	Field voltage control signal lower limit on AVR base (Emin) (< ExcHU.emax). Typical value = -0,866.
emax	0..1	PU	Field voltage control signal upper limit on AVR base (Emax) (> ExcHU.emin). Typical value = 0,996.
ki	0..1	Float	Current base conversion constant (Ki). Typical value = 0,21428.
ai	0..1	PU	Minor loop PI tag gain factor (Ai). Typical value = 22.
ti	0..1	Seconds	Minor loop PI control tag integration time constant (Ti) (>= 0). Typical value = 0,01333.
atr	0..1	PU	AVR constant (Atr). Typical value = 2,19.
ke	0..1	Float	Voltage base conversion constant (Ke). Typical value = 4,666.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 193 shows all association ends of ExcHU with other classes.

Table 193 – Association ends of ExcitationSystemDynamics::ExcHU with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.45 ExcNI

Bus or solid fed SCR (silicon-controlled rectifier) bridge excitation system model type NI (NVE).

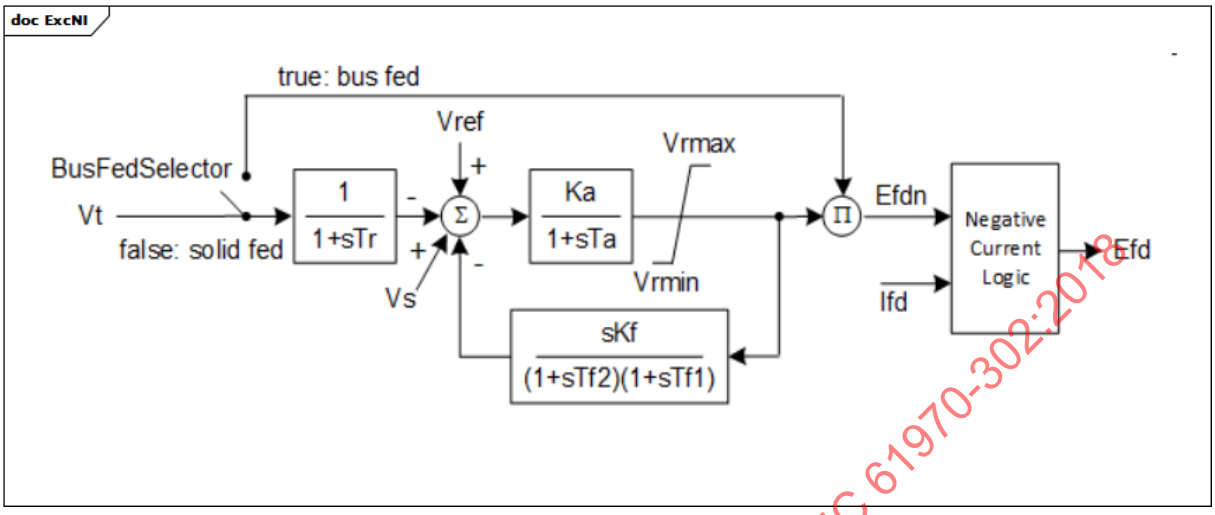

Figure 114 – ExcNI

Figure 114: This diagram describes the ExcNI excitation system model.

Parameter details:

1) R shall either be = 0 (meaning the exciter has negative current capability) or > 0 (meaning the exciter has no negative current capability).
2) The 'Negative Current Logic' block logic uses the R parameter and the Efdn and Ifd inputs. The output Efd is set equal to the input Efdn unless R x Ifd > 0 and R x Ifd > Efdn, in which case Efd is set equal to R x Ifd. This means that the negative current logic is active (R and Ifd are used to calculate Efd) only when the current is positive and the exciter does not have current capability (i.e. when ExcNi.r is greater than 0).

Table 194 shows all attributes of ExcNI.

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Table 194 – Attributes of ExcitationSystemDynamics::ExcNI

name	mult	type	description
busFedSelector	0..1	Boolean	'Fed by' selector (BusFedSelector). true = bus fed (switch is closed) false = solid fed (switch is open). Typical value = true.
tr	0..1	Seconds	Time constant (Tr) (>= 0). Typical value = 0,02.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 210.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator ouput (Vrmax) (> ExcNI.vrmin). Typical value = 5,0.
vrmin	0..1	PU	Minimum voltage regulator ouput (Vrmin) (< ExcNI.vrmax). Typical value = -2,0.
kf	0..1	PU	Excitation control system stabilizer gain (Kf) (> 0). Typical value 0,01.
tf2	0..1	Seconds	Excitation control system stabilizer time constant (Tf2) (> 0). Typical value = 0,1.
tf1	0..1	Seconds	Excitation control system stabilizer time constant (Tf1) (> 0). Typical value = 1,0.
r	0..1	PU	rc / rfd (R) (>= 0). 0 means exciter has negative current capability > 0 means exciter does not have negative current capability. Typical value = 5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 195 shows all association ends of ExcNI with other classes.

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Table 195 – Association ends of ExcitationSystemDynamics::ExcNI with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.46 ExcOEX3T

Modified IEEE type ST1 excitation system with semi-continuous and acting terminal voltage limiter.

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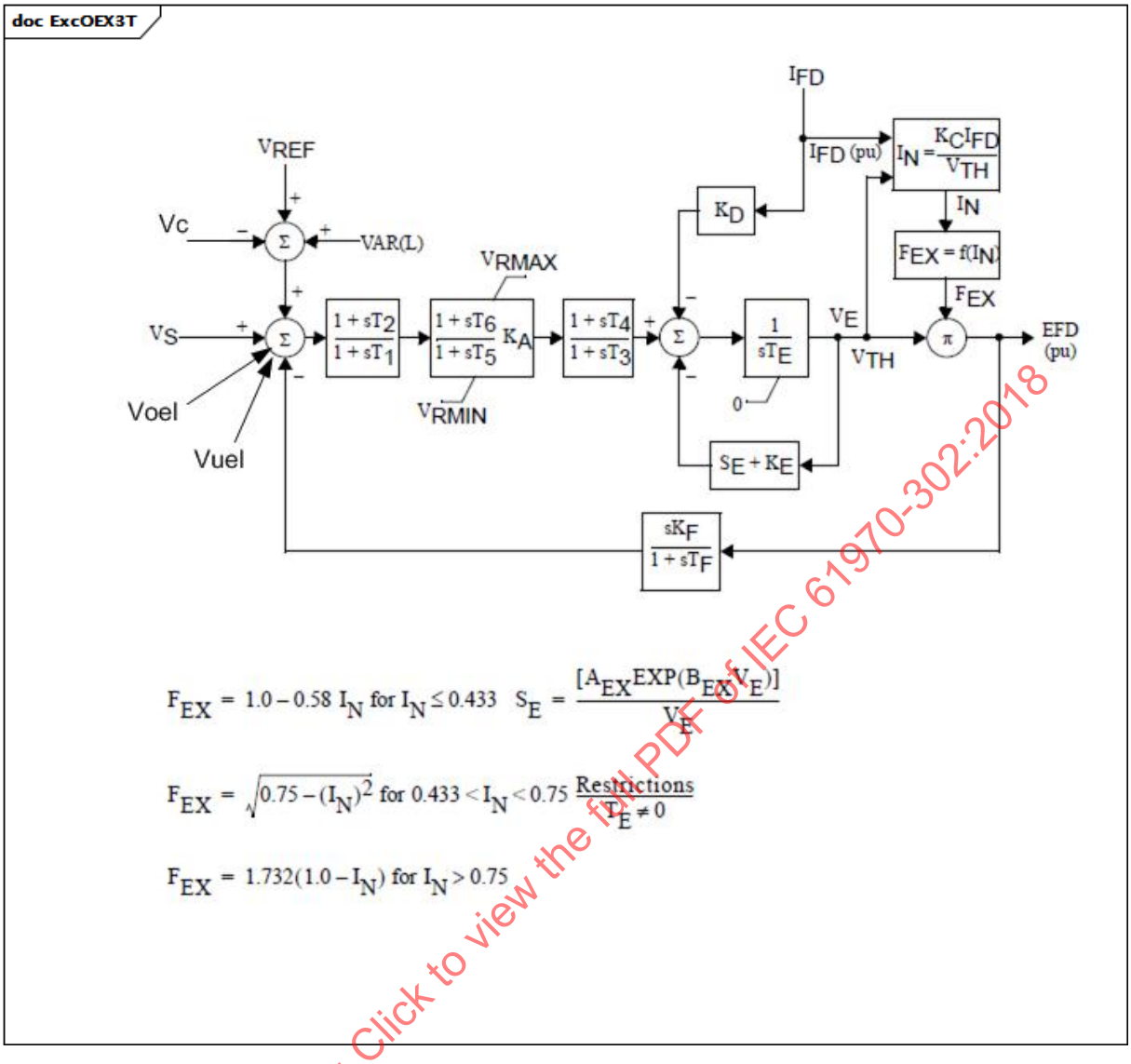

Figure 115 – ExcOEX3T

Figure 115: This diagram describes the ExcOEX3T excitation system model.

Table 196 shows all attributes of ExcOEX3T.

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Table 196 – Attributes of ExcitationSystemDynamics::ExcOEX3T

name	mult	type	description
t1	0..1	Seconds	Time constant (T1) (>= 0).
t2	0..1	Seconds	Time constant (T2) (>= 0).
t3	0..1	Seconds	Time constant (T3) (>= 0).
t4	0..1	Seconds	Time constant (T4) (>= 0).
ka	0..1	PU	Gain (KA).
t5	0..1	Seconds	Time constant (T5) (>= 0).
t6	0..1	Seconds	Time constant (T6) (>= 0).
vrmax	0..1	PU	Limiter (VRMAX) (> ExcOEX3T.vrmin).
vrmin	0..1	PU	Limiter (VRMIN) (< ExcOEX3T.vrmax).
te	0..1	Seconds	Time constant (TE) (>= 0).
kf	0..1	PU	Gain (KF).
tf	0..1	Seconds	Time constant (TF) (>= 0).
kc	0..1	PU	Gain (KC).
kd	0..1	PU	Gain (KD).
ke	0..1	PU	Gain (KE).
e1	0..1	PU	Saturation parameter (E1).
see1	0..1	PU	Saturation parameter (SE[E1]).
e2	0..1	PU	Saturation parameter (E2).
see2	0..1	PU	Saturation parameter (SE[E2]).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 197 shows all association ends of ExcOEX3T with other classes.

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Table 197 – Association ends of ExcitationSystemDynamics::ExcOEX3T with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.47 ExcPIC

Proportional/integral regulator excitation system. This model can be used to represent excitation systems with a proportional-integral (PI) voltage regulator controller.

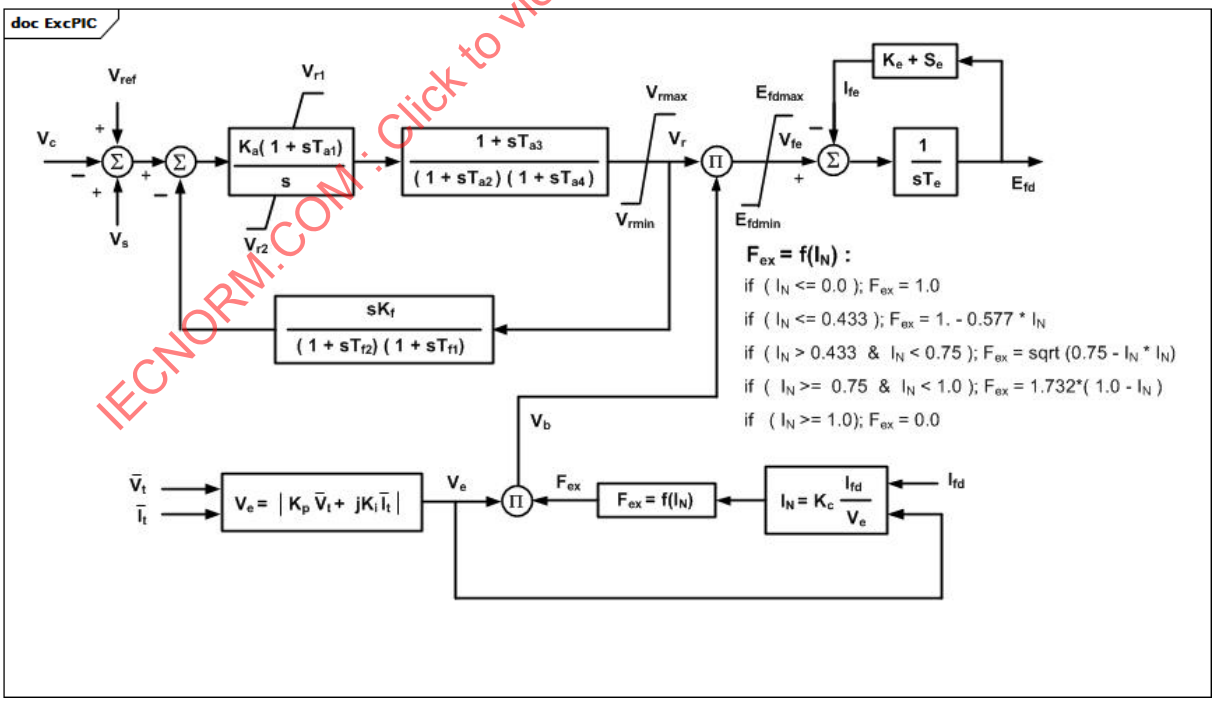

Figure 116 – ExcPIC

Figure 116: This diagram describes the ExcPIC excitation system model.

Table 198 shows all attributes of ExcPIC.

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Table 198 – Attributes of ExcitationSystemDynamics::ExcPIC

name	mult	type	description
ka	0..1	PU	PI controller gain (Ka). Typical value = 3,15.
ta1	0..1	Seconds	PI controller time constant (Ta1) (>= 0). Typical value = 1.
vr1	0..1	PU	PI maximum limit (Vr1). Typical value = 1.
vr2	0..1	PU	PI minimum limit (Vr2). Typical value = -0,87.
ta2	0..1	Seconds	Voltage regulator time constant (Ta2) (>= 0). Typical value = 0,01.
ta3	0..1	Seconds	Lead time constant (Ta3) (>= 0). Typical value = 0.
ta4	0..1	Seconds	Lag time constant (Ta4) (>= 0). Typical value = 0.
vrmax	0..1	PU	Voltage regulator maximum limit (Vrmax) (> ExcPIC.vrmin). Typical value = 1.
vrmin	0..1	PU	Voltage regulator minimum limit (Vrmin) (< ExcPIC.vrmax). Typical value = -0,87.
kf	0..1	PU	Rate feedback gain (Kf). Typical value = 0.
tf1	0..1	Seconds	Rate feedback time constant (Tf1) (>= 0). Typical value = 0.
tf2	0..1	Seconds	Rate feedback lag time constant (Tf2) (>= 0). Typical value = 0.
efdmax	0..1	PU	Exciter maximum limit (Efdmax) (> ExcPIC.efdmin). Typical value = 8.
efdmin	0..1	PU	Exciter minimum limit (Efdmin) (< ExcPIC.efdmax). Typical value = -0,87.
ke	0..1	PU	Exciter constant (Ke). Typical value = 0.
te	0..1	Seconds	Exciter time constant (Te) (>= 0). Typical value = 0.
e1	0..1	PU	Field voltage value 1 (E1). Typical value = 0.
se1	0..1	PU	Saturation factor at E1 (Se1). Typical value = 0.
e2	0..1	PU	Field voltage value 2 (E2). Typical value = 0.
se2	0..1	PU	Saturation factor at E2 (Se2). Typical value = 0.
kp	0..1	PU	Potential source gain (Kp). Typical value = 6,5.
ki	0..1	PU	Current source gain (Ki). Typical value = 0.
kc	0..1	PU	Exciter regulation factor (Kc). Typical value = 0,08.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 199 shows all association ends of ExcPIC with other classes.

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Table 199 – Association ends of ExcitationSystemDynamics::ExcPIC with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.48 ExcREXS

General purpose rotating excitation system. This model can be used to represent a wide range of excitation systems whose DC power source is an AC or DC generator. It encompasses IEEE type AC1, AC2, DC1, and DC2 excitation system models.

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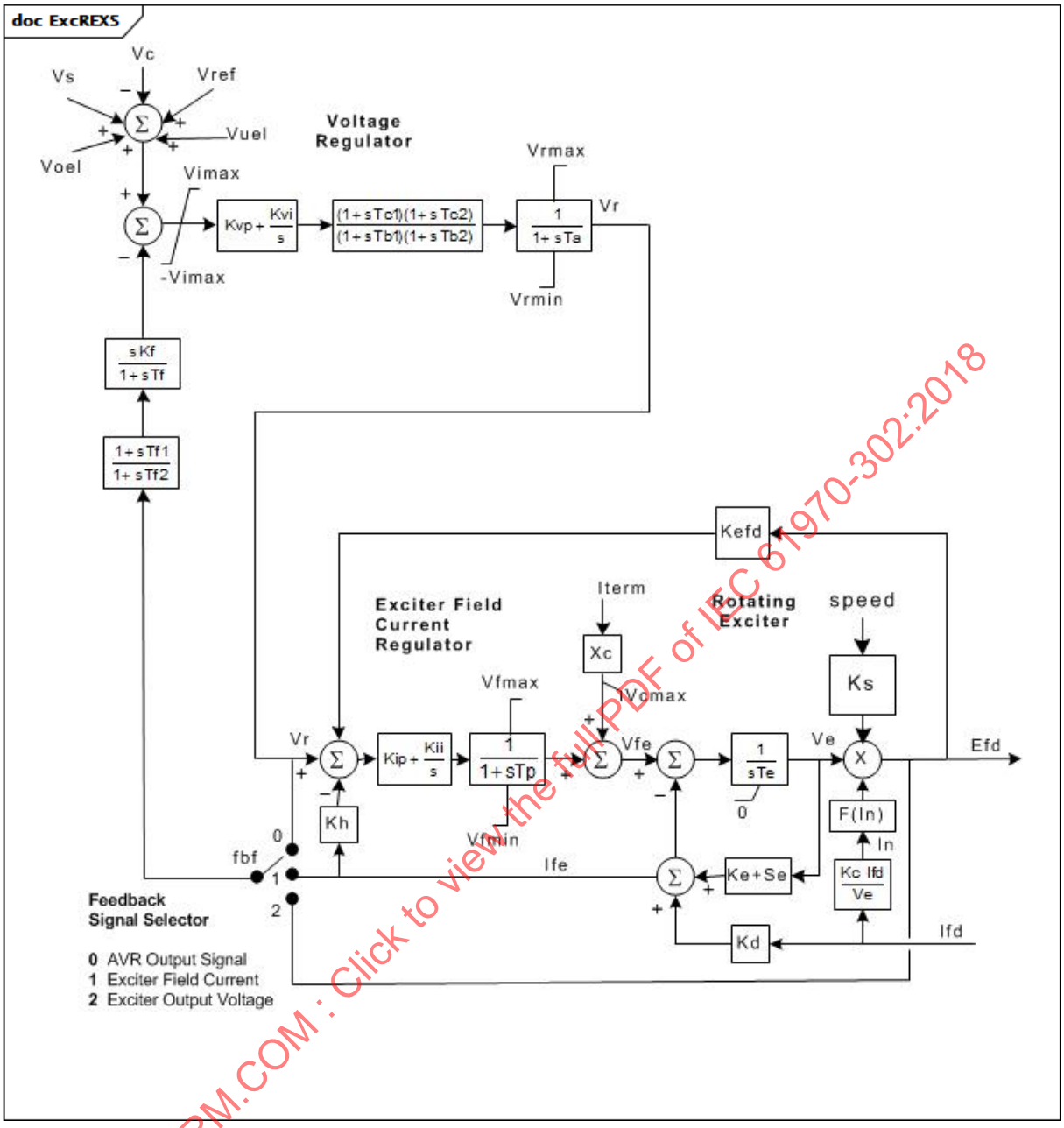

Figure 117 – ExcREXS

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Figure 117: This diagram describes the ExcREXS excitation system model.

Parameter details:

1) The rotating exciter can be of either DC or brushless AC type. To model a DC exciter, set Kc = Kd = 0.
2) An AC exciter can be modelled either by setting Kc and Kd to non- zero values to represent the armature reaction of the exciter and the regulation of the rotating rectifier, respectively, or by specifying the saturation factors, Se1 and Se2, to represent the excitation-output-voltage curve of the exciter as loaded by the field resistance of the main generator. It is preferable to use the first approach (Kd = 0) since the later approach does not represent the effect of armature reaction in the exciter on its field current and hence invalidates the model when field current is sensed by the voltage regulator.
3) When this model is used to represent a separately-excited exciter, the value of Ke should normally be close to unity. A shunt-excited DC exciter can be modelled by setting Ke to

the appropriate small negative value needed to represent the relationship between the exciter's air gap line and field resistance line. Note, though, that this model does not determine the value of Ke automatically when a shunt field DC exciter is being represented

4) The voltage regulator can be of proportional or proportional-plus-integral form. Either Kvp or Kvi, but not both, can be zero.

5) The voltage regulator output can be either the field voltage applied directly to the exciter or the input to an exciter field current regulator by choice of values of Kip, Kii, and Kh. Either or both of Kip and Kii shall be non-zero. If Kii is non-zero, Kh should normally be non-zero.

6) The voltage regulator reference is modified by a volts-per-hertz limiter when shaft speed falls below Nvphz. When the shaft speed is below Nvphz the regulator reference is reduced as follows: effective Vref = Vref (1,0 – Kvphz (speed – Nvphz)) The volts-per-hertz limiter can be disabled by setting Nvphz = 0 or Kvphz = 0.

7) Saturation parameters are given by the IEEE saturation factor definition using the open circuit magnetization of the exciter. Either point [E1, S(E1) or E2, S(E2)] can be the higher value and the other the lower.

8) If Ks is set to 1, the output (Efd) is multiplied by generator speed.

9) The voltage regulator output limits, Vrmax and Vrmin, shall be stated as multiples of the value of exciter field current needed to maintain the exciter output at its base value. The field current limit, Vlr, shall be stated as a multiple of the exciter field current needed to maintain the exciter output at its base value. That is, Vrmax and Vrmin shall be stated in terms of the PU exciter output voltage to which they correspond in the steady state.

10) The regulator output limit flag indicates whether the control power supply for the voltage regulator is a transformer at the generator terminals or an independent source such as a permanent magnet generator. Set Flimf as follows:

    – Flimf = 0 the limits on regulator output are Vrmax, Vrmin, Vfmax and Vfmin;
    – Flimf = 1 the limits on regulator output are (Vrmax x Vterm), (Vrmin x Vterm), (Vfmax x Vterm), and (Vfmin x Vterm).

11) Feedback signal selector uses ExcREXSFeedbackSignalKind, where:

    – 0 (AVR output signal) = ExcREXSFeedbackSignalKind.fieldVoltage;
    – 1 (exciter field current) = ExcREXSFeedbackSignalKind.fieldCurent;
    – 2 (exciter output voltage) = ExcREXSFeedbackSignalKind.outputVoltage.

Table 200 shows all attributes of ExcREXS.

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Table 200 – Attributes of ExcitationSystemDynamics::ExcREXS

name	mult	type	description
e1	0..1	PU	Field voltage value 1 (E1). Typical value = 3.
e2	0..1	PU	Field voltage value 2 (E2). Typical value = 4.
fbf	0..1	ExcREXSFeedbackSignalKind	Rate feedback signal flag (fbf). Typical value = fieldCurrent.
flimf	0..1	PU	Limit type flag (Flimf). Typical value = 0.
kc	0..1	PU	Rectifier regulation factor (Kc). Typical value = 0,05.
kd	0..1	PU	Exciter regulation factor (Kd). Typical value = 2.
ke	0..1	PU	Exciter field proportional constant (Ke). Typical value = 1.
kefd	0..1	PU	Field voltage feedback gain (Kefd). Typical value = 0.
kf	0..1	Seconds	Rate feedback gain (Kf) (>= 0). Typical value = 0,05.
kh	0..1	PU	Field voltage controller feedback gain (Kh). Typical value = 0.
kii	0..1	PU	Field current regulator integral gain (Kii). Typical value = 0.
kip	0..1	PU	Field current regulator proportional gain (Kip). Typical value = 1.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
kvi	0..1	PU	Voltage regulator integral gain (Kvi). Typical value = 0.
kvp	0..1	PU	Voltage regulator proportional gain (Kvp). Typical value = 2800.
kvphz	0..1	PU	V/Hz limiter gain (Kvphz). Typical value = 0.
nvphz	0..1	PU	Pickup speed of V/Hz limiter (Nvphz). Typical value = 0.
se1	0..1	PU	Saturation factor at E1 (Se1). Typical value = 0,0001.
se2	0..1	PU	Saturation factor at E2 (Se2). Typical value = 0,001.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (>= 0). If = 0, block is bypassed. Typical value = 0,01.
tb1	0..1	Seconds	Lag time constant (Tb1) (>= 0). If = 0, block is bypassed. Typical value = 0.
tb2	0..1	Seconds	Lag time constant (Tb2) (>= 0). If = 0, block is bypassed. Typical value = 0.
tc1	0..1	Seconds	Lead time constant (Tc1) (>= 0). Typical value = 0.
tc2	0..1	Seconds	Lead time constant (Tc2) (>= 0). Typical value = 0.
te	0..1	Seconds	Exciter field time constant (Te) (> 0). Typical value = 1,2.
tf	0..1	Seconds	Rate feedback time constant (Tf) (>= 0). If = 0, the feedback path is not used. Typical value = 1.
tf1	0..1	Seconds	Feedback lead time constant (Tf1) (>= 0). Typical value = 0.
tf2	0..1	Seconds	Feedback lag time constant (Tf2) (>= 0). If = 0, block is bypassed. Typical value = 0.
tp	0..1	Seconds	Field current bridge time constant (Tp) (>= 0). Typical value = 0.
vcmax	0..1	PU	Maximum compounding voltage (Vcmax). Typical value = 0.
vfmax	0..1	PU	Maximum exciter field current (Vfmax) (> ExcREXS.vfmin). Typical value = 47.
vfmin	0..1	PU	Minimum exciter field current (Vfmin) (< ExcREXS.vfmax). Typical value = -20.
vimax	0..1	PU	Voltage regulator input limit (Vimax). Typical value = 0,1.
vrmax	0..1	PU	Maximum controller output (Vrmax) (> ExcREXS.vrmin). Typical value = 47.
vrmin	0..1	PU	Minimum controller output (Vrmin) (< ExcREXS.vrmax). Typical value = -20.

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name	mult	type	description
xc	0..1	PU	Exciter compounding reactance (Xc). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 201 shows all association ends of ExcREXS with other classes.

Table 201 – Association ends of ExcitationSystemDynamics::ExcREXS with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.49 ExcRQB

Excitation system type RQB (four-loop regulator, régulateur quatre boucles, developed in France) primarily used in nuclear or thermal generating units. This excitation system shall be always used together with power system stabilizer type PssRQB.

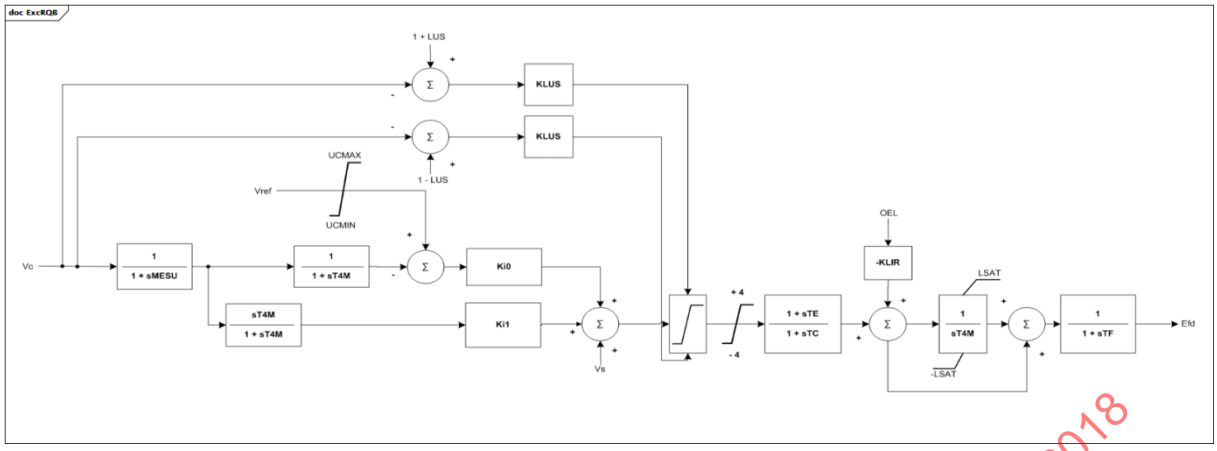

Figure 118 – ExcRQB

Figure 118: This diagram describes the ExcRQB excitation system model.

Table 202 shows all attributes of ExcRQB.

Table 202 – Attributes of ExcitationSystemDynamics::ExcRQB

name	mult	type	description
ki0	0..1	Float	Voltage reference input gain (Ki0). Typical value = 12,7.
ki1	0..1	Float	Voltage input gain (Ki1). Typical value = -16,8.
te	0..1	Seconds	Lead lag time constant (TE) (>= 0). Typical value = 0,22.
tc	0..1	Seconds	Lead lag time constant (TC) (>= 0). Typical value = 0,02.
klir	0..1	Float	OEL input gain (KLIR). Typical value = 12,13.
ucmin	0..1	PU	Minimum voltage reference limit (UCMIN) (< ExcRQB.ucmax). Typical value = 0,9.
ucmax	0..1	PU	Maximum voltage reference limit (UCMAX) (> ExcRQB.ucmin). Typical value = 1,1.
lus	0..1	PU	Setpoint (LUS). Typical value = 0,12.
klus	0..1	Float	Limiter gain (KLUS). Typical value = 50.
mesu	0..1	Seconds	Voltage input time constant (MESU) (>= 0). Typical value = 0,02.
t4m	0..1	Seconds	Input time constant (T4M) (>= 0). Typical value = 5.
lsat	0..1	PU	Integrator limiter (LSAT). Typical value = 5,73.
tf	0..1	Seconds	Exciter time constant (TF) (>= 0). Typical value = 0,01.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 203 shows all association ends of ExcRQB with other classes.

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Table 203 – Association ends of ExcitationSystemDynamics::ExcRQB with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.50 ExcSCRX

Simple excitation system with generic characteristics typical of many excitation systems; intended for use where negative field current could be a problem.

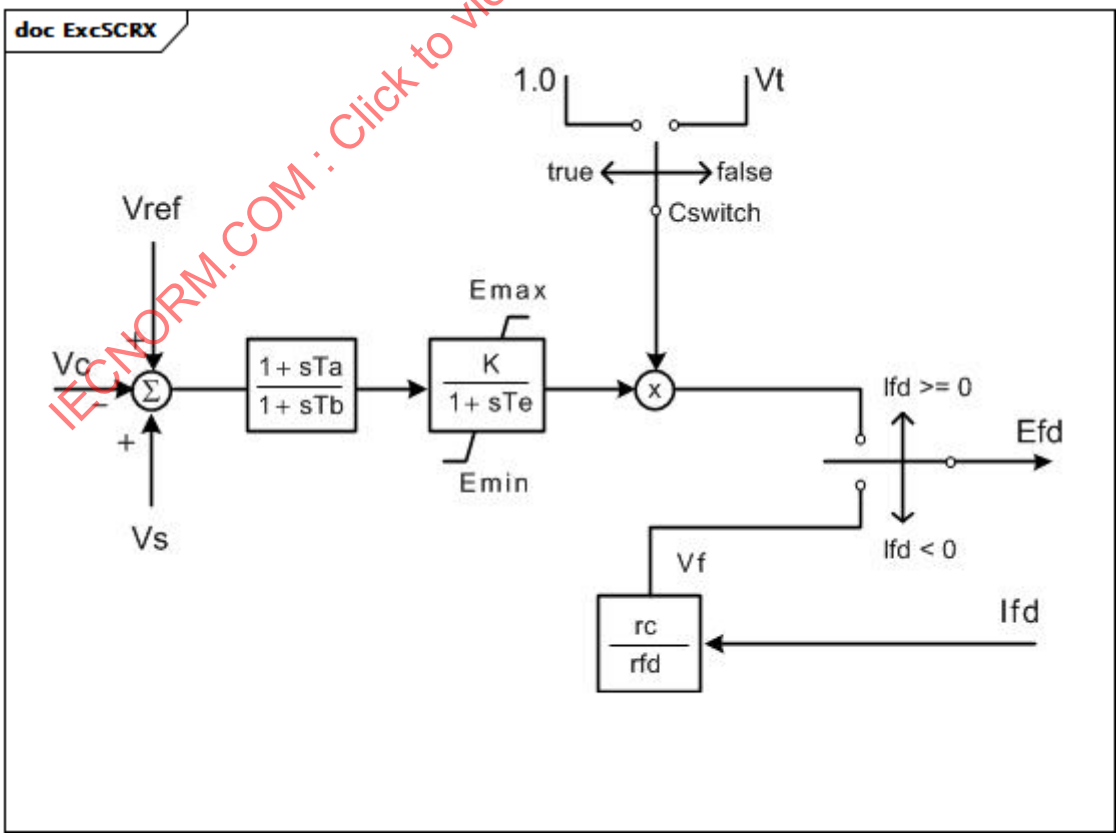

Figure 119 – ExcSCRX

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Figure 119: This diagram describes the ExcSCRX excitation system model.

Table 204 shows all attributes of ExcSCRX.

Table 204 – Attributes of ExcitationSystemDynamics::ExcSCRX

name	mult	type	description
tatb	0..1	Float	Gain reduction ratio of lag-lead element ([Ta / Tb]). The parameter Ta is not defined explicitly. Typical value = 0.1.
tb	0..1	Seconds	Denominator time constant of lag-lead block (Tb) (>= 0). Typical value = 10.
k	0..1	PU	Gain (K) (> 0). Typical value = 200.
te	0..1	Seconds	Time constant of gain block (Te) (> 0). Typical value = 0,02.
emin	0..1	PU	Minimum field voltage output (Emin) (< ExcSCRX.emax). Typical value = 0.
emax	0..1	PU	Maximum field voltage output (Emax) (> ExcSCRX.emin). Typical value = 5.
cswitch	0..1	Boolean	Power source switch (Cswitch). true = fixed voltage of 1.0 PU false = generator terminal voltage.
rcrfd	0..1	Float	Ratio of field discharge resistance to field winding resistance ([rc / rfd]). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 205 shows all association ends of ExcSCRX with other classes.

Table 205 – Association ends of ExcitationSystemDynamics::ExcSCRX with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.51 ExcSEXS

Simplified excitation system.

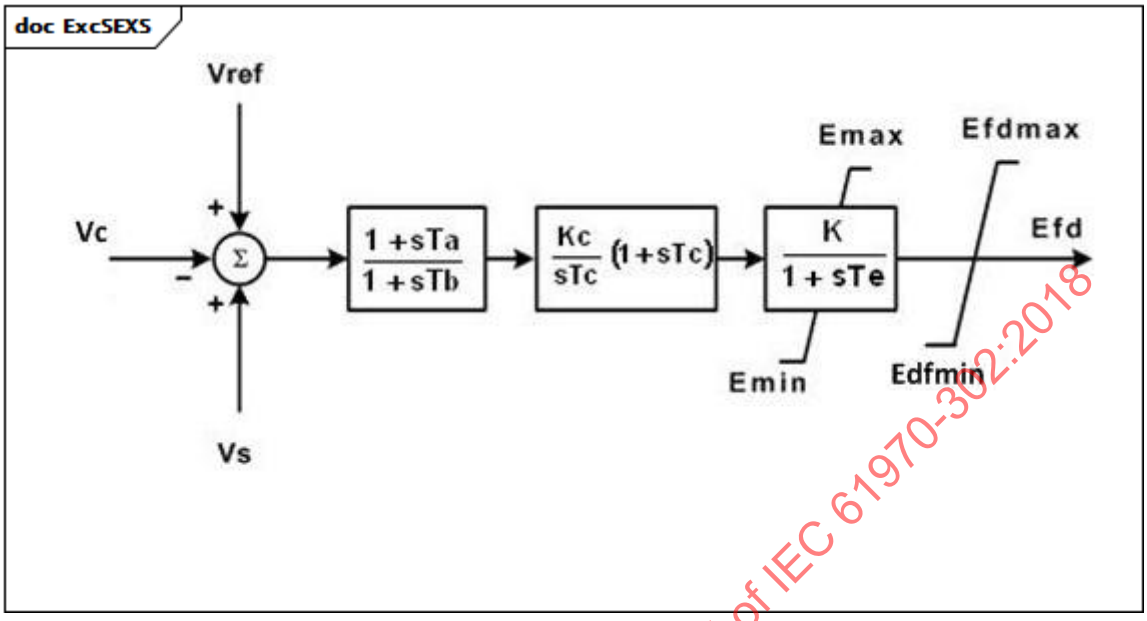

Figure 120 – ExcSEXS

Figure 120: This diagram describes the ExcSEXS excitation system model.

Table 206 shows all attributes of ExcSEXS.

Table 206 – Attributes of ExcitationSystemDynamics::ExcSEXS

name	mult	type	description
tatb	0..1	Float	Gain reduction ratio of lag-lead element ([Ta / Tb]). Typical value = 0,1.
tb	0..1	Seconds	Denominator time constant of lag-lead block (Tb) (>= 0). Typical value = 10.
k	0..1	PU	Gain (K) (> 0). Typical value = 100.
te	0..1	Seconds	Time constant of gain block (Te) (> 0). Typical value = 0,05.
emin	0..1	PU	Minimum field voltage output (Emin) (< ExcSEXS.emax). Typical value = -5.
emax	0..1	PU	Maximum field voltage output (Emax) (> ExcSEXS.emin). Typical value = 5.
kc	0..1	PU	PI controller gain (Kc) (> 0 if ExcSEXS.tc > 0). Typical value = 0,08.
tc	0..1	Seconds	PI controller phase lead time constant (Tc) (>= 0). Typical value = 0.
efdmin	0..1	PU	Field voltage clipping minimum limit (Efdmin) (< ExcSEXS.efdmax). Typical value = -5.
efdmax	0..1	PU	Field voltage clipping maximum limit (Efdmax) (> ExcSEXS.efdmin). Typical value = 5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 207 shows all association ends of ExcSEXS with other classes.

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Table 207 – Association ends of ExcitationSystemDynamics::ExcSEXS with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.52 ExcSK

Slovakian excitation system. UEL and secondary voltage control are included in this model. When this model is used, there cannot be a separate underexcitation limiter or VAr controller model.

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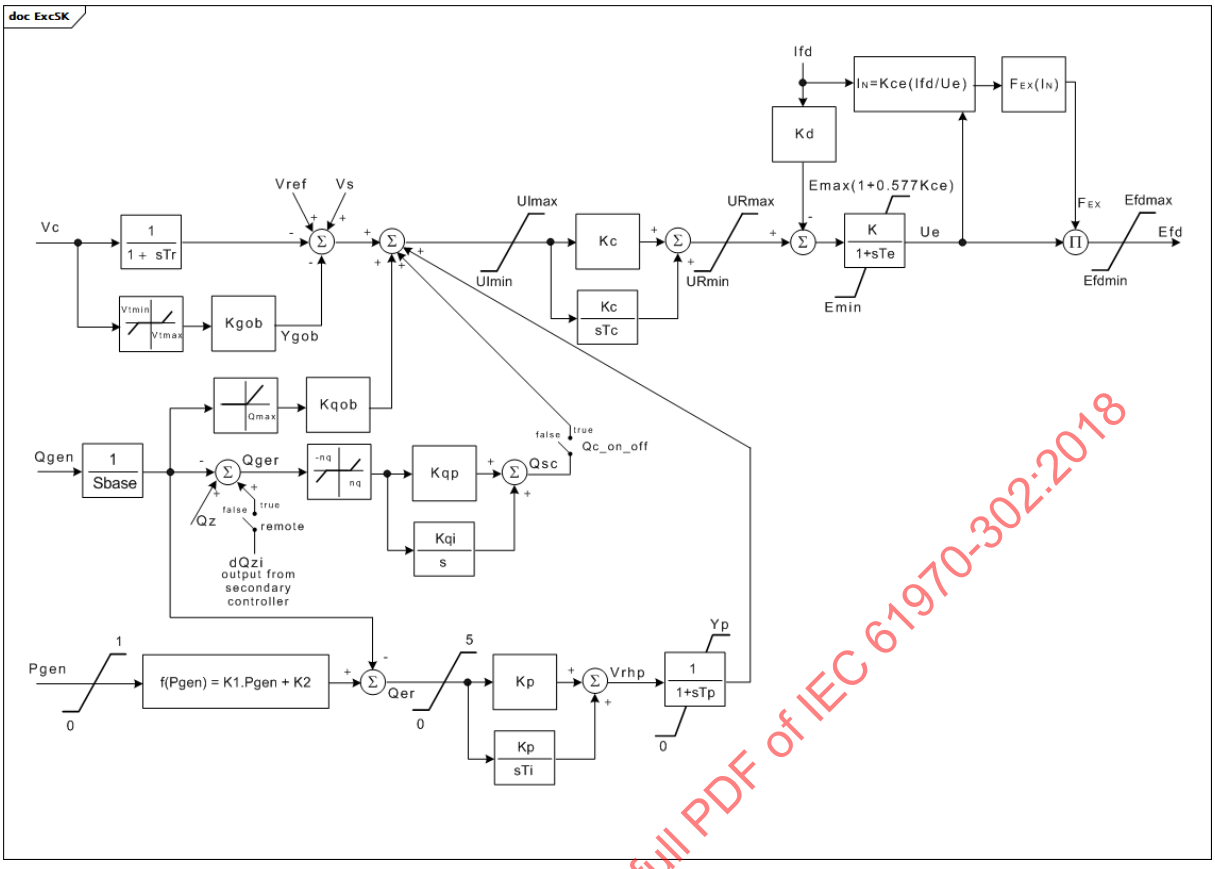

Figure 121 – ExcSK

Figure 121: This diagram describes the ExcSK excitation system model.

Parameter details:

1) Qmax is calculated using this equation: Qmax = K1 x Pgen + K2.
2) Pgen and Qgen are in PU.
3) The part of the model which includes Qmax and Kqob represents back-coupling from the reactive power with statics. It is used for parallel co-operation with other generators to share the reactive power demand. This can be neglected if the configuration is a single generating unit.
4) The block Fex (In) is modelled as described in IEEE 421.5 – part on rectifier regulation equations.

Table 208 shows all attributes of ExcSK.

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Table 208 – Attributes of ExcitationSystemDynamics::ExcSK

name	mult	type	description
efdmax	0..1	PU	Field voltage clipping upper level limit (Efdmax) (> ExcSK.efdmin).
efdmin	0..1	PU	Field voltage clipping lower level limit (Efdmin) (< ExcSK.efdmax).
emax	0..1	PU	Maximum field voltage output (Emax) (> ExcSK.emin). Typical value = 20.
emin	0..1	PU	Minimum field voltage output (Emin) (< ExcSK.emax). Typical value = -20.
k	0..1	PU	Gain (K). Typical value = 1.
k1	0..1	PU	Parameter of underexcitation limit (K1). Typical value = 0,1364.
k2	0..1	PU	Parameter of underexcitation limit (K2). Typical value = -0,3861.
kc	0..1	PU	PI controller gain (Kc). Typical value = 70.
kce	0..1	PU	Rectifier regulation factor (Kce). Typical value = 0.
kd	0..1	PU	Exciter internal reactance (Kd). Typical value = 0.
kgob	0..1	PU	P controller gain (Kgob). Typical value = 10.
kp	0..1	PU	PI controller gain (Kp). Typical value = 1.
kqi	0..1	PU	PI controller gain of integral component (Kqi). Typical value = 0.
kqob	0..1	PU	Rate of rise of the reactive power (Kqob).
kqp	0..1	PU	PI controller gain (Kqp). Typical value = 0.
nq	0..1	PU	Deadband of reactive power (nq). Determines the range of sensitivity. Typical value = 0,001.
qconoff	0..1	Boolean	Secondary voltage control state (Qc_on_off). true = secondary voltage control is on false = secondary voltage control is off. Typical value = false.
qz	0..1	PU	Desired value (setpoint) of reactive power, manual setting (Qz).
remote	0..1	Boolean	Selector to apply automatic calculation in secondary controller model (remote). true = automatic calculation is activated false = manual set is active; the use of desired value of reactive power (Qz) is required. Typical value = true.
sbase	0..1	ApparentPower	Apparent power of the unit (Sbase) (> 0). Unit = MVA. Typical value = 259.
tc	0..1	Seconds	PI controller phase lead time constant (Tc) (>= 0). Typical value = 8.
te	0..1	Seconds	Time constant of gain block (Te) (>= 0). Typical value = 0,1.
ti	0..1	Seconds	PI controller phase lead time constant (Ti) (>= 0). Typical value = 2.
tp	0..1	Seconds	Time constant (Tp) (>= 0). Typical value = 0,1.
tr	0..1	Seconds	Voltage transducer time constant (Tr) (>= 0). Typical value = 0,01.
uimax	0..1	PU	Maximum error (UImax) (> ExcSK.uimin). Typical value = 10.
uimin	0..1	PU	Minimum error (UImin) (< ExcSK.uimax). Typical value = -10.
urmax	0..1	PU	Maximum controller output (URmax) (> ExcSK.urmin). Typical value = 10.
urmin	0..1	PU	Minimum controller output (URmin) (< ExcSK.urmax). Typical value = -10.
vtmax	0..1	PU	Maximum terminal voltage input (Vtmax) (> ExcSK.vtmin). Determines the range of voltage deadband. Typical value = 1,05.
vtmin	0..1	PU	Minimum terminal voltage input (Vtmin) (< ExcSK.vtmax). Determines the range of voltage deadband. Typical value = 0,95.
yp	0..1	PU	Maximum output (Yp). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject

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name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 209 shows all association ends of ExcSK with other classes.

Table 209 – Association ends of ExcitationSystemDynamics::ExcSK with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.53 ExcST1A

Modification of an old IEEE ST1A static excitation system without overexcitation limiter (OEL) and underexcitation limiter (UEL).

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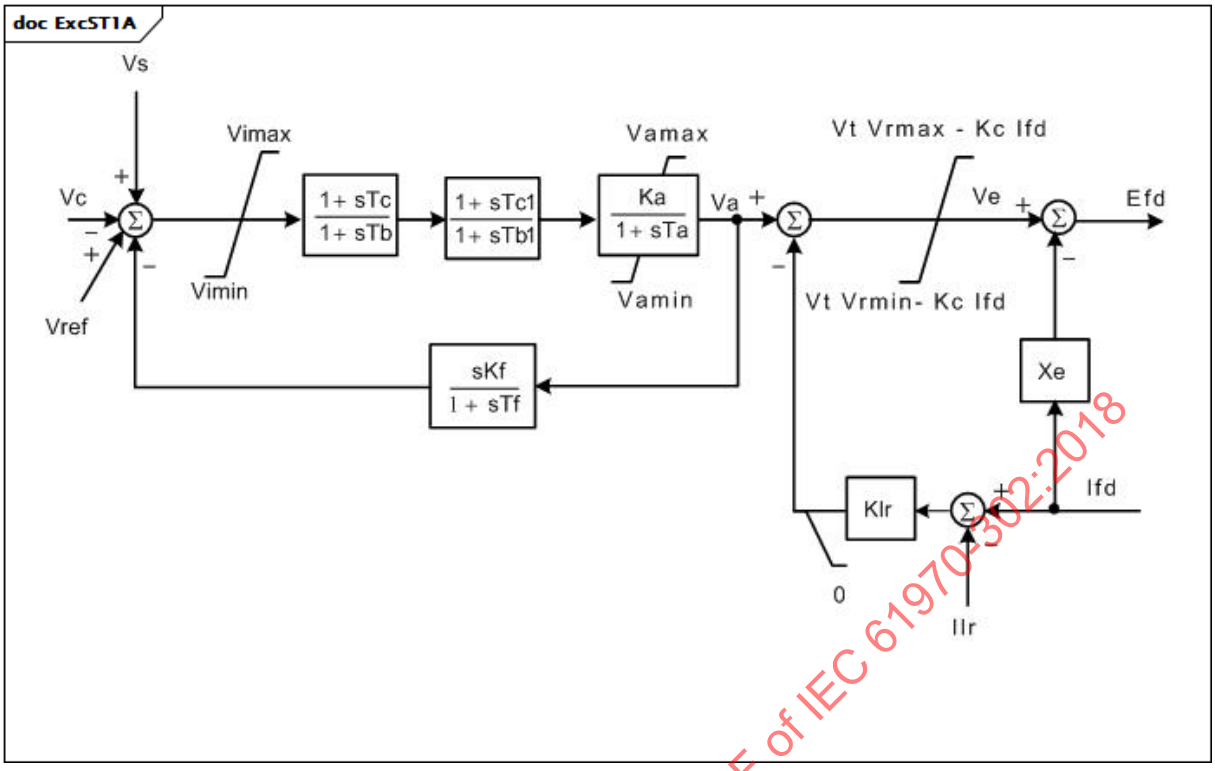

Figure 122 – ExcST1A

Figure 122: This diagram describes the ExcST1A excitation system model.

Table 210 shows all attributes of ExcST1A.

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Table 210 – Attributes of ExcitationSystemDynamics::ExcST1A

name	mult	type	description
vimax	0..1	PU	Maximum voltage regulator input limit (Vimax) (> 0). Typical value = 999.
vimin	0..1	PU	Minimum voltage regulator input limit (Vimin) (< 0). Typical value = -999.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 1.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 10.
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 190.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (>= 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator outputs (Vrmax) (> 0) . Typical value = 7,8.
vrmin	0..1	PU	Minimum voltage regulator outputs (Vrmin) (< 0). Typical value = -6,7.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,05.
kf	0..1	PU	Excitation control system stabilizer gains (Kf) (>= 0). Typical value = 0.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (>= 0). Typical value = 1.
tc1	0..1	Seconds	Voltage regulator time constant (Tc1) (>= 0). Typical value = 0.
tb1	0..1	Seconds	Voltage regulator time constant (Tb1) (>= 0). Typical value = 0.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 999.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -999.
ilr	0..1	PU	Exciter output current limit reference (Ilr). Typical value = 0.
klr	0..1	PU	Exciter output current limiter gain (Klr). Typical value = 0.
xe	0..1	PU	Excitation xfmr effective reactance (Xe). Typical value = 0,04.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 211 shows all association ends of ExcST1A with other classes.

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Table 211 – Association ends of ExcitationSystemDynamics::ExcST1A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.54 ExcST2A

Modified IEEE ST2A static excitation system with another lead-lag block added to match the model defined by WECC.

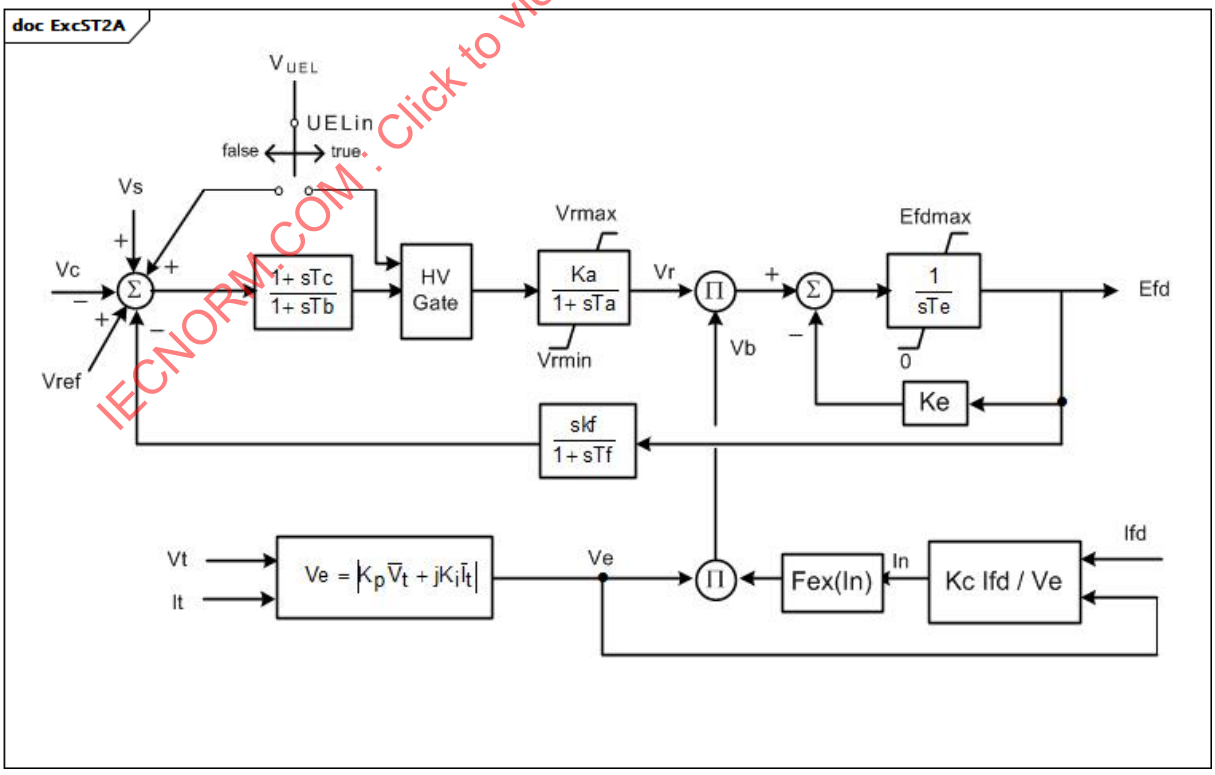

Figure 123 – ExcST2A

Figure 123: This diagram describes the ExcST2A excitation system model.

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Table 212 shows all attributes of ExcST2A.

Table 212 – Attributes of ExcitationSystemDynamics::ExcST2A

name	mult	type	description
ka	0..1	PU	Voltage regulator gain (Ka) (> 0). Typical value = 120.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (> 0). Typical value = 0,15.
vrmax	0..1	PU	Maximum voltage regulator outputs (Vrmax) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator outputs (Vrmin) (< 0). Typical value = -1.
ke	0..1	PU	Exciter constant related to self-excited field (Ke). Typical value = 1.
te	0..1	Seconds	Exciter time constant, integration rate associated with exciter control (Te) (> 0). Typical value = 0,5.
kf	0..1	PU	Excitation control system stabilizer gains (kf) (>= 0). Typical value = 0,05.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (>= 0). Typical value = 0,7.
kp	0..1	PU	Potential circuit gain coefficient (Kp) (>= 0). Typical value = 4,88.
ki	0..1	PU	Potential circuit gain coefficient (Ki) (>= 0). Typical value = 8.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 1,82.
efdmax	0..1	PU	Maximum field voltage (Efdmax) (>= 0). Typical value = 99.
uelin	0..1	Boolean	UEL input (UELin). true = HV gate false = add to error signal. Typical value = false.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 0.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 213 shows all association ends of ExcST2A with other classes.

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Table 213 – Association ends of ExcitationSystemDynamics::ExcST2A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.55 ExcST3A

Modified IEEE ST3A static excitation system with added speed multiplier.

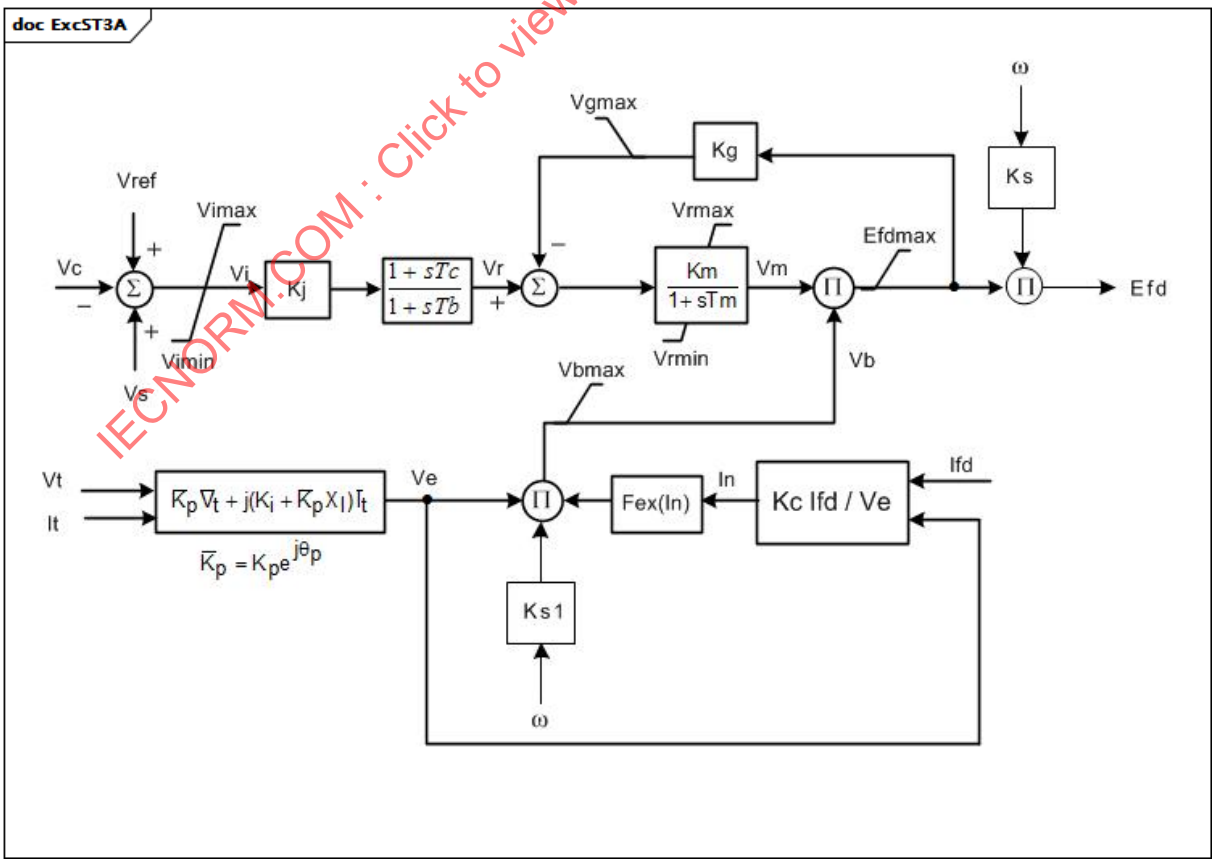

Figure 124 – ExcST3A

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Figure 124: This diagram describes the ExcST3A excitation system model.

Parameter details:

1) If Ks or Ks1 is set to 1, the output (Efd) is multiplied by generator speed.

Table 214 shows all attributes of ExcST3A.

Table 214 – Attributes of ExcitationSystemDynamics::ExcST3A

name	mult	type	description
vimax	0..1	PU	Maximum voltage regulator input limit (Vimax) (> 0). Typical value = 0,2.
vimin	0..1	PU	Minimum voltage regulator input limit (Vimin) (< 0). Typical value = -0,2.
kj	0..1	PU	AVR gain (Kj) (> 0). Typical value = 200.
tb	0..1	Seconds	Voltage regulator time constant (Tb) (>= 0). Typical value = 6,67.
tc	0..1	Seconds	Voltage regulator time constant (Tc) (>= 0). Typical value = 1.
efdmax	0..1	PU	Maximum AVR output (Efdmax) (>= 0). Typical value = 6,9.
km	0..1	PU	Forward gain constant of the inner loop field regulator (Km) (> 0). Typical value = 7,04.
tm	0..1	Seconds	Forward time constant of inner loop field regulator (Tm) (> 0). Typical value = 1.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -1.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (Kg) (>= 0). Typical value = 1.
kp	0..1	PU	Potential source gain (Kp) (> 0). Typical value = 4,37.
thetap	0..1	AngleDegrees	Potential circuit phase angle (thetap). Typical value = 20.
ki	0..1	PU	Potential circuit gain coefficient (Ki) (>= 0). Typical value = 4,83.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 1,1.
xl	0..1	PU	Reactance associated with potential source (Xl) (>= 0). Typical value = 0,09.
vbmax	0..1	PU	Maximum excitation voltage (Vbmax) (> 0). Typical value = 8,63.
vgmax	0..1	PU	Maximum inner loop feedback voltage (Vgmax) (>= 0). Typical value = 6,53.
ks	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks). Typical value = 0.
ks1	0..1	PU	Coefficient to allow different usage of the model-speed coefficient (Ks1). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 215 shows all association ends of ExcST3A with other classes.

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Table 215 – Association ends of ExcitationSystemDynamics::ExcST3A with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.56 ExcST4B

Modified IEEE ST4B static excitation system with maximum inner loop feedback gain Vgmax.

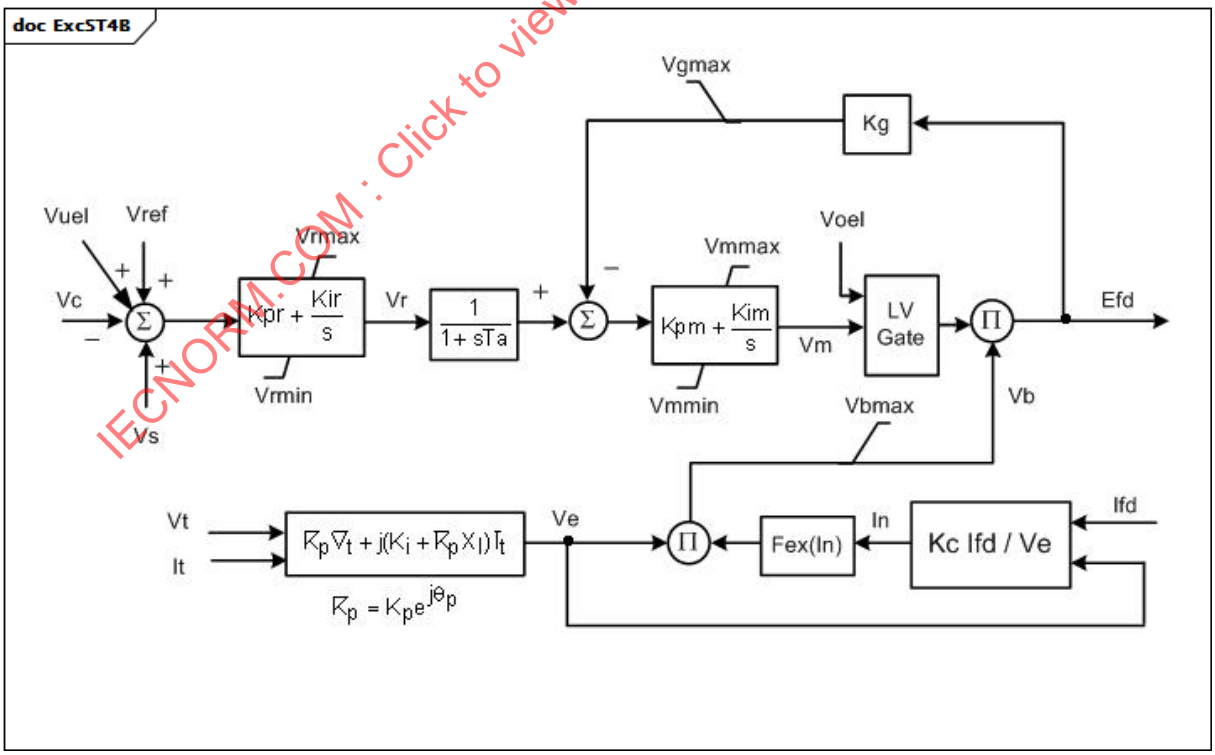

Figure 125 – ExcST4B

Figure 125: This diagram describes the ExcST4B excitation system model.

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Table 216 shows all attributes of ExcST4B.

Table 216 – Attributes of ExcitationSystemDynamics::ExcST4B

name	mult	type	description
kpr	0..1	PU	Voltage regulator proportional gain (Kpr). Typical value = 10,75.
kir	0..1	PU	Voltage regulator integral gain (Kir). Typical value = 10,75.
ta	0..1	Seconds	Voltage regulator time constant (Ta) (>= 0). Typical value = 0,02.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 1.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -0,87.
kpm	0..1	PU	Voltage regulator proportional gain output (Kpm). Typical value = 1.
kim	0..1	PU	Voltage regulator integral gain output (Kim). Typical value = 0.
vmmax	0..1	PU	Maximum inner loop output (Vmmax) (> ExcST4B.vmmin). Typical value = 99.
vmmin	0..1	PU	Minimum inner loop output (Vmmin) (< ExcST4B.vmmax). Typical value = -99.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (Kg) (>= 0). Typical value = 0.
kp	0..1	PU	Potential circuit gain coefficient (Kp) (> 0). Typical value = 9,3.
thetap	0..1	AngleDegrees	Potential circuit phase angle (thetap). Typical value = 0.
ki	0..1	PU	Potential circuit gain coefficient (Ki) (>= 0). Typical value = 0.
kc	0..1	PU	Rectifier loading factor proportional to commutating reactance (Kc) (>= 0). Typical value = 0,113.
xl	0..1	PU	Reactance associated with potential source (Xl) (>= 0). Typical value = 0,124.
vbmax	0..1	PU	Maximum excitation voltage (Vbmax) (> 0). Typical value = 11,63.
vgmax	0..1	PU	Maximum inner loop feedback voltage (Vgmax) (>= 0). Typical value = 5,8.
uel	0..1	Boolean	Selector (UEL). true = UEL is part of block diagram false = UEL is not part of block diagram. Typical value = false.
lvgate	0..1	Boolean	Selector (LVGate). true = LVGate is part of the block diagram false = LVGate is not part of the block diagram. Typical value = false.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 217 shows all association ends of ExcST4B with other classes.

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Table 217 – Association ends of ExcitationSystemDynamics::ExcST4B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.57 ExcST6B

Modified IEEE ST6B static excitation system with PID controller and optional inner feedback loop.

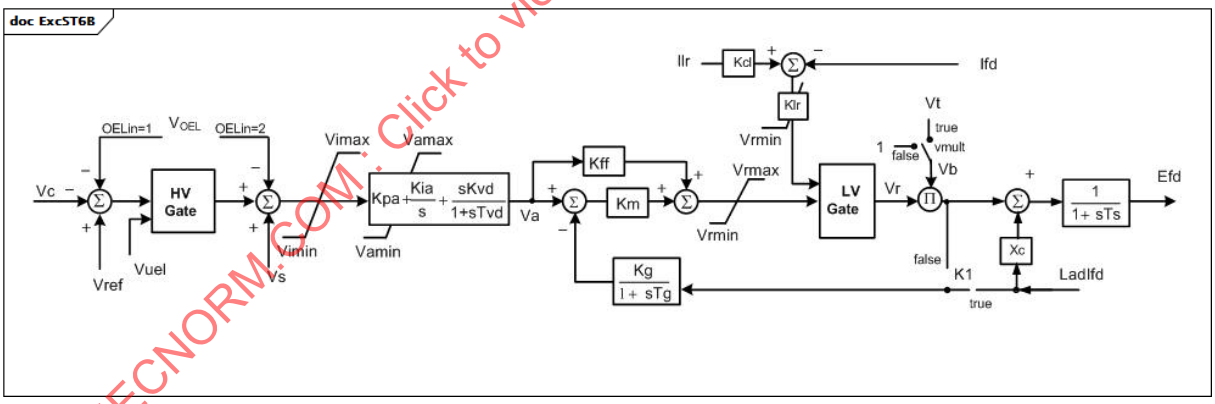

Figure 126 – ExcST6B

Figure 126: This diagram describes the ExcST6B excitation system model.

Table 218 shows all attributes of ExcST6B.

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Table 218 – Attributes of ExcitationSystemDynamics::ExcST6B

name	mult	type	description
ilr	0..1	PU	Exciter output current limit reference (Ilr) (> 0). Typical value = 4,164.
k1	0..1	Boolean	Selector (K1). true = feedback is from Ifd false = feedback is not from Ifd. Typical value = true.
kcl	0..1	PU	Exciter output current limit adjustment (Kcl) (> 0). Typical value = 1,0577.
kff	0..1	PU	Pre-control gain constant of the inner loop field regulator (Kff). Typical value = 1.
kg	0..1	PU	Feedback gain constant of the inner loop field regulator (Kg) (>= 0). Typical value = 1.
kia	0..1	PU	Voltage regulator integral gain (Kia) (> 0). Typical value = 45,094.
klr	0..1	PU	Exciter output current limit adjustment (Kcl) (> 0). Typical value = 17,33.
km	0..1	PU	Forward gain constant of the inner loop field regulator (Km). Typical value = 1.
kpa	0..1	PU	Voltage regulator proportional gain (Kpa) (> 0). Typical value = 18,038.
kvd	0..1	PU	Voltage regulator derivative gain (Kvd). Typical value = 0.
oelin	0..1	ExcST6BOELselectorKind	OEL input selector (OELin). Typical value = noOELinput (corresponds to OELin = 0 on diagram).
tg	0..1	Seconds	Feedback time constant of inner loop field voltage regulator (Tg) (>= 0). Typical value = 0,02.
ts	0..1	Seconds	Rectifier firing time constant (Ts) (>= 0). Typical value = 0.
tvd	0..1	Seconds	Voltage regulator derivative gain (Tvd) (>= 0). Typical value = 0.
vamax	0..1	PU	Maximum voltage regulator output (Vamax) (> 0). Typical value = 4,81.
vamin	0..1	PU	Minimum voltage regulator output (Vamin) (< 0). Typical value = -3,85.
vilim	0..1	Boolean	Selector (Vilim). true = Vimin-Vimax limiter is active false = Vimin-Vimax limiter is not active. Typical value = true.
vimax	0..1	PU	Maximum voltage regulator input limit (Vimax) (> ExcST6B.vimin). Typical value = 10.
vimin	0..1	PU	Minimum voltage regulator input limit (Vimin) (< ExcST6B.vimax). Typical value = -10.
vmult	0..1	Boolean	Selector (vmult). true = multiply regulator output by terminal voltage false = do not multiply regulator output by terminal voltage. Typical value = true.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 4,81.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -3,85.
xc	0..1	PU	Excitation source reactance (Xc). Typical value = 0,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject

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name	mult	type	description
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 219 shows all association ends of ExcST6B with other classes.

Table 219 – Association ends of ExcitationSystemDynamics::ExcST6B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.9.58 ExcST7B

Modified IEEE ST7B static excitation system without stator current limiter (SCL) and current compensator (DROOP) inputs.

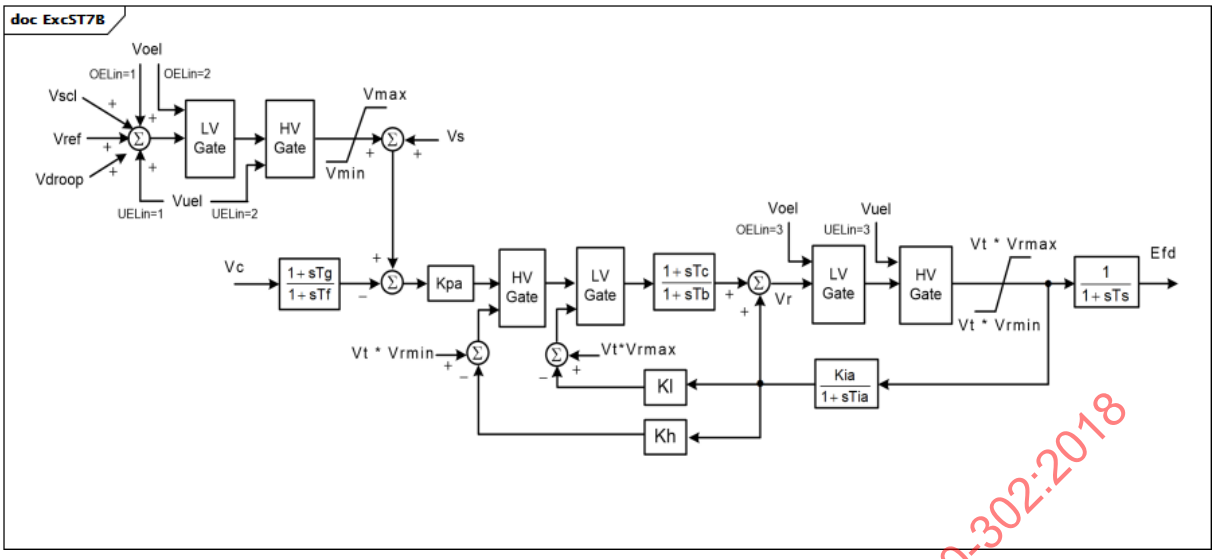

Figure 127 – ExcST7B

Figure 127: This diagram describes the ExcST7B excitation system model.

Table 220 shows all attributes of ExcST7B.

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Table 220 – Attributes of ExcitationSystemDynamics::ExcST7B

name	mult	type	description
kh	0..1	PU	High-value gate feedback gain (Kh) (>= 0). Typical value = 1.
kia	0..1	PU	Voltage regulator integral gain (Kia) (>= 0). Typical value = 1.
kl	0..1	PU	Low-value gate feedback gain (Kl) (>= 0). Typical value = 1.
kpa	0..1	PU	Voltage regulator proportional gain (Kpa) (> 0). Typical value = 40.
oelin	0..1	ExcST7BOELselectorKind	OEL input selector (OELin). Typical value = noOELinput.
tb	0..1	Seconds	Regulator lag time constant (Tb) (>= 0). Typical value = 1.
tc	0..1	Seconds	Regulator lead time constant (Tc) (>= 0). Typical value = 1.
tf	0..1	Seconds	Excitation control system stabilizer time constant (Tf) (>= 0). Typical value = 1.
tg	0..1	Seconds	Feedback time constant of inner loop field voltage regulator (Tg) (>= 0). Typical value = 1.
tia	0..1	Seconds	Feedback time constant (Tia) (>= 0). Typical value = 3.
ts	0..1	Seconds	Rectifier firing time constant (Ts) (>= 0). Typical value = 0.
uelin	0..1	ExcST7BUELselectorKind	UEL input selector (UELin). Typical value = noUELinput.
vmax	0..1	PU	Maximum voltage reference signal (Vmax) (> 0 and > ExcST7B.vmin)). Typical value = 1,1.
vmin	0..1	PU	Minimum voltage reference signal (Vmin) (> 0 and < ExcST7B.vmax). Typical value = 0,9.
vrmax	0..1	PU	Maximum voltage regulator output (Vrmax) (> 0). Typical value = 5.
vrmin	0..1	PU	Minimum voltage regulator output (Vrmin) (< 0). Typical value = -4,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 221 shows all association ends of ExcST7B with other classes.

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Table 221 – Association ends of ExcitationSystemDynamics::ExcST7B with other classes

mult from	name	mult to	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.9.59 ExcIEEEST1AUELselectorKind enumeration

Types of connections for the UEL input used in ExcIEEEST1A.

Table 222 shows all literals of ExcIEEEST1AUELselectorKind.

Table 222 – Literals of ExcitationSystemDynamics::ExcIEEEST1AUELselectorKind

literal	value	description
ignoreUELsignal		Ignore UEL signal.
inputHVgateVoltageOutput		UEL input HV gate with voltage regulator output.
inputHVgateErrorSignal		UEL input HV gate with error signal.
inputAddedToErrorSignal		UEL input added to error signal.

5.3.9.60 ExcREXSFeedbackSignalKind enumeration

Types of rate feedback signals.

Table 223 shows all literals of ExcREXSFeedbackSignalKind.

Table 223 – Literals of ExcitationSystemDynamics::ExcREXSFeedbackSignalKind

literal	value	description
fieldVoltage		The voltage regulator output voltage is used. It is the same as exciter field voltage.
fieldCurrent		The exciter field current is used.
outputVoltage		The output voltage of the exciter is used.

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5.3.9.61 ExcST6BOELselectorKind enumeration

Types of connections for the OEL input used for static excitation systems type 6B.

Table 224 shows all literals of ExcST6BOELselectorKind.

Table 224 – Literals of ExcitationSystemDynamics::ExcST6BOELselectorKind

literal	value	description
noOELinput		No OEL input is used. Corresponds to OELin not = 1 and not = 2 on the ExcST6B diagram. Original ExcST6B model would have called this OELin = 0.
beforeUEL		The connection is before UEL. Corresponds to OELin = 1 on the ExcST6B diagram.
afterUEL		The connection is after UEL. Corresponds to OELin = 2 on the ExcST6B diagram.

5.3.9.62 ExcST7BOELselectorKind enumeration

Types of connections for the OEL input used for static excitation systems type 7B.

Table 225 shows all literals of ExcST7BOELselectorKind.

Table 225 – Literals of ExcitationSystemDynamics::ExcST7BOELselectorKind

literal	value	description
noOELinput		No OEL input is used. Corresponds to OELin not = 1 and not = 2 and not = 3 on the ExcST7B diagram. Original ExcST7B model would have called this OELin = 0.
addVref		The signal is added to Vref. Corresponds to OELin = 1 on the ExcST7B diagram.
inputLVgate		The signal is connected into the input LVGate. Corresponds to OELin = 2 on the ExcST7B diagram.
outputLVgate		The signal is connected into the output LVGate. Corresponds to OELin = 3 on the ExcST7B diagram.

5.3.9.63 ExcST7BUELselectorKind enumeration

Types of connections for the UEL input used for static excitation systems type 7B.

Table 226 shows all literals of ExcST7BUELselectorKind.

Table 226 – Literals of ExcitationSystemDynamics::ExcST7BUELselectorKind

literal	value	description
noUELinput		No UEL input is used. Corresponds to UELin not = 1 and not = 2 and not = 3 on the ExcST7B diagram. Original ExcST7B model would have called this UELin = 0.
addVref		The signal is added to Vref. Corresponds to UELin = 1 on the ExcST7B diagram.
inputHVgate		The signal is connected into the input HVGate. Corresponds to UELin = 2 on the ExcST7B diagram.
outputHVgate		The signal is connected into the output HVGate. Corresponds to UELin = 3 on the ExcST7B diagram.

5.3.10 Package OverexcitationLimiterDynamics

5.3.10.1 General

Overexcitation limiters (OELs) are also referred to as maximum excitation limiters and field current limiters. The possibility of voltage collapse in stressed power systems increases the

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importance of modelling these limiters in studies of system conditions that cause machines to operate at high levels of excitation for a sustained period, such as voltage collapse or system-islanding. Such events typically occur over a long time frame compared with transient or small-signal stability simulations.

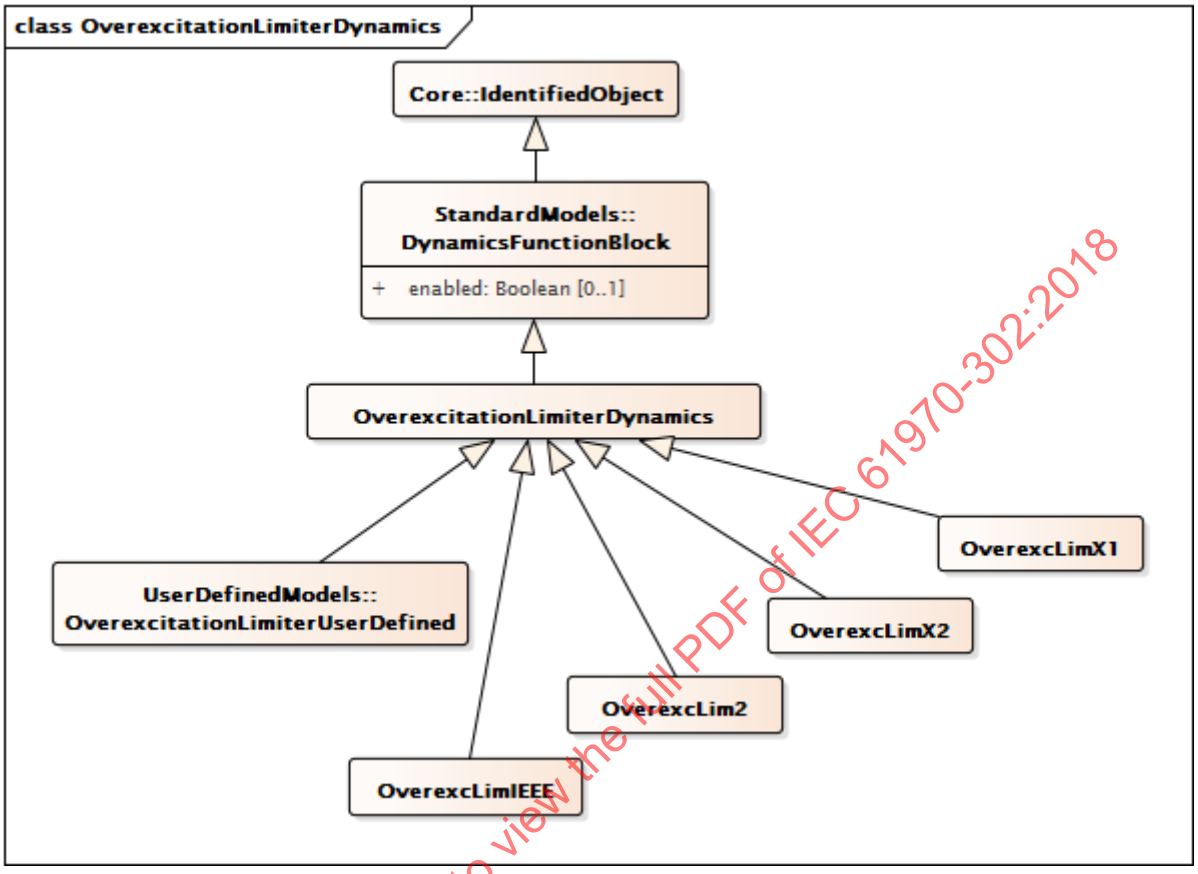

Figure 128 – Class diagram OverexcitationLimiterDynamics::OverexcitationLimiterDynamics

Figure 128: This diagram shows dynamic standard model overexcitation limiter classes and their inheritance from the OverexcitationLimiterDynamics class.

5.3.10.2 OverexcitationLimiterDynamics

Overexcitation limiter function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 227 shows all attributes of OverexcitationLimiterDynamics.

Table 227 – Attributes of OverexcitationLimiterDynamics::OverexcitationLimiterDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 228 shows all association ends of OverexcitationLimiterDynamics with other classes.

Table 228 – Association ends of OverexcitationLimiterDynamics::OverexcitationLimiterDynamics with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this overexcitation limiter model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.10.3 OverexcLimIEEE

The over excitation limiter model is intended to represent the significant features of OELs necessary for some large-scale system studies. It is the result of a pragmatic approach to obtain a model that can be widely applied with attainable data from generator owners. An attempt to include all variations in the functionality of OELs and duplicate how they interact with the rest of the excitation systems would likely result in a level of application insufficient for the studies for which they are intended.

Reference: IEEE OEL 421.5-2005, 9.

Table 229 shows all attributes of OverexcLimIEEE.

Table 229 – Attributes of OverexcitationLimiterDynamics::OverexcLimIEEE

name	mult	type	description
itfpu	0..1	PU	OEL timed field current limiter pickup level (ITFPU). Typical value = 1,05.
ifdmax	0..1	PU	OEL instantaneous field current limit (IFDMAX). Typical value = 1,5.
ifdlim	0..1	PU	OEL timed field current limit (IFDLIM). Typical value = 1,05.
hyst	0..1	PU	OEL pickup/drop-out hysteresis (HYST). Typical value = 0,03.
kcd	0..1	PU	OEL cooldown gain (KCD). Typical value = 1.
kramp	0..1	Float	OEL ramped limit rate (KRAMP). Unit = PU / s. Typical value = 10.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 230 shows all association ends of OverexcLimIEEE with other classes.

Table 230 – Association ends of OverexcitationLimiterDynamics::OverexcLimIEEE with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: OverexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.10.4 OverexcLim2

Different from LimIEEEOEL, LimOEL2 has a fixed pickup threshold and reduces the excitation set-point by means of a non-windup integral regulator.

Irated is the rated machine excitation current (calculated from nameplate conditions: Vnom, Pnom, CosPhinom).

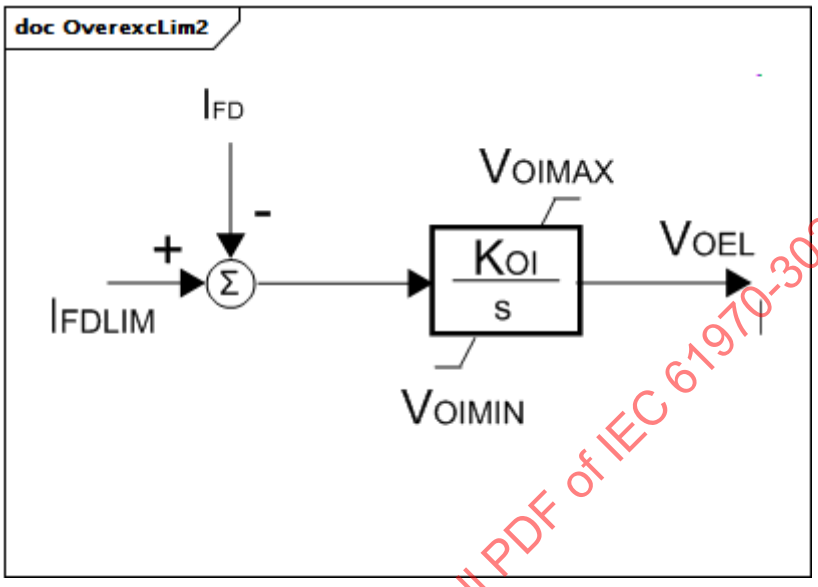

Figure 129 – OverexcLim2

Figure 129: This diagram describes the OverexcLim2 overexcitation limiter model.

Table 231 shows all attributes of OverexcLim2.

Table 231 – Attributes of OverexcitationLimiterDynamics::OverexcLim2

name	mult	type	description
koi	0..1	PU	Gain Over excitation limiter (KOI). Typical value = 0,1.
voimax	0..1	PU	Maximum error signal (VOIMAX) (> OverexcLim2.voimin). Typical value = 0.
voimin	0..1	PU	Minimum error signal (VOIMIN) (< OverexcLim2.voimax). Typical value = -9999.
ifdlim	0..1	PU	Limit value of rated field current (IFDLIM). Typical value = 1,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 232 shows all association ends of OverexcLim2 with other classes.

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Table 232 – Association ends of OverexcitationLimiterDynamics::OverexcLim2 with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: OverexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.10.5 OverexcLimX1

Field voltage over excitation limiter.

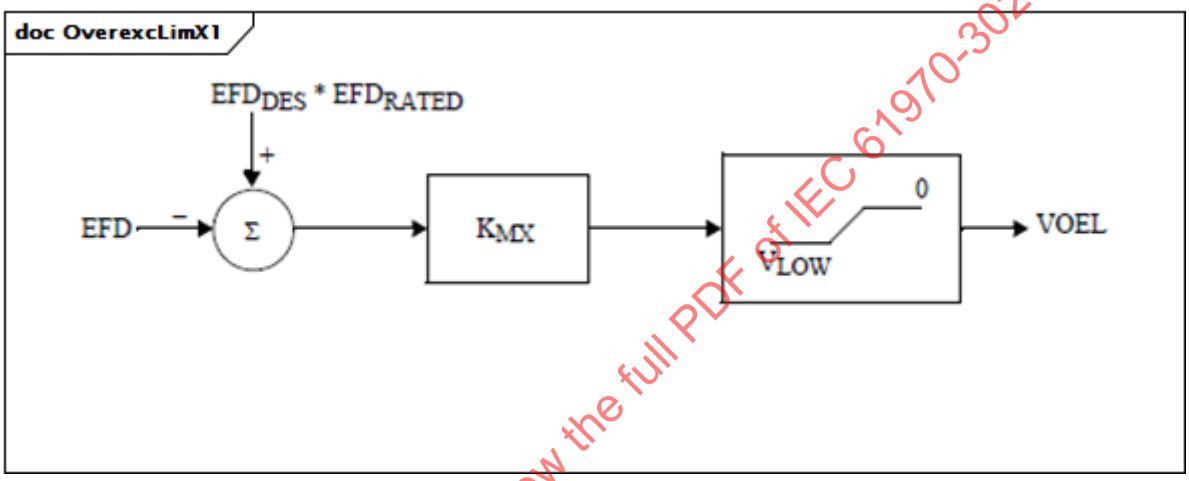

Figure 130 – OverexcLimX1

Figure 130: This diagram describes the OverexcLimX1 overexcitation limiter model.

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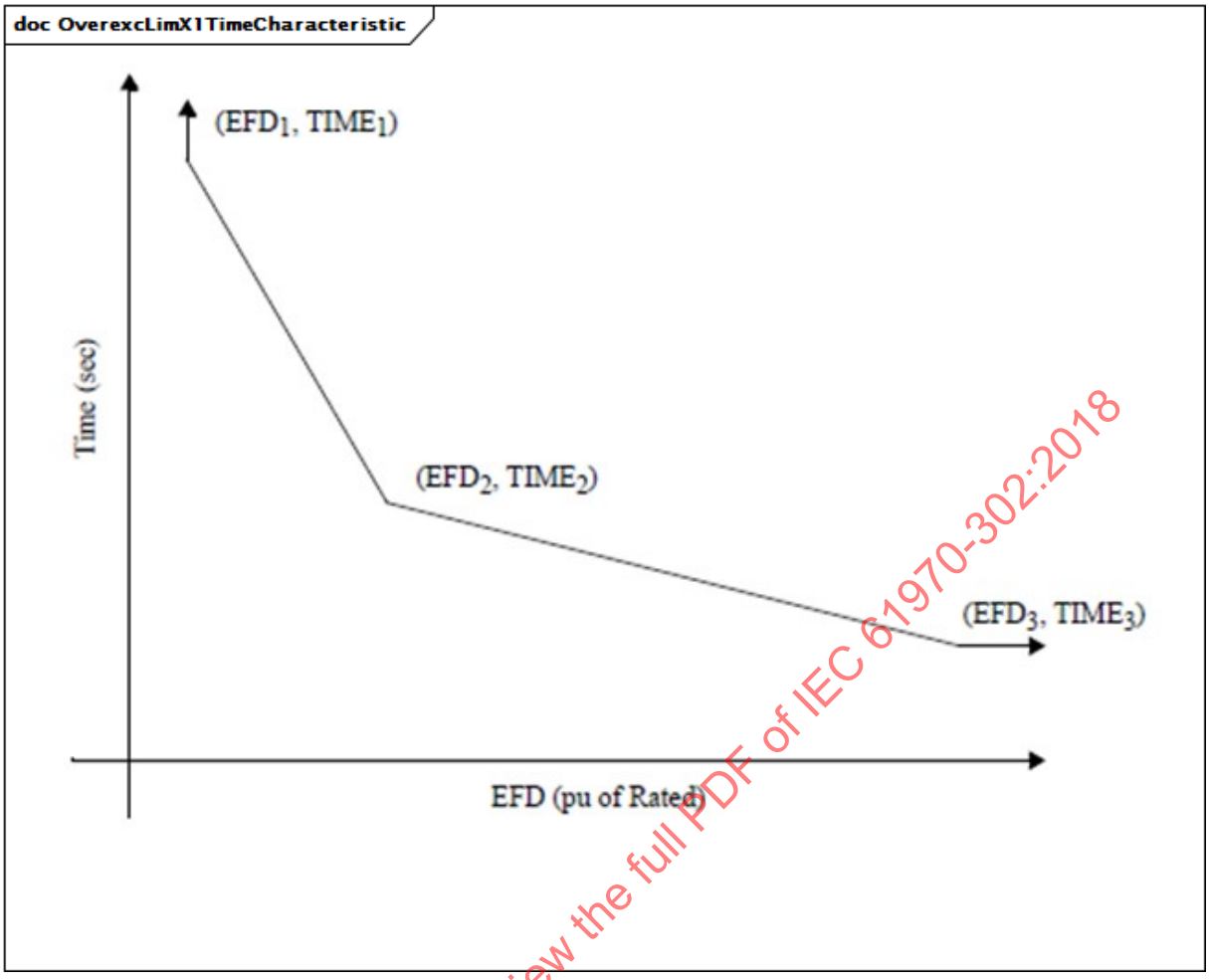

Figure 131 – OverexcLimX1TimeCharacteristic

Figure 131: This model assumes an inverse time characteristic, where operating time is a function of the magnitude of the overvoltage.

Table 233 shows all attributes of OverexcLimX1.

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Table 233 – Attributes of OverexcitationLimiterDynamics::OverexcLimX1

name	mult	type	description
efdrated	0..1	PU	Rated field voltage (EFDRATED). Typical value = 1,05.
efd1	0..1	PU	Low voltage point on the inverse time characteristic (EFD1). Typical value = 1,1.
t1	0..1	Seconds	Time to trip the exciter at the low voltage point on the inverse time characteristic (TIME1) (>= 0). Typical value = 120.
efd2	0..1	PU	Mid voltage point on the inverse time characteristic (EFD2). Typical value = 1,2.
t2	0..1	Seconds	Time to trip the exciter at the mid voltage point on the inverse time characteristic (TIME2) (>= 0). Typical value = 40.
efd3	0..1	PU	High voltage point on the inverse time characteristic (EFD3). Typical value = 1,5.
t3	0..1	Seconds	Time to trip the exciter at the high voltage point on the inverse time characteristic (TIME3) (>= 0). Typical value = 15.
efddes	0..1	PU	Desired field voltage (EFDDES). Typical value = 0,9.
kmx	0..1	PU	Gain (KMX). Typical value = 0,01.
vlow	0..1	PU	Low voltage limit (VLOW) (> 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 234 shows all association ends of OverexcLimX1 with other classes.

Table 234 – Association ends of OverexcitationLimiterDynamics::OverexcLimX1 with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: OverexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.10.6 OverexcLimX2

Field voltage or current overexcitation limiter designed to protect the generator field of an AC machine with automatic excitation control from overheating due to prolonged overexcitation.

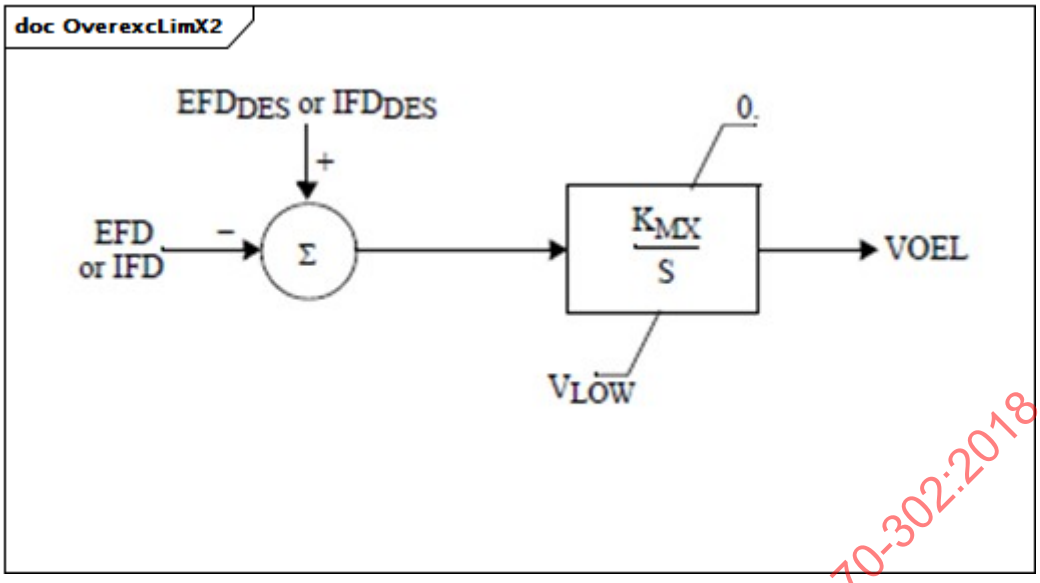

Figure 132 – OverexcLimX2

Figure 132: This diagram describes the OverexcLimX2 overexcitation limiter model.

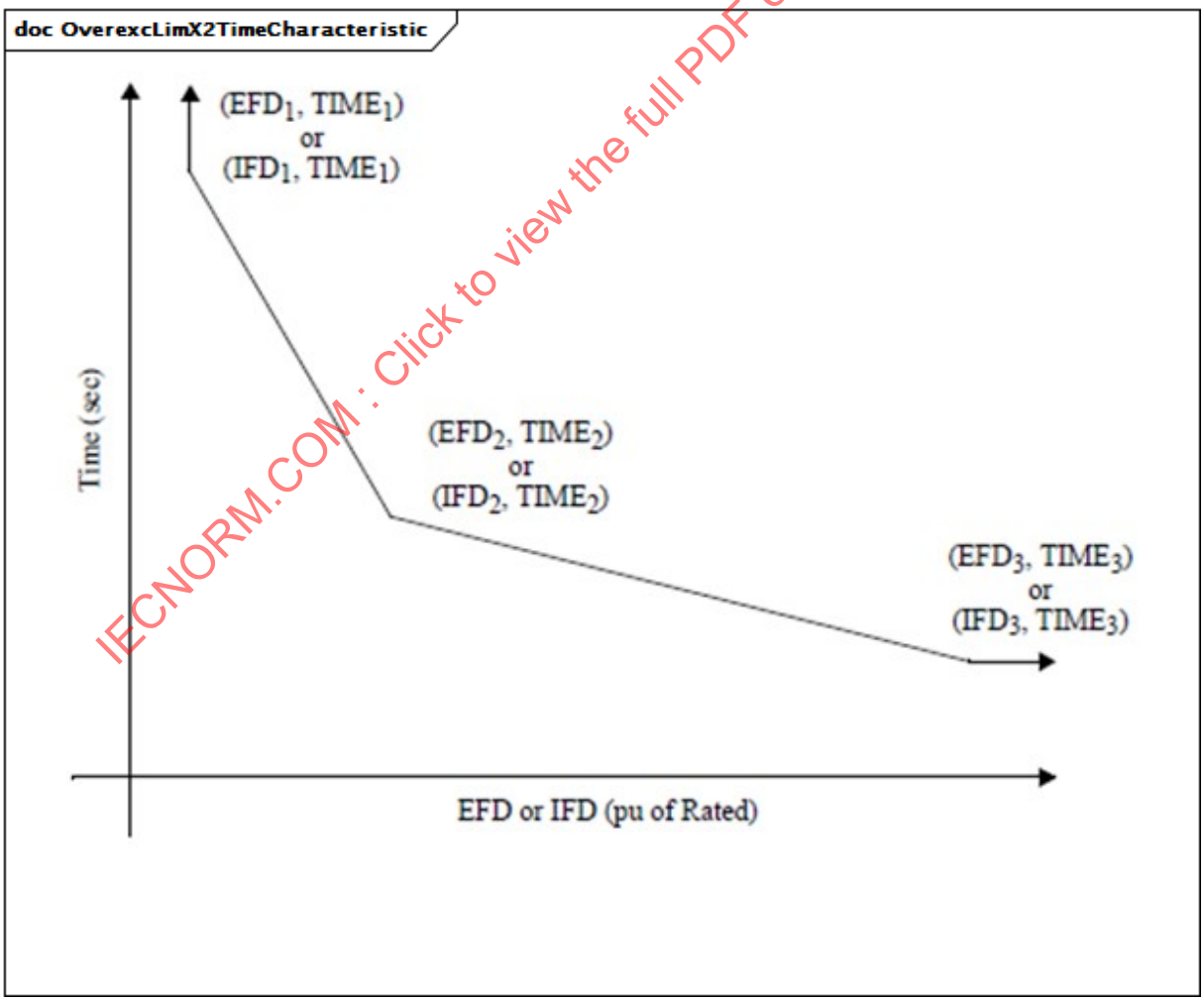

Figure 133 – OverexcLimX2TimeCharacteristic

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Figure 133: This model assumes an inverse time characteristic, where operating time is a function of the magnitude of the overvoltage.

Table 235 shows all attributes of OverexcLimX2.

Table 235 – Attributes of OverexcitationLimiterDynamics::OverexcLimX2

name	mult	type	description
m	0..1	Boolean	(m). true = IFD limiting false = EFD limiting.
efdrated	0..1	PU	Rated field voltage if m = false or rated field current if m = true (EFDRATED). Typical value = 1,05.
efd1	0..1	PU	Low voltage or current point on the inverse time characteristic (EFD1). Typical value = 1,1.
t1	0..1	Seconds	Time to trip the exciter at the low voltage or current point on the inverse time characteristic (TIME1) (>= 0). Typical value = 120.
efd2	0..1	PU	Mid voltage or current point on the inverse time characteristic (EFD2). Typical value = 1,2.
t2	0..1	Seconds	Time to trip the exciter at the mid voltage or current point on the inverse time characteristic (TIME2) (>= 0). Typical value = 40.
efd3	0..1	PU	High voltage or current point on the inverse time characteristic (EFD3). Typical value = 1,5.
t3	0..1	Seconds	Time to trip the exciter at the high voltage or current point on the inverse time characteristic (TIME3) (>= 0). Typical value = 15.
efddes	0..1	PU	Desired field voltage if m = false or desired field current if m = true (EFDDES). Typical value = 1.
kmx	0..1	PU	Gain (KMX). Typical value = 0,002.
vlow	0..1	PU	Low voltage limit (VLOW) (> 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 236 shows all association ends of OverexcLimX2 with other classes.

Table 236 – Association ends of OverexcitationLimiterDynamics::OverexcLimX2 with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: OverexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11 Package UnderexcitationLimiterDynamics

5.3.11.1 General

Underexcitation limiters (UELs) act to boost excitation. The UEL typically senses either a combination of voltage and current of the synchronous machine or a combination of real and

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reactive power. Some UELs utilize a temperature or pressure recalibration feature, in which the UEL characteristic is shifted depending upon the generator cooling gas temperature or pressure.

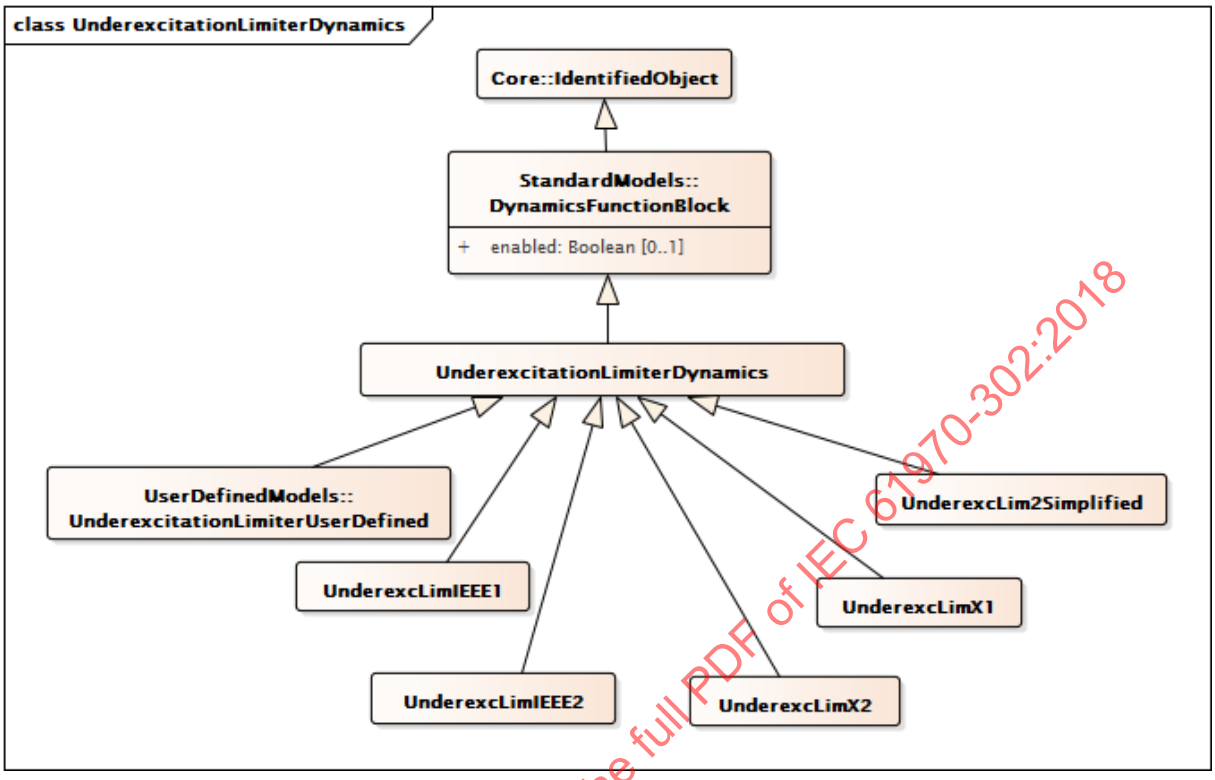

Figure 134 – Class diagram UnderexcitationLimiterDynamics::UnderexcitationLimiterDynamics

Figure 134: This diagram shows dynamic standard model underexcitation limiter classes and their inheritance from the UnderexcitationLimiterDynamics class.

5.3.11.2 UnderexcitationLimiterDynamics

Underexcitation limiter function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 237 shows all attributes of UnderexcitationLimiterDynamics.

Table 237 – Attributes of UnderexcitationLimiterDynamics::UnderexcitationLimiterDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 238 shows all association ends of UnderexcitationLimiterDynamics with other classes.

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Table 238 – Association ends of UnderexcitationLimiterDynamics::UnderexcitationLimiterDynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by this underexcitation limiter model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this underexcitation limiter model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11.3 UnderexcLimIEEE1

Type UEL1 model which has a circular limit boundary when plotted in terms of machine reactive power vs. real power output.

Reference: IEEE UEL1 421.5-2005, 10.1.

Table 239 shows all attributes of UnderexcLimIEEE1.

Table 239 – Attributes of UnderexcitationLimiterDynamics::UnderexcLimIEEE1

name	mult	type	description
kur	0..1	PU	UEL radius setting (KUR). Typical value = 1,95.
kuc	0..1	PU	UEL centre setting (KUC). Typical value = 1,38.
kuf	0..1	PU	UEL excitation system stabilizer gain (KUF). Typical value = 3,3.
vurmax	0..1	PU	UEL maximum limit for radius phasor magnitude (VURMAX). Typical value = 5,8.
vucmax	0..1	PU	UEL maximum limit for operating point phasor magnitude (VUCMAX). Typical value = 5,8.
kui	0..1	PU	UEL integral gain (KUI). Typical value = 0.
kul	0..1	PU	UEL proportional gain (KUL). Typical value = 100.
vuimax	0..1	PU	UEL integrator output maximum limit (VUIMAX) (> UnderexcLimIEEE1.vuimin).
vuimin	0..1	PU	UEL integrator output minimum limit (VUIMIN) (< UnderexcLimIEEE1.vuimax).
tu1	0..1	Seconds	UEL lead time constant (TU1) (>= 0). Typical value = 0.
tu2	0..1	Seconds	UEL lag time constant (TU2) (>= 0). Typical value = 0,05.
tu3	0..1	Seconds	UEL lead time constant (TU3) (>= 0). Typical value = 0.
tu4	0..1	Seconds	UEL lag time constant (TU4) (>= 0). Typical value = 0.
vulmax	0..1	PU	UEL output maximum limit (VULMAX) (> UnderexcLimIEEE1.vulmin). Typical value = 18.
vulmin	0..1	PU	UEL output minimum limit (VULMIN) (< UnderexcLimIEEE1.vulmax). Typical value = -18.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 240 shows all association ends of UnderexcLimIEEE1 with other classes.

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Table 240 – Association ends of UnderexcitationLimiterDynamics::UnderexcLimIEEE1 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11.4 UnderexcLimIEEE2

Type UEL2 underexcitation limiter which has either a straight-line or multi-segment characteristic when plotted in terms of machine reactive power output vs. real power output.

Reference: IEEE UEL2 421.5-2005, 10.2 (limit characteristic lookup table shown in Figure 10.4 (p 32)).

Table 241 shows all attributes of UnderexcLimIEEE2.

Table 241 – Attributes of UnderexcitationLimiterDynamics::UnderexcLimIEEE2

name	mult	type	description
tuv	0..1	Seconds	Voltage filter time constant (TUV) (>= 0). Typical value = 5.
tup	0..1	Seconds	Real power filter time constant (TUP) (>= 0). Typical value = 5.
tuq	0..1	Seconds	Reactive power filter time constant (TUQ) (>= 0). Typical value = 0.
kui	0..1	PU	UEL integral gain (KUI). Typical value = 0,5.
kul	0..1	PU	UEL proportional gain (KUL). Typical value = 0,8.
vuimax	0..1	PU	UEL integrator output maximum limit (VUIMAX) (> UnderexcLimIEEE2.vuimin). Typical value = 0,25.
vuimin	0..1	PU	UEL integrator output minimum limit (VUIMIN) (< UnderexcLimIEEE2.vuimax). Typical value = 0.
kuf	0..1	PU	UEL excitation system stabilizer gain (KUF). Typical value = 0.
kfb	0..1	PU	Gain associated with optional integrator feedback input signal to UEL (KFB). Typical value = 0.
tul	0..1	Seconds	Time constant associated with optional integrator feedback input signal to UEL (TUL) (>= 0). Typical value = 0.
tu1	0..1	Seconds	UEL lead time constant (TU1) (>= 0). Typical value = 0.
tu2	0..1	Seconds	UEL lag time constant (TU2) (>= 0). Typical value = 0.
tu3	0..1	Seconds	UEL lead time constant (TU3) (>= 0). Typical value = 0.
tu4	0..1	Seconds	UEL lag time constant (TU4) (>= 0). Typical value = 0.
vulmax	0..1	PU	UEL output maximum limit (VULMAX) (> UnderexcLimIEEE2.vulmin). Typical value = 0,25.
vulmin	0..1	PU	UEL output minimum limit (VULMIN) (< UnderexcLimIEEE2.vulmax). Typical value = 0.
p0	0..1	PU	Real power values for endpoints (P0). Typical value = 0.
q0	0..1	PU	Reactive power values for endpoints (Q0). Typical value = -0,31.
p1	0..1	PU	Real power values for endpoints (P1). Typical value = 0,3.
q1	0..1	PU	Reactive power values for endpoints (Q1). Typical value = -0,31.
p2	0..1	PU	Real power values for endpoints (P2). Typical value = 0,6.

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name	mult	type	description
q2	0..1	PU	Reactive power values for endpoints (Q2). Typical value = -0,28.
p3	0..1	PU	Real power values for endpoints (P3). Typical value = 0,9.
q3	0..1	PU	Reactive power values for endpoints (Q3). Typical value = -0,21.
p4	0..1	PU	Real power values for endpoints (P4). Typical value = 1,02.
q4	0..1	PU	Reactive power values for endpoints (Q4). Typical value = 0.
p5	0..1	PU	Real power values for endpoints (P5).
q5	0..1	PU	Reactive power values for endpoints (Q5).
p6	0..1	PU	Real power values for endpoints (P6).
q6	0..1	PU	Reactive power values for endpoints (Q6).
p7	0..1	PU	Real power values for endpoints (P7).
q7	0..1	PU	Reactive power values for endpoints (Q7).
p8	0..1	PU	Real power values for endpoints (P8).
q8	0..1	PU	Reactive power values for endpoints (Q8).
p9	0..1	PU	Real power values for endpoints (P9).
q9	0..1	PU	Reactive power values for endpoints (Q9).
p10	0..1	PU	Real power values for endpoints (P10).
q10	0..1	PU	Reactive power values for endpoints (Q10).
k1	0..1	Float	UEL terminal voltage exponent applied to real power input to UEL limit look-up table (k1). Typical value = 2.
k2	0..1	Float	UEL terminal voltage exponent applied to reactive power output from UEL limit look-up table (k2). Typical value = 2.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 242 shows all association ends of UnderexcLimIEEE2 with other classes.

Table 242 – Association ends of UnderexcitationLimiterDynamics::UnderexcLimIEEE2 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11.5 UnderexcLim2Simplified

Simplified type UEL2 underexcitation limiter. This model can be derived from UnderexcLimIEEE2. The limit characteristic (look –up table) is a single straight-line, the same as UnderexcLimIEEE2 (see Figure 10.4 (p 32), IEEE 421.5-2005 Section 10.2).

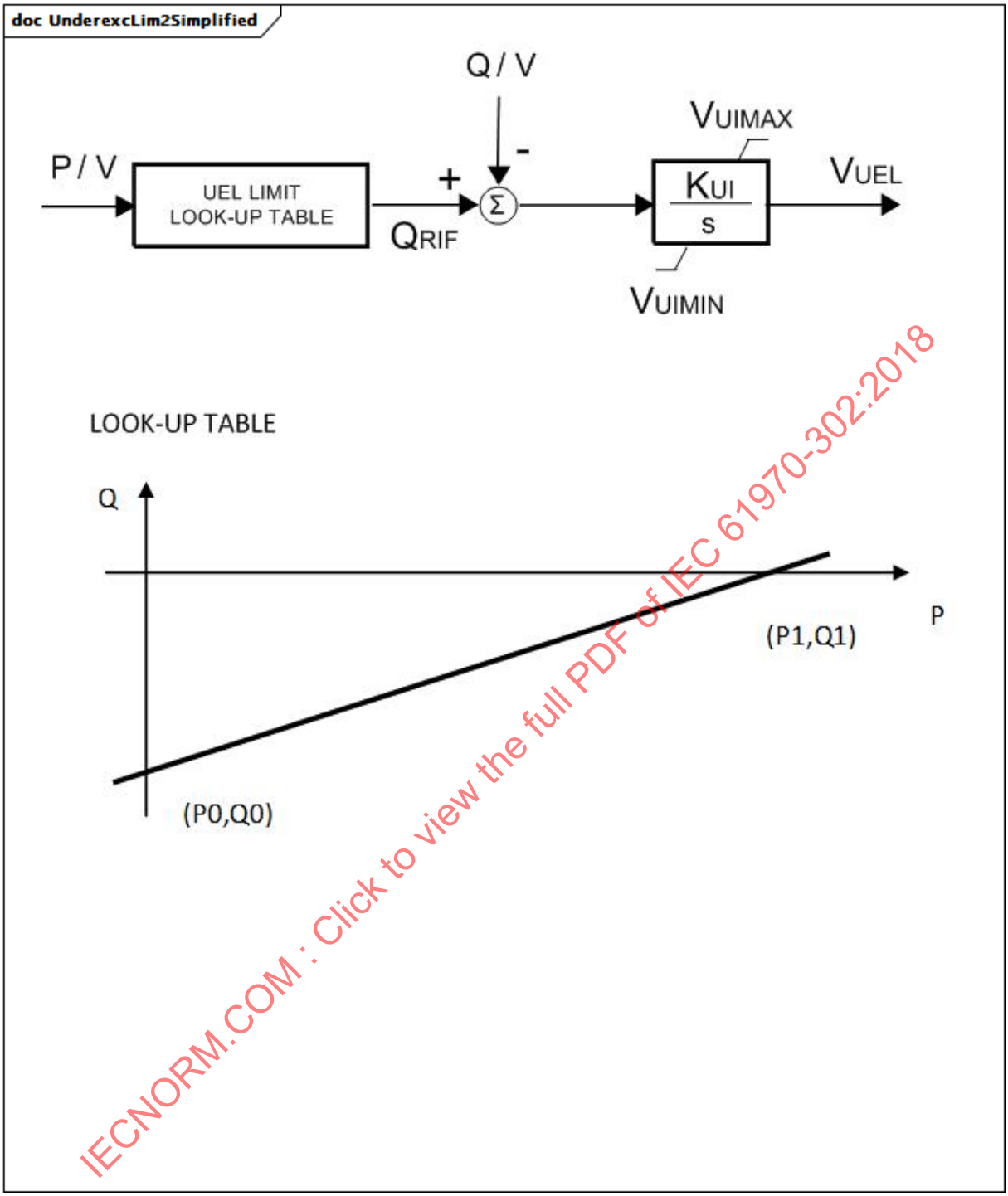

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Figure 135 – UnderexcLim2Simplified

Figure 135: This diagram describes the UnderexcLim2Simplified underexcitation limiter model.

Table 243 shows all attributes of UnderexcLim2Simplified.

Table 243 – Attributes of UnderexcitationLimiterDynamics::UnderexcLim2Simplified

name	mult	type	description
q0	0..1	PU	Segment Q initial point (Q0). Typical value = -0,31.
q1	0..1	PU	Segment Q end point (Q1). Typical value = -0,1.
p0	0..1	PU	Segment P initial point (P0). Typical value = 0.
p1	0..1	PU	Segment P end point (P1). Typical value = 1.
kui	0..1	PU	Gain Under excitation limiter (KUI). Typical value = 0,1.
vuimin	0..1	PU	Minimum error signal (VUIMIN) (< UnderexcLim2Simplified.vuimax). Typical value = 0.
vuimax	0..1	PU	Maximum error signal (VUIMAX) (> UnderexcLim2Simplified.vuimin). Typical value = 1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 244 shows all association ends of UnderexcLim2Simplified with other classes.

Table 244 – Association ends of UnderexcitationLimiterDynamics::UnderexcLim2Simplified with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11.6 UnderexcLimX1

Allis-Chalmers minimum excitation limiter.

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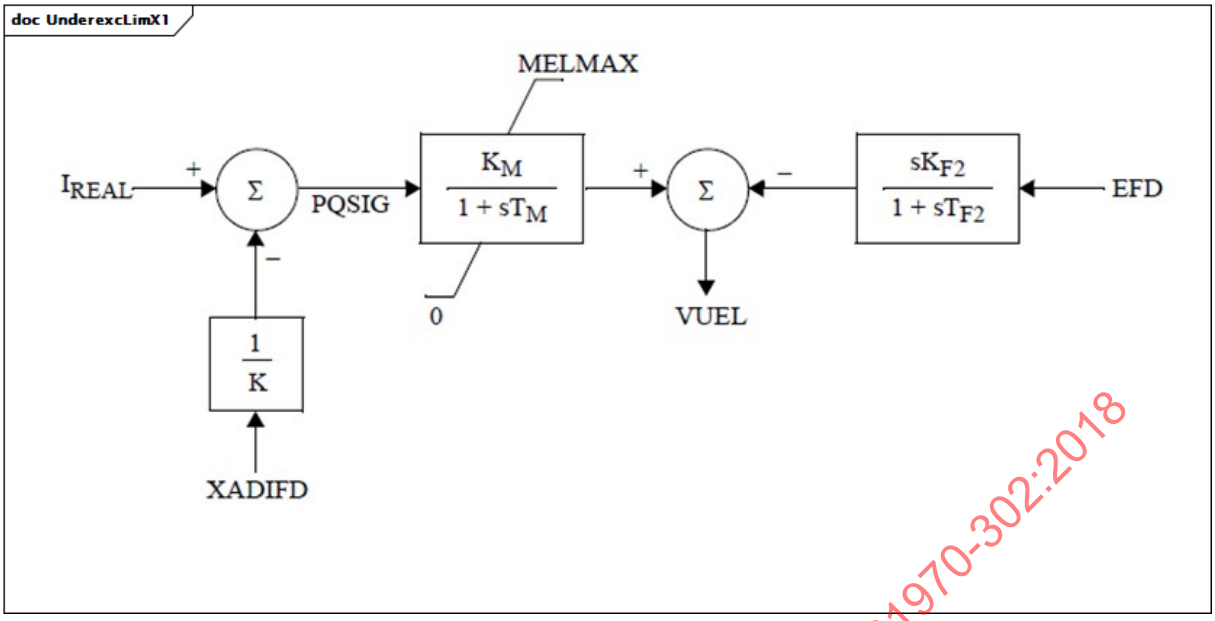

Figure 136 – UnderexcLimX1

Figure 136: This diagram describes the UnderexcLimX1 underexcitation limiter model.

Parameter details:

1) IREAL is the real part of stator current.
2) XADIFD is the signal Ifd as shown in the diagram of the SubtransientRoundRotor model, i.e. the XADIFD = E'q + [(E'q – psid) x (Xd – X'd) x (X'd – X"d) + Id x (Xd – X'd) x (X"d – Xl) x (X'd – Xl)] / (X'd – Xl) ** 2, where the psi in psid is the Greek symbol psi.

Table 245 shows all attributes of UnderexcLimX1.

Table 245 – Attributes of UnderexcitationLimiterDynamics::UnderexcLimX1

name	mult	type	description
kf2	0..1	PU	Differential gain (KF2).
tf2	0..1	Seconds	Differential time constant (TF2) (>= 0).
km	0..1	PU	Minimum excitation limit gain (KM).
tm	0..1	Seconds	Minimum excitation limit time constant (TM) (>= 0).
melmax	0..1	PU	Minimum excitation limit value (MELMAX).
k	0..1	PU	Minimum excitation limit slope (K) (> 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 246 shows all association ends of UnderexcLimX1 with other classes.

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Table 246 – Association ends of UnderexcitationLimiterDynamics::UnderexcLimX1 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.11.7 UnderexcLimX2

Westinghouse minimum excitation limiter.

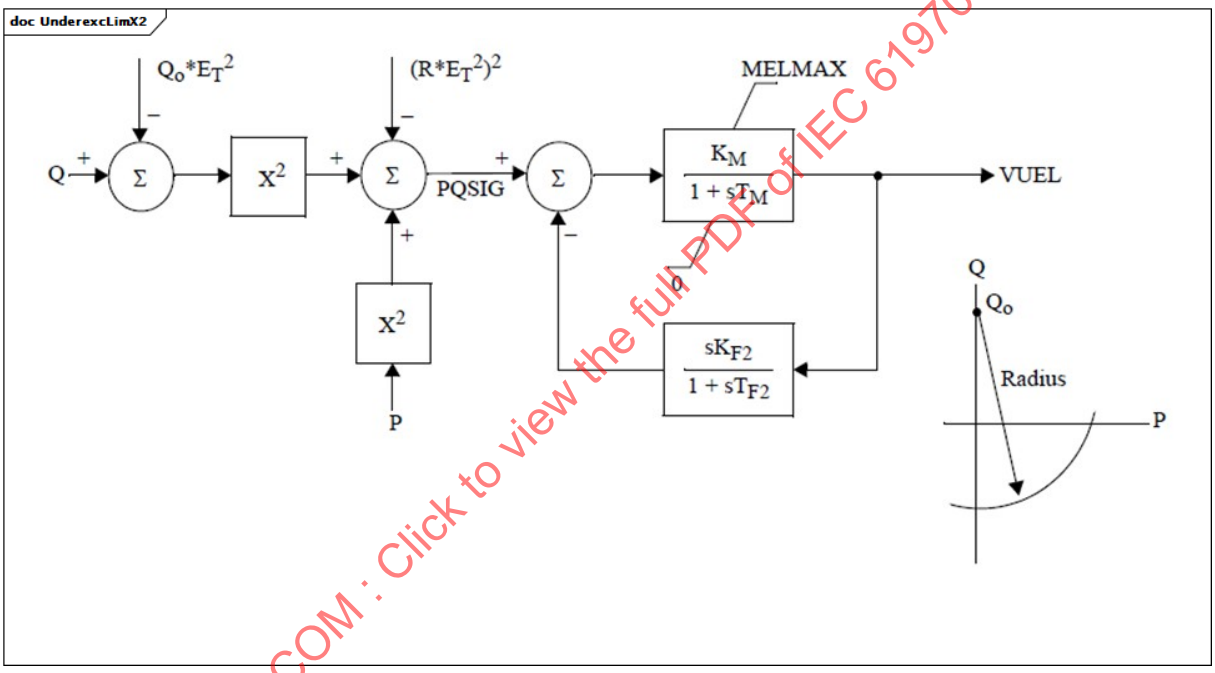

Figure 137 – UnderexcLimX2

Figure 137: This diagram describes the UnderexcLimX2 underexcitation limiter model.

Table 247 shows all attributes of UnderexcLimX2.

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Table 247 – Attributes of UnderexcitationLimiterDynamics::UnderexcLimX2

name	mult	type	description
kf2	0..1	PU	Differential gain (KF2).
tf2	0..1	Seconds	Differential time constant (TF2) (>= 0).
km	0..1	PU	Minimum excitation limit gain (KM).
tm	0..1	Seconds	Minimum excitation limit time constant (TM) (>= 0).
melmax	0..1	PU	Minimum excitation limit value (MELMAX).
qo	0..1	PU	Excitation centre setting (QO).
r	0..1	PU	Excitation radius (R).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 248 shows all association ends of UnderexcLimX2 with other classes.

Table 248 – Association ends of UnderexcitationLimiterDynamics::UnderexcLimX2 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12 Package PowerSystemStabilizerDynamics

5.3.12.1 General

The power system stabilizer (PSS) model provides an input (Vs) to the excitation system model to improve damping of system oscillations. A variety of input signals can be used depending on the particular design.

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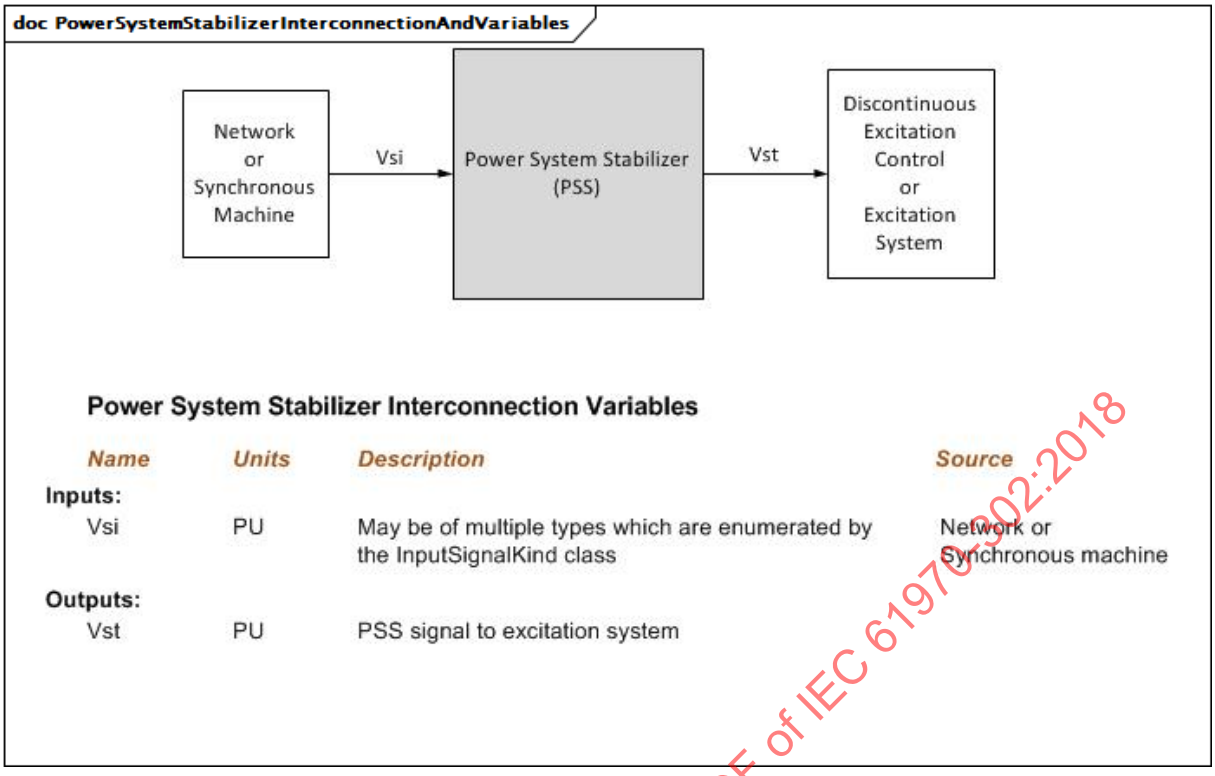

Power System Stabilizer Interconnection Variables

Name	*Units*	*Description*	*Source*
Inputs:			
Vsi	PU	May be of multiple types which are enumerated by the InputSignalKind class	Network or Synchronous machine
Outputs:			
Vst	PU	PSS signal to excitation system	

Figure 138 – PowerSystemStabilizerInterconnectionAndVariables

Figure 138: This diagram illustrates the inputs and outputs for a power system stabilizer.

Diagram details:

1) If there is no discontinuous excitation control function block present, then output is Vs, not Vst
2) Vs is always initialized to zero by the excitation system model.
3) If bus voltage frequency is not available from network, the model can calculate it as derivative of the bus voltage angle.

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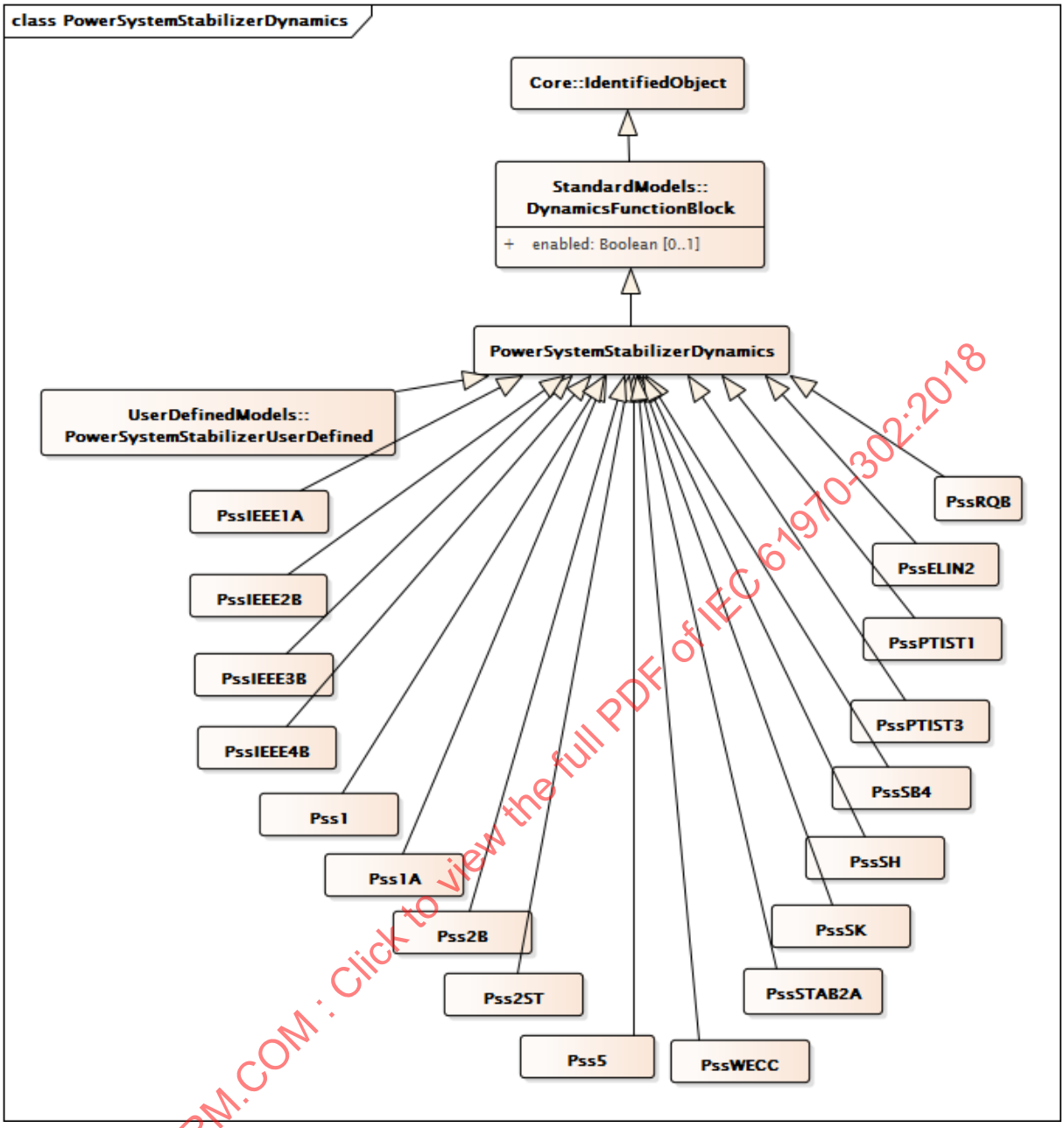

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Figure 139 – Class diagram
PowerSystemStabilizerDynamics::PowerSystemStabilizerDynamics

Figure 139: This diagram shows dynamic standard model power system stabilizer classes and their inheritance from the PowerSystemStabilizerDynamics class.

5.3.12.2 PowerSystemStabilizerDynamics

Power system stabilizer function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 249 shows all attributes of PowerSystemStabilizerDynamics.

Table 249 – Attributes of PowerSystemStabilizerDynamics::PowerSystemStabilizerDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 250 shows all association ends of PowerSystemStabilizerDynamics with other classes.

Table 250 – Association ends of PowerSystemStabilizerDynamics::PowerSystemStabilizerDynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	Remote input signal used by this power system stabilizer model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this power system stabilizer model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.3 PssIEEE1A

IEEE 421.5-2005 type PSS1A power system stabilizer model. PSS1A is the generalized form of a PSS with a single input signal.

Reference: IEEE 1A 421.5-2005, 8.1.

Table 251 shows all attributes of PssIEEE1A.

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Table 251 – Attributes of PowerSystemStabilizerDynamics::PssIEEE1A

name	mult	type	description
inputSignalType	0..1	InputSignalKind	Type of input signal (rotorAngularFrequencyDeviation, generatorElectricalPower, or busFrequencyDeviation). Typical value = rotorAngularFrequencyDeviation.
a1	0..1	PU	PSS signal conditioning frequency filter constant (A1). Typical value = 0,061.
a2	0..1	PU	PSS signal conditioning frequency filter constant (A2). Typical value = 0,0017.
t1	0..1	Seconds	Lead/lag time constant (T1) (>= 0). Typical value = 0,3.
t2	0..1	Seconds	Lead/lag time constant (T2) (>= 0). Typical value = 0,03.
t3	0..1	Seconds	Lead/lag time constant (T3) (>= 0). Typical value = 0,3.
t4	0..1	Seconds	Lead/lag time constant (T4) (>= 0). Typical value = 0,03.
t5	0..1	Seconds	Washout time constant (T5) (>= 0). Typical value = 10.
t6	0..1	Seconds	Transducer time constant (T6) (>= 0). Typical value = 0,01.
ks	0..1	PU	Stabilizer gain (Ks). Typical value = 5.
vrmax	0..1	PU	Maximum stabilizer output (Vrmax) (> PssIEEE1A.vrmin). Typical value = 0,05.
vrmin	0..1	PU	Minimum stabilizer output (Vrmin) (< PssIEEE1A.vrmax). Typical value = -0,05.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 252 shows all association ends of PssIEEE1A with other classes.

Table 252 – Association ends of PowerSystemStabilizerDynamics::PssIEEE1A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.4 PssIEEE2B

IEEE 421.5-2005 type PSS2B power system stabilizer model. This stabilizer model is designed to represent a variety of dual-input stabilizers, which normally use combinations of power and speed or frequency to derive the stabilizing signal.

Reference: IEEE 2B 421.5-2005, 8.2.

Table 253 shows all attributes of PssIEEE2B.

Table 253 – Attributes of PowerSystemStabilizerDynamics::PssIEEE2B

name	mult	type	description
inputSignal1Type	0..1	InputSignalKind	Type of input signal #1 (rotorAngularFrequencyDeviation, busFrequencyDeviation). Typical value = rotorAngularFrequencyDeviation.
inputSignal2Type	0..1	InputSignalKind	Type of input signal #2 (generatorElectricalPower). Typical value = generatorElectricalPower.
vsi1max	0..1	PU	Input signal #1 maximum limit (Vsi1max) (> PssIEEE2B.vsi1min). Typical value = 2.
vsi1min	0..1	PU	Input signal #1 minimum limit (Vsi1min) (< PssIEEE2B.vsi1max). Typical value = -2.
tw1	0..1	Seconds	First washout on signal #1 (Tw1) (>= 0). Typical value = 2.
tw2	0..1	Seconds	Second washout on signal #1 (Tw2) (>= 0). Typical value = 2.
vsi2max	0..1	PU	Input signal #2 maximum limit (Vsi2max) (> PssIEEE2B.vsi2min). Typical value = 2.
vsi2min	0..1	PU	Input signal #2 minimum limit (Vsi2min) (< PssIEEE2B.vsi2max). Typical value = -2.
tw3	0..1	Seconds	First washout on signal #2 (Tw3) (>= 0). Typical value = 2.
tw4	0..1	Seconds	Second washout on signal #2 (Tw4) (>= 0). Typical value = 0.
t1	0..1	Seconds	Lead/lag time constant (T1) (>= 0). Typical value = 0,12.
t2	0..1	Seconds	Lead/lag time constant (T2) (>= 0). Typical value = 0,02.
t3	0..1	Seconds	Lead/lag time constant (T3) (>= 0). Typical value = 0,3.
t4	0..1	Seconds	Lead/lag time constant (T4) (>= 0). Typical value = 0,02.
t6	0..1	Seconds	Time constant on signal #1 (T6) (>= 0). Typical value = 0.
t7	0..1	Seconds	Time constant on signal #2 (T7) (>= 0). Typical value = 2.
t8	0..1	Seconds	Lead of ramp tracking filter (T8) (>= 0). Typical value = 0,2.
t9	0..1	Seconds	Lag of ramp tracking filter (T9) (>= 0). Typical value = 0,1.
t10	0..1	Seconds	Lead/lag time constant (T10) (>= 0). Typical value = 0.
t11	0..1	Seconds	Lead/lag time constant (T11) (>= 0). Typical value = 0.
ks1	0..1	PU	Stabilizer gain (Ks1). Typical value = 12.
ks2	0..1	PU	Gain on signal #2 (Ks2). Typical value = 0,2.
ks3	0..1	PU	Gain on signal #2 input before ramp-tracking filter (Ks3). Typical value = 1.
n	0..1	Integer	Order of ramp tracking filter (N). Typical value = 1.
m	0..1	Integer	Denominator order of ramp tracking filter (M). Typical value = 5.
vstmax	0..1	PU	Stabilizer output maximum limit (Vstmax) (> PssIEEE2B.vstmin). Typical value = 0,1.
vstmin	0..1	PU	Stabilizer output minimum limit (Vstmin) (< PssIEEE2B.vstmax). Typical value = -0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 254 shows all association ends of PssIEEE2B with other classes.

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Table 254 – Association ends of PowerSystemStabilizerDynamics::PssIEEE2B with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.5 PssIEEE3B

IEEE 421.5-2005 type PSS3B power system stabilizer model. The PSS model PSS3B has dual inputs of electrical power and rotor angular frequency deviation. The signals are used to derive an equivalent mechanical power signal.

This model has 2 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): the first one is of rotorAngleFrequencyDeviation type and the second one is of generatorElectricalPower type.

Reference: IEEE 3B 421.5-2005, 8.3.

Table 255 shows all attributes of PssIEEE3B.

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Table 255 – Attributes of PowerSystemStabilizerDynamics::PssIEEE3B

name	mult	type	description
t1	0..1	Seconds	Transducer time constant (T1) (>= 0). Typical value = 0,012.
t2	0..1	Seconds	Transducer time constant (T2) (>= 0). Typical value = 0,012.
tw1	0..1	Seconds	Washout time constant (Tw1) (>= 0). Typical value = 0,3.
tw2	0..1	Seconds	Washout time constant (Tw2) (>= 0). Typical value = 0,3.
tw3	0..1	Seconds	Washout time constant (Tw3) (>= 0). Typical value = 0,6.
ks1	0..1	PU	Gain on signal # 1 (Ks1). Typical value = -0,602.
ks2	0..1	PU	Gain on signal # 2 (Ks2). Typical value = 30,12.
a1	0..1	PU	Notch filter parameter (A1). Typical value = 0,359.
a2	0..1	PU	Notch filter parameter (A2). Typical value = 0,586.
a3	0..1	PU	Notch filter parameter (A3). Typical value = 0,429.
a4	0..1	PU	Notch filter parameter (A4). Typical value = 0,564.
a5	0..1	PU	Notch filter parameter (A5). Typical value = 0,001.
a6	0..1	PU	Notch filter parameter (A6). Typical value = 0.
a7	0..1	PU	Notch filter parameter (A7). Typical value = 0,031.
a8	0..1	PU	Notch filter parameter (A8). Typical value = 0.
vstmax	0..1	PU	Stabilizer output maximum limit (Vstmax) (> PssIEEE3B.vstmin). Typical value = 0,1.
vstmin	0..1	PU	Stabilizer output minimum limit (Vstmin) (< PssIEEE3B.vstmax). Typical value = -0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 256 shows all association ends of PssIEEE3B with other classes.

Table 256 – Association ends of PowerSystemStabilizerDynamics::PssIEEE3B with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.6 PssIEEE4B

IEEE 421.5-2005 type PSS4B power system stabilizer. The PSS4B model represents a structure based on multiple working frequency bands. Three separate bands, respectively dedicated to the low-, intermediate- and high-frequency modes of oscillations, are used in this delta omega (speed input) PSS.

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There is an error in the in IEEE 421.5-2005 PSS4B model: the Pe input should read –Pe. This implies that the input Pe needs to be multiplied by -1.

Reference: IEEE 4B 421.5-2005, 8.4.

Parameter details:

This model has 2 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): the first one is of rotorAngleFrequencyDeviation type and the second one is of generatorElectricalPower type.

Table 257 shows all attributes of PssIEEE4B.

Table 257 – Attributes of PowerSystemStabilizerDynamics::PssIEEE4B

name	mult	type	description
bwh1	0..1	Float	Notch filter 1 (high-frequency band): three dB bandwidth (Bwi).
bwh2	0..1	Float	Notch filter 2 (high-frequency band): three dB bandwidth (Bwi).
bwl1	0..1	Float	Notch filter 1 (low-frequency band): three dB bandwidth (Bwi).
bwl2	0..1	Float	Notch filter 2 (low-frequency band): three dB bandwidth (Bwi).
kh	0..1	PU	High band gain (KH). Typical value = 120.
kh1	0..1	PU	High band differential filter gain (KH1). Typical value = 66.
kh11	0..1	PU	High band first lead-lag blocks coefficient (KH11). Typical value = 1.
kh17	0..1	PU	High band first lead-lag blocks coefficient (KH17). Typical value = 1.
kh2	0..1	PU	High band differential filter gain (KH2). Typical value = 66.
ki	0..1	PU	Intermediate band gain (KI). Typical value = 30.
ki1	0..1	PU	Intermediate band differential filter gain (KI1). Typical value = 66.
ki11	0..1	PU	Intermediate band first lead-lag blocks coefficient (KI11). Typical value = 1.
ki17	0..1	PU	Intermediate band first lead-lag blocks coefficient (KI17). Typical value = 1.
ki2	0..1	PU	Intermediate band differential filter gain (KI2). Typical value = 66.
kl	0..1	PU	Low band gain (KL). Typical value = 7.5.
kl1	0..1	PU	Low band differential filter gain (KL1). Typical value = 66.
kl11	0..1	PU	Low band first lead-lag blocks coefficient (KL11). Typical value = 1.
kl17	0..1	PU	Low band first lead-lag blocks coefficient (KL17). Typical value = 1.
kl2	0..1	PU	Low band differential filter gain (KL2). Typical value = 66.
omeganh1	0..1	Float	Notch filter 1 (high-frequency band): filter frequency (omegani).
omeganh2	0..1	Float	Notch filter 2 (high-frequency band): filter frequency (omegani).
omeganl1	0..1	Float	Notch filter 1 (low-frequency band): filter frequency (omegani).
omeganl2	0..1	Float	Notch filter 2 (low-frequency band): filter frequency (omegani).
th1	0..1	Seconds	High band time constant (TH1) (>= 0). Typical value = 0,01513.
th10	0..1	Seconds	High band time constant (TH10) (>= 0). Typical value = 0.
th11	0..1	Seconds	High band time constant (TH11) (>= 0). Typical value = 0.
th12	0..1	Seconds	High band time constant (TH12) (>= 0). Typical value = 0.
th2	0..1	Seconds	High band time constant (TH2) (>= 0). Typical value = 0,01816.
th3	0..1	Seconds	High band time constant (TH3) (>= 0). Typical value = 0.
th4	0..1	Seconds	High band time constant (TH4) (>= 0). Typical value = 0.
th5	0..1	Seconds	High band time constant (TH5) (>= 0). Typical value = 0.
th6	0..1	Seconds	High band time constant (TH6) (>= 0). Typical value = 0.

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name	mult	type	description
th7	0..1	Seconds	High band time constant (TH7) (>= 0). Typical value = 0,01816.
th8	0..1	Seconds	High band time constant (TH8) (>= 0). Typical value = 0,02179.
th9	0..1	Seconds	High band time constant (TH9) (>= 0). Typical value = 0.
ti1	0..1	Seconds	Intermediate band time constant (TI1) (>= 0). Typical value = 0,173.
ti10	0..1	Seconds	Intermediate band time constant (TI10) (>= 0). Typical value = 0.
ti11	0..1	Seconds	Intermediate band time constant (TI11) (>= 0). Typical value = 0.
ti12	0..1	Seconds	Intermediate band time constant (TI12) (>= 0). Typical value = 0.
ti2	0..1	Seconds	Intermediate band time constant (TI2) (>= 0). Typical value = 0,2075.
ti3	0..1	Seconds	Intermediate band time constant (TI3) (>= 0). Typical value = 0.
ti4	0..1	Seconds	Intermediate band time constant (TI4) (>= 0). Typical value = 0.
ti5	0..1	Seconds	Intermediate band time constant (TI5) (>= 0). Typical value = 0.
ti6	0..1	Seconds	Intermediate band time constant (TI6) (>= 0). Typical value = 0.
ti7	0..1	Seconds	Intermediate band time constant (TI7) (>= 0). Typical value = 0,2075.
ti8	0..1	Seconds	Intermediate band time constant (TI8) (>= 0). Typical value = 0,2491.
ti9	0..1	Seconds	Intermediate band time constant (TI9) (>= 0). Typical value = 0.
tl1	0..1	Seconds	Low band time constant (TL1) (>= 0). Typical value = 1,73.
tl10	0..1	Seconds	Low band time constant (TL10) (>= 0). Typical value = 0.
tl11	0..1	Seconds	Low band time constant (TL11) (>= 0). Typical value = 0.
tl12	0..1	Seconds	Low band time constant (TL12) (>= 0). Typical value = 0.
tl2	0..1	Seconds	Low band time constant (TL2) (>= 0). Typical value = 2,075.
tl3	0..1	Seconds	Low band time constant (TL3) (>= 0). Typical value = 0.
tl4	0..1	Seconds	Low band time constant (TL4) (>= 0). Typical value = 0.
tl5	0..1	Seconds	Low band time constant (TL5) (>= 0). Typical value = 0.
tl6	0..1	Seconds	Low band time constant (TL6) (>= 0). Typical value = 0.
tl7	0..1	Seconds	Low band time constant (TL7) (>= 0). Typical value = 2,075.
tl8	0..1	Seconds	Low band time constant (TL8) (>= 0). Typical value = 2,491.
tl9	0..1	Seconds	Low band time constant (TL9) (>= 0). Typical value = 0.
vhmax	0..1	PU	High band output maximum limit (VHmax) (> PssIEEE4B.vhmin). Typical value = 0,6.
vhmin	0..1	PU	High band output minimum limit (VHmin) (< PssIEEE4V.vhmax). Typical value = -0,6.
vimax	0..1	PU	Intermediate band output maximum limit (VImax) (> PssIEEE4B.vimin). Typical value = 0,6.
vimin	0..1	PU	Intermediate band output minimum limit (VImin) (< PssIEEE4B.vimax). Typical value = -0,6.
vlmax	0..1	PU	Low band output maximum limit (VLmax) (> PssIEEE4B.vlmin). Typical value = 0,075.
vlmin	0..1	PU	Low band output minimum limit (VLmin) (< PssIEEE4B.vlmax). Typical value = -0,075.
vstmax	0..1	PU	PSS output maximum limit (VSTmax) (> PssIEEE4B.vstmin). Typical value = 0,15.
vstmin	0..1	PU	PSS output minimum limit (VSTmin) (< PssIEEE4B.vstmax). Typical value = -0,15.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 258 shows all association ends of PssIEEE4B with other classes.

Table 258 – Association ends of PowerSystemStabilizerDynamics::PssIEEE4B with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.7 Pss1

Italian PSS with three inputs (speed, frequency, power).

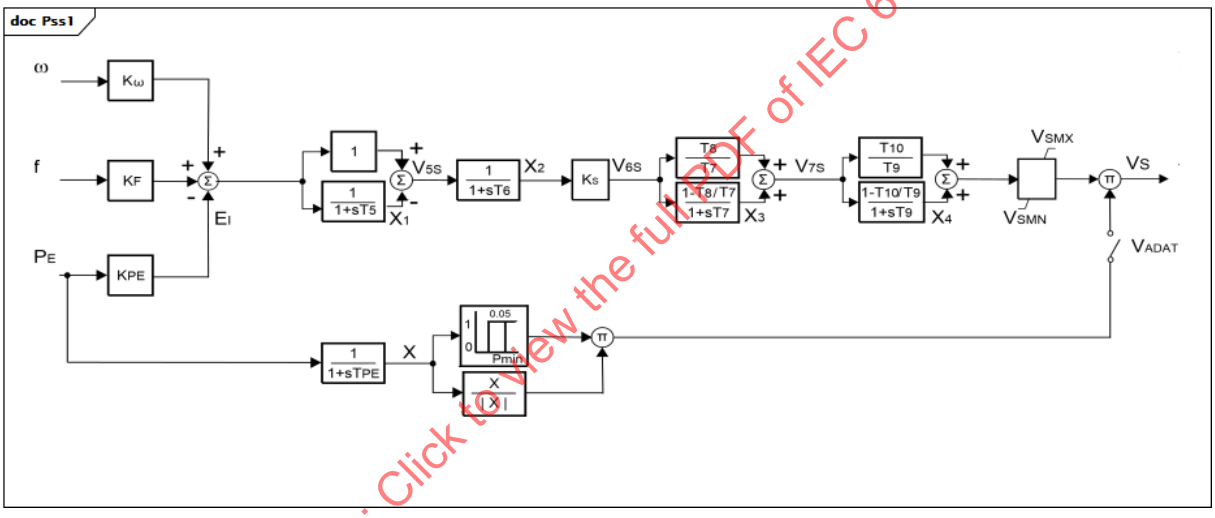

Figure 140 – Pss1

Figure 140: This diagram describes the Pss1 power system stabilizer model.

Parameter details:

1) This model has 3 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): omega is of rotorSpeed type, f is of busFrequency type, and PE is of generatorElectricalPower type.
2) X is not a parameter, but rather an input signal to the block [X /|X|]. The block reflects the sign of Pe. When Pe is negative (for example, for a unit in pumping mode), the output of the block [X /|X|] is negative. When Pe is positive, the output of the block is positive.

Table 259 shows all attributes of Pss1.

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Table 259 – Attributes of PowerSystemStabilizerDynamics::Pss1

name	mult	type	description
komega	0..1	Float	Shaft speed power input gain (Komega). Typical value = 0.
kf	0..1	Float	Frequency power input gain (KF). Typical value = 5.
kpe	0..1	Float	Electric power input gain (KPE). Typical value = 0,3.
pmin	0..1	PU	Minimum power PSS enabling (Pmin). Typical value = 0,25.
ks	0..1	Float	PSS gain (Ks). Typical value = 1.
vsmn	0..1	PU	Stabilizer output maximum limit (VSMN). Typical value = -0,06.
vsmx	0..1	PU	Stabilizer output minimum limit (VSMX). Typical value = 0,06.
tpe	0..1	Seconds	Electric power filter time constant (TPE) (>= 0). Typical value = 0,05.
t5	0..1	Seconds	Washout (T5) (>= 0). Typical value = 3,5.
t6	0..1	Seconds	Filter time constant (T6) (>= 0). Typical value = 0.
t7	0..1	Seconds	Lead/lag time constant (T7) (>= 0). If = 0, both blocks are bypassed. Typical value = 0.
t8	0..1	Seconds	Lead/lag time constant (T8) (>= 0). Typical value = 0.
t9	0..1	Seconds	Lead/lag time constant (T9) (>= 0). If = 0, both blocks are bypassed. Typical value = 0.
t10	0..1	Seconds	Lead/lag time constant (T10) (>= 0). Typical value = 0.
vadat	0..1	Boolean	Signal selector (VADAT). true = closed (generator power is greater than Pmin) false = open (Pe is smaller than Pmin). Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 260 shows all association ends of Pss1 with other classes.

Table 260 – Association ends of PowerSystemStabilizerDynamics::Pss1 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.8 Pss1A

Single input power system stabilizer. It is a modified version in order to allow representation of various vendors' implementations on PSS type 1A.

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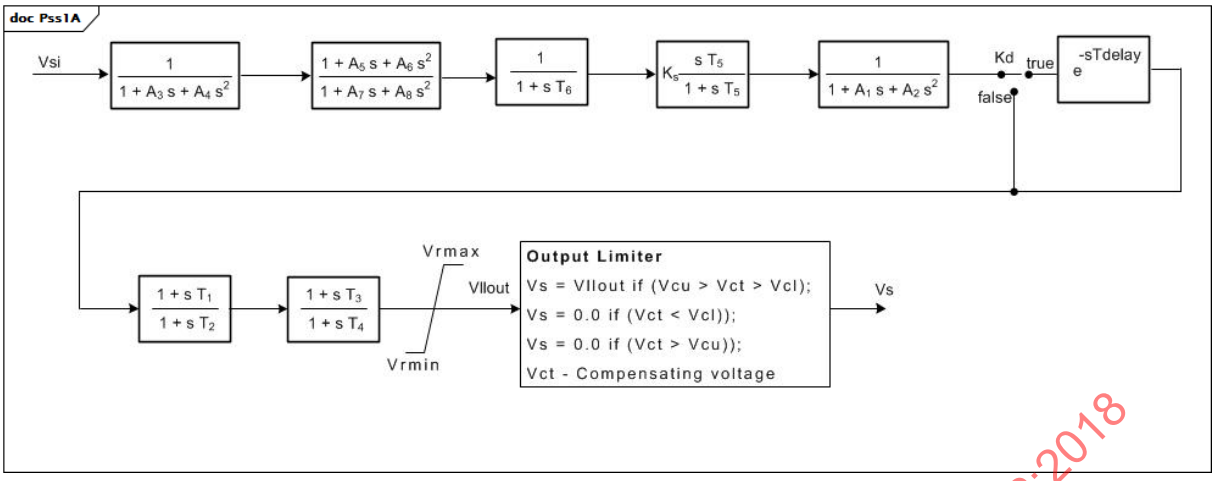

Figure 141 – Pss1A

Figure 141: This diagram describes the Pss1A power system stabilizer model.

Table 261 shows all attributes of Pss1A.

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Table 261 – Attributes of PowerSystemStabilizerDynamics::Pss1A

name	mult	type	description
inputSignalType	0..1	InputSignalKind	Type of input signal (rotorAngularFrequencyDeviation, busFrequencyDeviation, generatorElectricalPower, generatorAcceleratingPower, busVoltage, or busVoltageDerivative).
a1	0..1	PU	Notch filter parameter (A1).
a2	0..1	PU	Notch filter parameter (A2).
t1	0..1	Seconds	Lead/lag time constant (T1) (>= 0).
t2	0..1	Seconds	Lead/lag time constant (T2) (>= 0).
t3	0..1	Seconds	Lead/lag time constant (T3) (>= 0).
t4	0..1	Seconds	Lead/lag time constant (T4) (>= 0).
t5	0..1	Seconds	Washout time constant (T5) (>= 0).
t6	0..1	Seconds	Transducer time constant (T6) (>= 0).
ks	0..1	PU	Stabilizer gain (Ks).
vrmax	0..1	PU	Maximum stabilizer output (Vrmax) (> Pss1A.vrmin).
vrmin	0..1	PU	Minimum stabilizer output (Vrmin) (< Pss1A.vrmax).
vcu	0..1	PU	Stabilizer input cutoff threshold (Vcu).
vcl	0..1	PU	Stabilizer input cutoff threshold (Vcl).
a3	0..1	PU	Notch filter parameter (A3).
a4	0..1	PU	Notch filter parameter (A4).
a5	0..1	PU	Notch filter parameter (A5).
a6	0..1	PU	Notch filter parameter (A6).
a7	0..1	PU	Notch filter parameter (A7).
a8	0..1	PU	Notch filter parameter (A8).
kd	0..1	Boolean	Selector (Kd). true = e-sTdelay used false = e-sTdelay not used.
tdelay	0..1	Seconds	Time constant (Tdelay) (>= 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 262 shows all association ends of Pss1A with other classes.

Table 262 – Association ends of PowerSystemStabilizerDynamics::Pss1A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.9 Pss2B

Modified IEEE PSS2B. Extra lead/lag (or rate) block added at end (up to 4 lead/lags total).

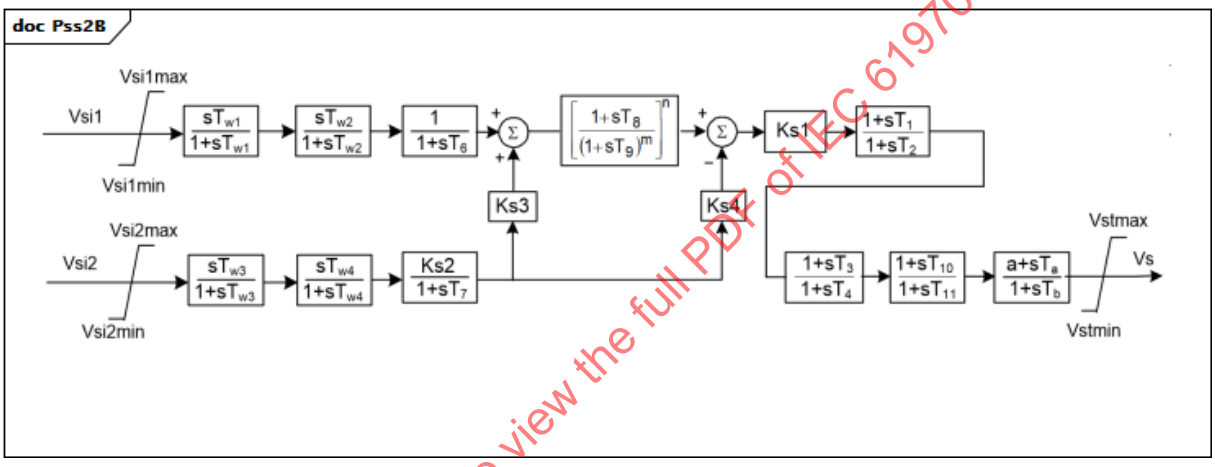

Figure 142 – Pss2B

Figure 142: This diagram describes the Pss2B power system stabilizer model.

Parameter details:

1) This model has 2 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): Vsi1 is of rotorSpeed type and Vsi2 is of generatorElectricalPower type.

Table 263 shows all attributes of Pss2B.

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Table 263 – Attributes of PowerSystemStabilizerDynamics::Pss2B

name	mult	type	description
vsi1max	0..1	PU	Input signal #1 maximum limit (Vsi1max) (> Pss2B.vsi1min). Typical value = 2.
vsi1min	0..1	PU	Input signal #1 minimum limit (Vsi1min) (< Pss2B.vsi1max). Typical value = -2.
tw1	0..1	Seconds	First washout on signal #1 (Tw1) (>= 0). Typical value = 2.
tw2	0..1	Seconds	Second washout on signal #1 (Tw2) (>= 0). Typical value = 2.
vsi2max	0..1	PU	Input signal #2 maximum limit (Vsi2max) (> Pss2B.vsi2min). Typical value = 2.
vsi2min	0..1	PU	Input signal #2 minimum limit (Vsi2min) (< Pss2B.vsi2max). Typical value = -2.
tw3	0..1	Seconds	First washout on signal #2 (Tw3) (>= 0). Typical value = 2.
tw4	0..1	Seconds	Second washout on signal #2 (Tw4) (>= 0). Typical value = 0.
t1	0..1	Seconds	Lead/lag time constant (T1) (>= 0). Typical value = 0,12.
t2	0..1	Seconds	Lead/lag time constant (T2) (>= 0). Typical value = 0,02.
t3	0..1	Seconds	Lead/lag time constant (T3) (>= 0). Typical value = 0,3.
t4	0..1	Seconds	Lead/lag time constant (T4) (>= 0). Typical value = 0,02.
t6	0..1	Seconds	Time constant on signal #1 (T6) (>= 0). Typical value = 0.
t7	0..1	Seconds	Time constant on signal #2 (T7) (>= 0). Typical value = 2.
t8	0..1	Seconds	Lead of ramp tracking filter (T8) (>= 0). Typical value = 0,2.
t9	0..1	Seconds	Lag of ramp tracking filter (T9) (>= 0). Typical value = 0,1.
t10	0..1	Seconds	Lead/lag time constant (T10) (>= 0). Typical value = 0.
t11	0..1	Seconds	Lead/lag time constant (T11) (>= 0). Typical value = 0.
ks1	0..1	PU	Stabilizer gain (Ks1). Typical value = 12.
ks2	0..1	PU	Gain on signal #2 (Ks2). Typical value = 0,2.
ks3	0..1	PU	Gain on signal #2 input before ramp-tracking filter (Ks3). Typical value = 1.
ks4	0..1	PU	Gain on signal #2 input after ramp-tracking filter (Ks4). Typical value = 1.
n	0..1	Integer	Order of ramp tracking filter (n). Typical value = 1.
m	0..1	Integer	Denominator order of ramp tracking filter (m). Typical value = 5.
vstmax	0..1	PU	Stabilizer output maximum limit (Vstmax) (> Pss2B.vstmin). Typical value = 0,1.
vstmin	0..1	PU	Stabilizer output minimum limit (Vstmin) (< Pss2B.vstmax). Typical value = -0,1.
a	0..1	Float	Numerator constant (a). Typical value = 1.
ta	0..1	Seconds	Lead constant (Ta) (>= 0). Typical value = 0.
tb	0..1	Seconds	Lag time constant (Tb) (>= 0). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 264 shows all association ends of Pss2B with other classes.

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Table 264 – Association ends of PowerSystemStabilizerDynamics::Pss2B with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.10 Pss2ST

PTI microprocessor-based stabilizer type 1.

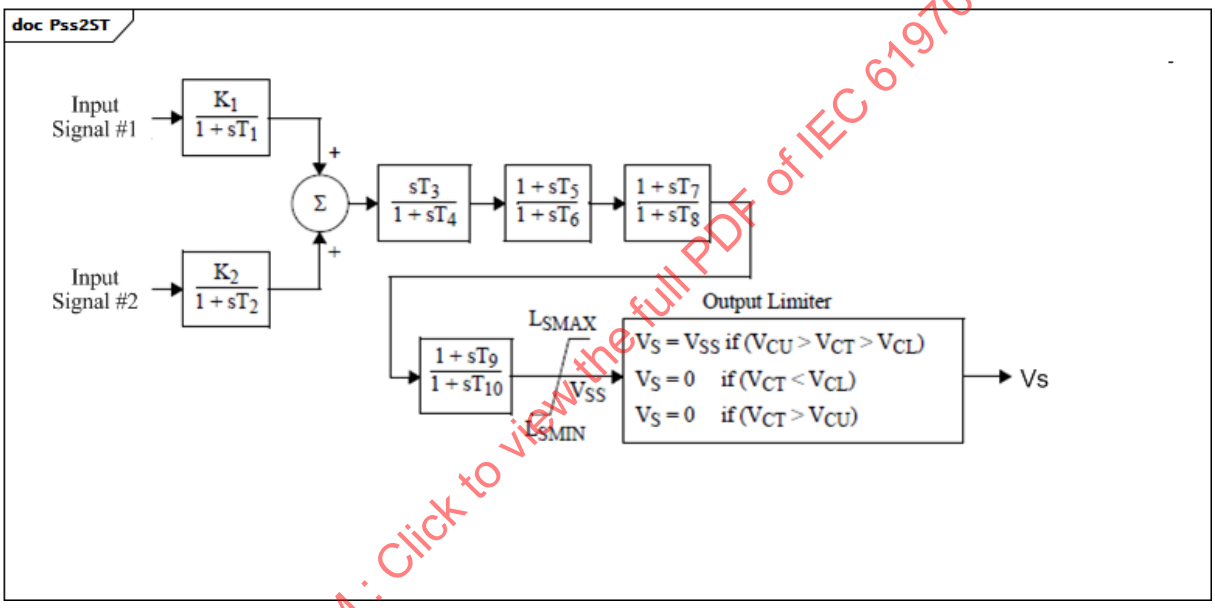

Figure 143 – Pss2ST

Figure 143: This diagram describes the Pss2ST power system stabilizer model.

Table 265 shows all attributes of Pss2ST.

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Table 265 – Attributes of PowerSystemStabilizerDynamics::Pss2ST

name	mult	type	description
inputSignal1Type	0..1	InputSignalKind	Type of input signal #1 (rotorAngularFrequencyDeviation, busFrequencyDeviation, generatorElectricalPower, generatorAcceleratingPower, busVoltage, or busVoltageDerivative – shall be different than Pss2ST.inputSignal2Type). Typical value = rotorAngularFrequencyDeviation.
inputSignal2Type	0..1	InputSignalKind	Type of input signal #2 (rotorAngularFrequencyDeviation, busFrequencyDeviation, generatorElectricalPower, generatorAcceleratingPower, busVoltage, or busVoltageDerivative – shall be different than Pss2ST.inputSignal1Type). Typical value = busVoltageDerivative.
k1	0..1	PU	Gain (K1).
k2	0..1	PU	Gain (K2).
t1	0..1	Seconds	Time constant (T1) (>= 0).
t2	0..1	Seconds	Time constant (T2) (>= 0).
t3	0..1	Seconds	Time constant (T3) (>= 0).
t4	0..1	Seconds	Time constant (T4) (>= 0).
t5	0..1	Seconds	Time constant (T5) (>= 0).
t6	0..1	Seconds	Time constant (T6) (>= 0).
t7	0..1	Seconds	Time constant (T7) (>= 0).
t8	0..1	Seconds	Time constant (T8) (>= 0).
t9	0..1	Seconds	Time constant (T9) (>= 0).
t10	0..1	Seconds	Time constant (T10) (>= 0).
lsmax	0..1	PU	Limiter (LSMAX) (> Pss2ST.lsmin).
lsmin	0..1	PU	Limiter (LSMIN) (< Pss2ST.lsmax).
vcu	0..1	PU	Cutoff limiter (VCU).
vcl	0..1	PU	Cutoff limiter (VCL).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 266 shows all association ends of Pss2ST with other classes.

Table 266 – Association ends of PowerSystemStabilizerDynamics::Pss2ST with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.11 Pss5

Detailed Italian PSS.

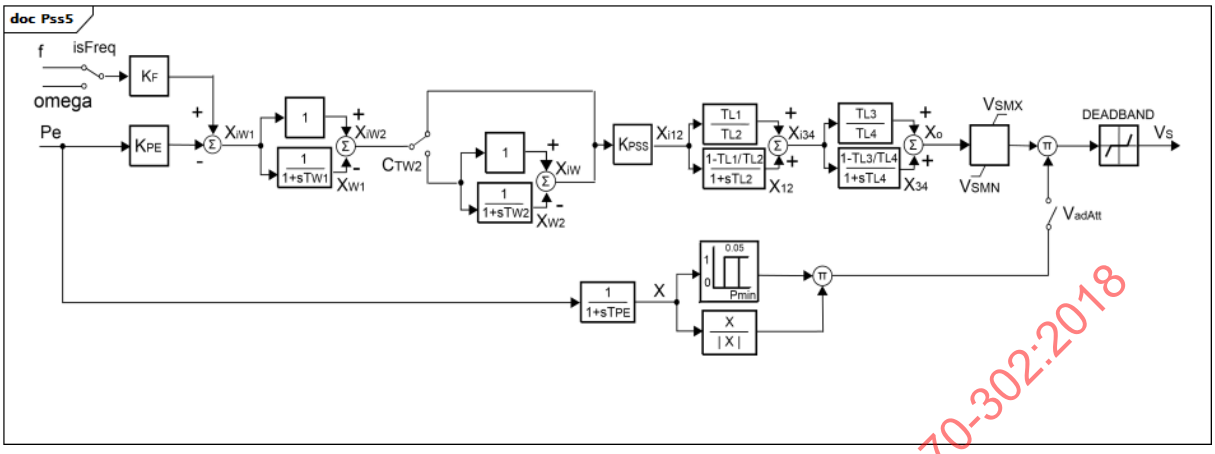

Figure 144 – Pss5

Figure 144: This diagram describes the Pss5 power system stabilizer model.

Parameter Details:

1) This model has 2 input signals. The type of first input signal is controlled by the isFreq switch (allowing the input to be either f with a type of busFrequency or omega with a type of rotorSpeed). The type of the second one, Pe, is generatorElectricalPower. (Types are described here as they are defined by InputSignalKind values).
2) X is not a parameter, but rather an input signal to the block [X /|X|]. The block reflects the sign of Pe. When Pe is negative (for example, for a unit in pumping mode), the output of the block [X /|X|] is negative. When Pe is positive, the output of the block is positive.

Table 267 shows all attributes of Pss5.

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Table 267 – Attributes of PowerSystemStabilizerDynamics::Pss5

name	mult	type	description
kpe	0..1	Float	Electric power input gain (KPE). Typical value = 0,3.
kf	0..1	Float	Frequency/shaft speed input gain (KF). Typical value = 5.
isfreq	0..1	Boolean	Selector for frequency/shaft speed input (isFreq). true = speed (same meaning as InputSignaKind.rotorSpeed) false = frequency (same meaning as InputSignalKind.busFrequency). Typical value = true (same meaning as InputSignalKind.rotorSpeed).
kpss	0..1	Float	PSS gain (KPSS). Typical value = 1.
ctw2	0..1	Boolean	Selector for second washout enabling (CTW2). true = second washout filter is bypassed false = second washout filter in use. Typical value = true.
tw1	0..1	Seconds	First washout (TW1) (>= 0). Typical value = 3,5.
tw2	0..1	Seconds	Second washout (TW2) (>= 0). Typical value = 0.
tl1	0..1	Seconds	Lead/lag time constant (TL1) (>= 0). Typical value = 0.
tl2	0..1	Seconds	Lead/lag time constant (TL2) (>= 0). If = 0, both blocks are bypassed. Typical value = 0.
tl3	0..1	Seconds	Lead/lag time constant (TL3) (>= 0). Typical value = 0.
tl4	0..1	Seconds	Lead/lag time constant (TL4) (>= 0). If = 0, both blocks are bypassed. Typical value = 0.
vsmn	0..1	PU	Stabilizer output maximum limit (VSMN). Typical value = -0,1.
vsmx	0..1	PU	Stabilizer output minimum limit (VSMX). Typical value = 0,1.
tpe	0..1	Seconds	Electric power filter time constant (TPE) (>= 0). Typical value = 0,05.
pmin	0..1	PU	Minimum power PSS enabling (Pmin). Typical value = 0,25.
deadband	0..1	PU	Stabilizer output deadband (DEADBAND). Typical value = 0.
vadat	0..1	Boolean	Signal selector (VadAtt). true = closed (generator power is greater than Pmin) false = open (Pe is smaller than Pmin). Typical value = true.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 268 shows all association ends of Pss5 with other classes.

Table 268 – Association ends of PowerSystemStabilizerDynamics::Pss5 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.12 PssELIN2

Power system stabilizer typically associated with ExcELIN2 (though PssIEEE2B or Pss2B can also be used).

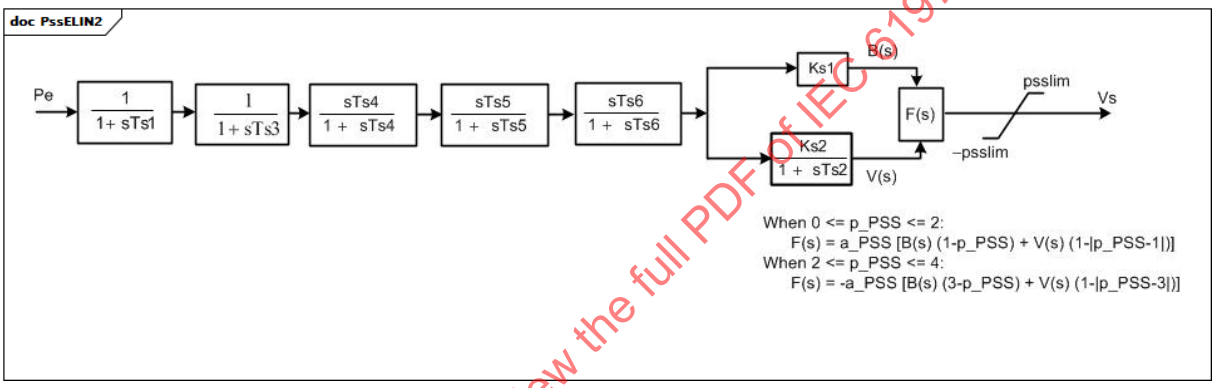

Figure 145 – PssELIN2

Figure 145: This diagram describes the PssELIN2 power system stabilizer model.

Parameter details:

1) The input Pe has the fixed type (expressed in terms of inputSignalKind value) of generatorElectricalPower.

Table 269 shows all attributes of PssELIN2.

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Table 269 – Attributes of PowerSystemStabilizerDynamics::PssELIN2

name	mult	type	description
ts1	0..1	Seconds	Time constant (Ts1) (>= 0). Typical value = 0.
ts2	0..1	Seconds	Time constant (Ts2) (>= 0). Typical value = 1.
ts3	0..1	Seconds	Time constant (Ts3) (>= 0). Typical value = 1.
ts4	0..1	Seconds	Time constant (Ts4) (>= 0). Typical value = 0,1.
ts5	0..1	Seconds	Time constant (Ts5) (>= 0). Typical value = 0.
ts6	0..1	Seconds	Time constant (Ts6) (>= 0). Typical value = 1.
ks1	0..1	PU	Gain (Ks1). Typical value = 1.
ks2	0..1	PU	Gain (Ks2). Typical value = 0,1.
ppss	0..1	PU	Coefficient (p_PSS) (>= 0 and <= 4). Typical value = 0,1.
apss	0..1	PU	Coefficient (a_PSS). Typical value = 0,1.
psslim	0..1	PU	PSS limiter (psslim). Typical value = 0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 270 shows all association ends of PssELIN2 with other classes.

Table 270 – Association ends of PowerSystemStabilizerDynamics::PssELIN2 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.12.13 PssPTIST1

PTI microprocessor-based stabilizer type 1.

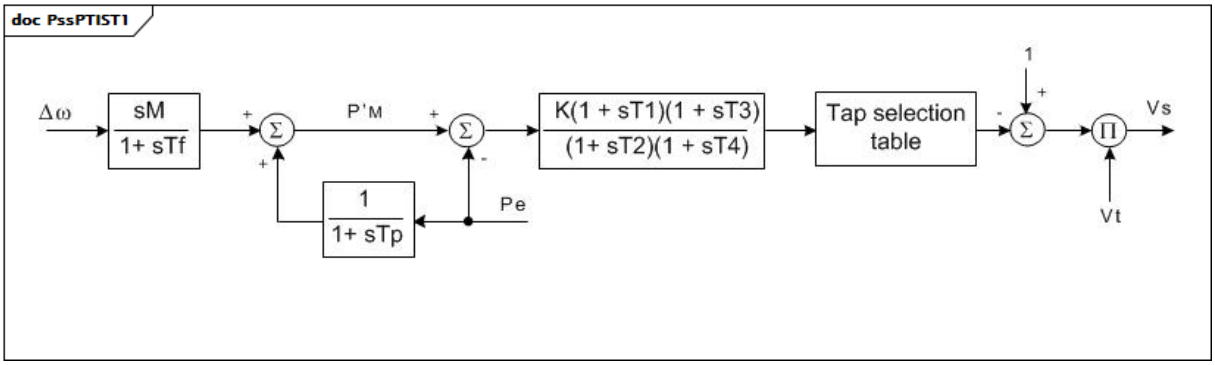

Figure 146 – PssPTIST1

Figure 146: This diagram describes the PssPTIST1 power system stabilizer model.

Parameter details:

1) Tap selection table enables the output control signal to be used to select an autotransformer tap position, which, in turn, modulates the feedback terminal voltage (digital output option).
2) This model has 2 input signals. The type (expressed in terms of InputSignalKind values) of the first signal (delta omega) is rotorAngularFrequency and the type of the second one, Pe, is generatorElectricalPower.

Table 271 shows all attributes of PssPTIST1.

Table 271 – Attributes of PowerSystemStabilizerDynamics::PssPTIST1

name	mult	type	description
m	0..1	PU	(M). M = 2 x H. Typical value = 5.
tf	0..1	Seconds	Time constant (Tf) (>= 0). Typical value = 0,2.
tp	0..1	Seconds	Time constant (Tp) (>= 0). Typical value = 0,2.
t1	0..1	Seconds	Time constant (T1) (>= 0). Typical value = 0,3.
t2	0..1	Seconds	Time constant (T2) (>= 0). Typical value = 1.
t3	0..1	Seconds	Time constant (T3) (>= 0). Typical value = 0,2.
t4	0..1	Seconds	Time constant (T4) (>= 0). Typical value = 0,05.
k	0..1	PU	Gain (K). Typical value = 9.
dtf	0..1	Seconds	Time step frequency calculation (deltatf) (>= 0). Typical value = 0,025.
dtc	0..1	Seconds	Time step related to activation of controls (deltatc) (>= 0). Typical value = 0,025.
dtp	0..1	Seconds	Time step active power calculation (deltatp) (>= 0). Typical value = 0,0125.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 272 shows all association ends of PssPTIST1 with other classes.

Table 272 – Association ends of PowerSystemStabilizerDynamics::PssPTIST1 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.14 PssPTIST3

PTI microprocessor-based stabilizer type 3.

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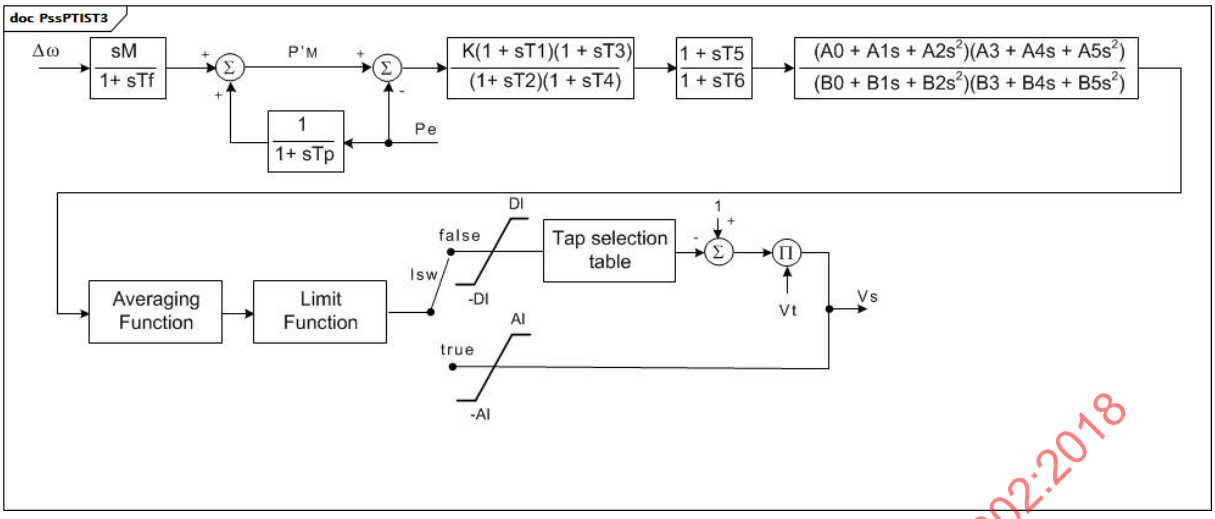

Figure 147 – PssPTIST3

Figure 147: This diagram describes the PssPTIST3 power system stabilizer model.

Parameter details:

1) This model has 2 input signals. The type (expressed in terms of InputSignalKind values) of the first signal (delta omega) is rotorAngularFrequency and the type of the second one, Pe, is generatorElectricalPower.
2) 'Tap selection table' enables the output control signal to be used to select an autotransformer tap position, which, in turn, modulates the feedback terminal voltage (digital output option).
3) 'Averaging Function' keeps a running average of the last NAV control outputs (clicks) up to a maximum of 16. This feature can be disabled by setting NAV equal to 1 (i.e., average 1 output). The last NAV outputs are stored in the output averaging table, VAR(1) to VAR(16). The sum of the last outputs is stored in the output accumulator. The averaging feature was added to reduce tap chattering under steady-state conditions. If the control output at any given click exceeds the threshold specified in Athres, the 'Averaging Function' will be automatically bypassed and that output signal will be passed directly to the 'Limit Function'. This feature has been added such that under transient conditions the stabilizer reverts to normal operation. When the absolute value of output signal is beyond the threshold, the output averaging table entries and accumulator are zeroed out. When the signal falls below the threshold, the table is rebuilt starting with the first signal within the threshold. If the output averaging is enabled, then the threshold value would probably be specified in the range from 0,002 to 0,02.
4) 'Limit Function' counts the number of control outputs that the output signal continuously exceeds a user-defined threshold as set in Lthres and, after the output signal has continuously exceeded the threshold for a number of user-defined counts as specified by NCL, the function ramps the tap position to nominal or the analogue output to zero over a user-specified number of counts as defined in NCR.

Table 273 shows all attributes of PssPTIST3.

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Table 273 – Attributes of PowerSystemStabilizerDynamics::PssPTIST3

name	mult	type	description
m	0..1	PU	(M). M = 2 x H. Typical value = 5.
tf	0..1	Seconds	Time constant (Tf) (>= 0). Typical value = 0,2.
tp	0..1	Seconds	Time constant (Tp) (>= 0). Typical value = 0,2.
t1	0..1	Seconds	Time constant (T1) (>= 0). Typical value = 0,3.
t2	0..1	Seconds	Time constant (T2) (>= 0). Typical value = 1.
t3	0..1	Seconds	Time constant (T3) (>= 0). Typical value = 0,2.
t4	0..1	Seconds	Time constant (T4) (>= 0). Typical value = 0,05.
k	0..1	PU	Gain (K). Typical value = 9.
dtf	0..1	Seconds	Time step frequency calculation (deltatf) (>= 0). Typical value = 0,025 (0,03 for 50 Hz).
dtc	0..1	Seconds	Time step related to activation of controls (deltatc) (>= 0). Typical value = 0,025 (0,03 for 50 Hz).
dtp	0..1	Seconds	Time step active power calculation (deltatp) (>= 0). Typical value = 0,0125 (0,015 for 50 Hz).
t5	0..1	Seconds	Time constant (T5) (>= 0).
t6	0..1	Seconds	Time constant (T6) (>= 0).
a0	0..1	PU	Filter coefficient (A0).
a1	0..1	PU	Limiter (Al).
a2	0..1	PU	Filter coefficient (A2).
b0	0..1	PU	Filter coefficient (B0).
b1	0..1	PU	Filter coefficient (B1).
b2	0..1	PU	Filter coefficient (B2).
a3	0..1	PU	Filter coefficient (A3).
a4	0..1	PU	Filter coefficient (A4).
a5	0..1	PU	Filter coefficient (A5).
b3	0..1	PU	Filter coefficient (B3).
b4	0..1	PU	Filter coefficient (B4).
b5	0..1	PU	Filter coefficient (B5).
athres	0..1	PU	Threshold value above which output averaging will be bypassed (Athres). Typical value = 0,005.
dl	0..1	PU	Limiter (Dl).
al	0..1	PU	Limiter (Al).
lthres	0..1	PU	Threshold value (Lthres).
pmin	0..1	PU	(Pmin).
isw	0..1	Boolean	Digital/analogue output switch (Isw). true = produce analogue output false = convert to digital output, using tap selection table.
nav	0..1	Float	Number of control outputs to average (NAV) (1 <= NAV <= 16). Typical value = 4.
ncl	0..1	Float	Number of counts at limit to active limit function (NCL) (> 0).
ncr	0..1	Float	Number of counts until reset after limit function is triggered (NCR).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 274 shows all association ends of PssPTIST3 with other classes.

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Table 274 – Association ends of PowerSystemStabilizerDynamics::PssPTIST3 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.15 PssRQB

Power system stabilizer type RQB. This power system stabilizer is intended to be used together with excitation system type ExcRQB, which is primarily used in nuclear or thermal generating units.

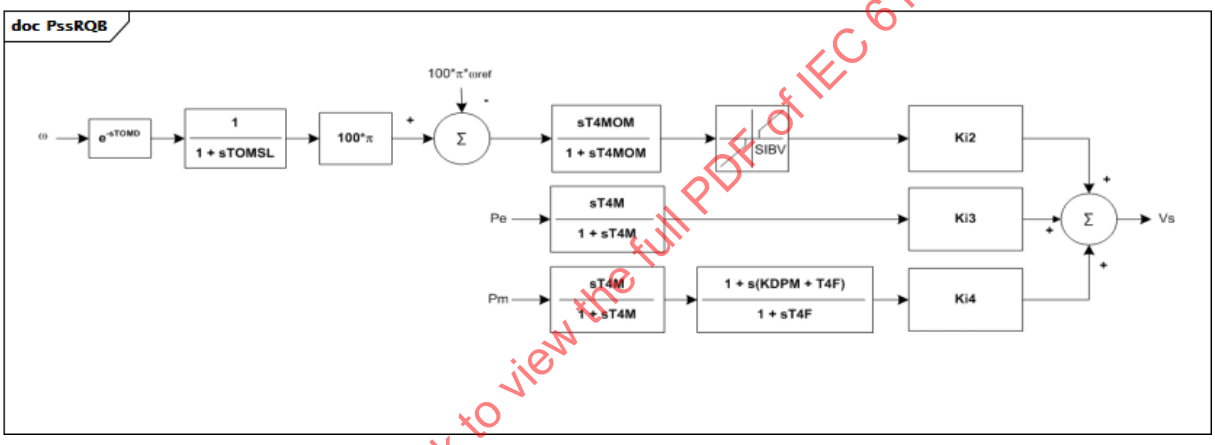

Figure 148 – PssRQB

Figure 148: This diagram describes the PssRQB power system stabilizer model.

Parameter details:

1) This model has 3 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): omega is of rotorSpeed type, Pe is of generatorElectricalPower type, and Pm is of generatorMechanicalPower type.
2) The block containing SIBV describes the following behaviour:
   – if input signal value < -SIBV, output signal = input + SIBV;
   – if input signal value is between -SIBV and SIBV, output signal = 0;
   – if input signal value > SIBV, output signal = input – SIBV.

Table 275 shows all attributes of PssRQB.

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Table 275 – Attributes of PowerSystemStabilizerDynamics::PssRQB

name	mult	type	description
ki2	0..1	Float	Speed input gain (Ki2). Typical value = 3,43.
ki3	0..1	Float	Electrical power input gain (Ki3). Typical value = -11,45.
ki4	0..1	Float	Mechanical power input gain (Ki4). Typical value = 11,86.
t4m	0..1	Seconds	Input time constant (T4M) (>= 0). Typical value = 5.
tomd	0..1	Seconds	Speed delay (TOMD) (>= 0). Typical value = 0,02.
tomsl	0..1	Seconds	Speed time constant (TOMSL) (>= 0). Typical value = 0,04.
t4mom	0..1	Seconds	Speed time constant (T4MOM) (>= 0). Typical value = 1,27.
sibv	0..1	PU	Speed deadband (SIBV). Typical value = 0,006.
kdpm	0..1	Float	Lead lag gain (KDPM). Typical value = 0,185.
t4f	0..1	Seconds	Lead lag time constant (T4F) (>= 0). Typical value = 0,045.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 276 shows all association ends of PssRQB with other classes.

Table 276 – Association ends of PowerSystemStabilizerDynamics::PssRQB with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.12.16 PssSB4

Power sensitive stabilizer model.

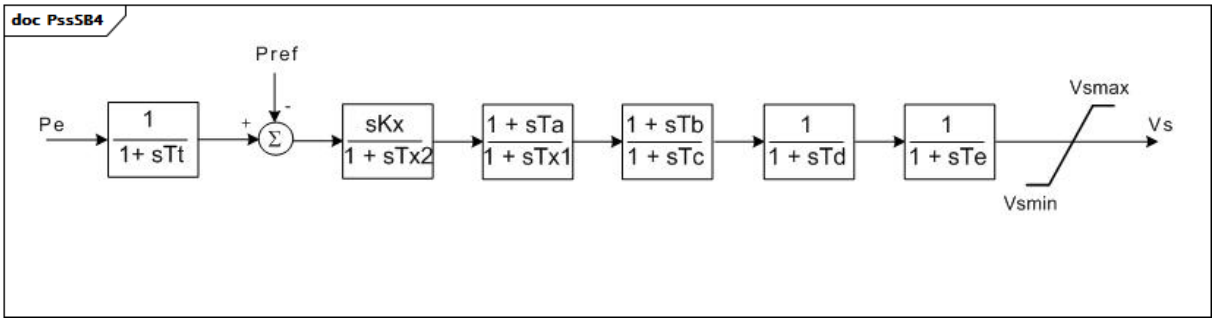

Figure 149 – PssSB4

Figure 149: This diagram describes the PssSB4 power system stabilizer model.

Parameter details:

1) The input Pe has the fixed type (expressed in terms of inputSignalKind value) of generatorElectricalPower.

Table 277 shows all attributes of PssSB4.

Table 277 – Attributes of PowerSystemStabilizerDynamics::PssSB4

name	mult	type	description
tt	0..1	Seconds	Time constant (Tt) (>= 0). Typical value = 0,18.
kx	0..1	PU	Gain (Kx). Typical value = 2,7.
tx2	0..1	Seconds	Time constant (Tx2) (>= 0). Typical value = 5,0.
ta	0..1	Seconds	Time constant (Ta) (>= 0). Typical value = 0,37.
tx1	0..1	Seconds	Reset time constant (Tx1) (>= 0). Typical value = 0,035.
tb	0..1	Seconds	Time constant (Tb) (>= 0). Typical value = 0,37.
tc	0..1	Seconds	Time constant (Tc) (>= 0). Typical value = 0,035.
td	0..1	Seconds	Time constant (Td) (>= 0). Typical value = 0,0.
te	0..1	Seconds	Time constant (Te) (>= 0). Typical value = 0,0169.
vsmax	0..1	PU	Limiter (Vsmax) (> PssSB4.vsmin). Typical value = 0,062.
vsmin	0..1	PU	Limiter (Vsmin) (< PssSB4.vsmax). Typical value = -0,062.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 278 shows all association ends of PssSB4 with other classes.

Table 278 – Association ends of PowerSystemStabilizerDynamics::PssSB4 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.12.17 PssSH

SiemensTM “H infinity” power system stabilizer with generator electrical power input.

[Footnote: Siemens "H infinity" power system stabilizers are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

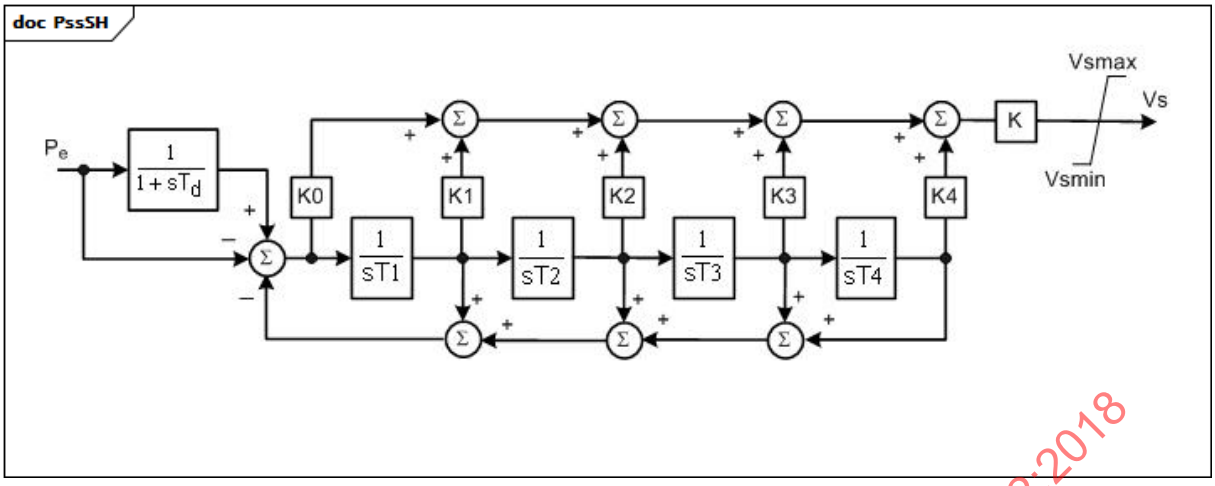

Figure 150 – PssSH

Figure 150: This diagram describes the PssSH power system stabilizer model.

Parameter details:

1) The input Pe has the fixed type (expressed in terms of inputSignalKind value) of generatorElectricalPower.

Table 279 shows all attributes of PssSH.

Table 279 – Attributes of PowerSystemStabilizerDynamics::PssSH

name	mult	type	description
k	0..1	PU	Main gain (K). Typical value = 1.
k0	0..1	PU	Gain 0 (K0). Typical value = 0,012.
k1	0..1	PU	Gain 1 (K1). Typical value = 0,488.
k2	0..1	PU	Gain 2 (K2). Typical value = 0,064.
k3	0..1	PU	Gain 3 (K3). Typical value = 0,224.
k4	0..1	PU	Gain 4 (K4). Typical value = 0,1.
td	0..1	Seconds	Input time constant (Td) (>= 0). Typical value = 10.
t1	0..1	Seconds	Time constant 1 (T1) (> 0). Typical value = 0,076.
t2	0..1	Seconds	Time constant 2 (T2) (> 0). Typical value = 0,086.
t3	0..1	Seconds	Time constant 3 (T3) (> 0). Typical value = 1,068.
t4	0..1	Seconds	Time constant 4 (T4) (> 0). Typical value = 1,913.
vsmax	0..1	PU	Output maximum limit (Vsmax) (> PssSH.vsmin). Typical value = 0,1.
vsmin	0..1	PU	Output minimum limit (Vsmin) (< PssSH.vsmax). Typical value = -0,1.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 280 shows all association ends of PssSH with other classes.

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Table 280 – Association ends of PowerSystemStabilizerDynamics::PssSH with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.18 PssSK

Slovakian PSS with three inputs.

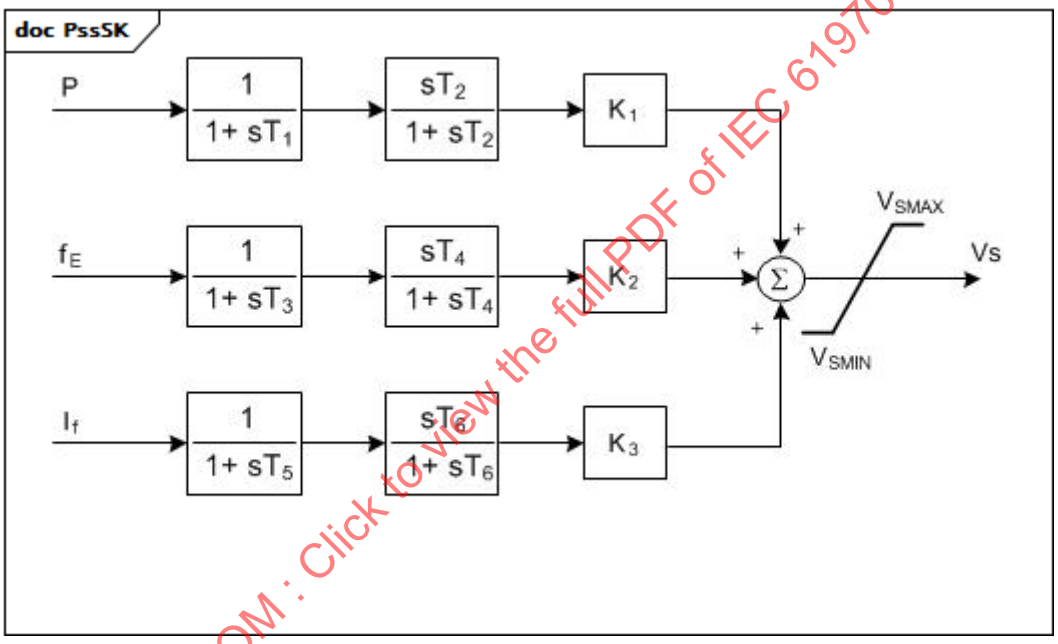

Figure 151 – PssSK

Figure 151: This diagram describes the PssSK power system stabilizer model.

Parameter details:

1) This model has 3 input signals. They have the following fixed types (expressed in terms of InputSignalKind values): P is of generatorElectricalPower type, fE is of busFrequency type, and If is of fieldCurrent type.

Table 281 shows all attributes of PssSK.

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Table 281 – Attributes of PowerSystemStabilizerDynamics::PssSK

name	mult	type	description
k1	0..1	PU	Gain P (K1). Typical value = -0,3.
k2	0..1	PU	Gain fE (K2). Typical value = -0,15.
k3	0..1	PU	Gain If (K3). Typical value = 10.
t1	0..1	Seconds	Denominator time constant (T1) (> 0,005). Typical value = 0,3.
t2	0..1	Seconds	Filter time constant (T2) (> 0,005). Typical value = 0,35.
t3	0..1	Seconds	Denominator time constant (T3) (> 0,005). Typical value = 0,22.
t4	0..1	Seconds	Filter time constant (T4) (> 0,005). Typical value = 0,02.
t5	0..1	Seconds	Denominator time constant (T5) (> 0,005). Typical value = 0,02.
t6	0..1	Seconds	Filter time constant (T6) (> 0,005). Typical value = 0,02.
vsmax	0..1	PU	Stabilizer output maximum limit (VSMAX) (> PssSK.vsmin). Typical value = 0,4.
vsmin	0..1	PU	Stabilizer output minimum limit (VSMIN) (< PssSK.vsmax). Typical value = -0.4.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 282 shows all association ends of PssSK with other classes.

Table 282 – Association ends of PowerSystemStabilizerDynamics::PssSK with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.19 PssSTAB2A

Power system stabilizer part of an ABB excitation system.

[Footnote: ABB excitation systems are an example of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these products.]

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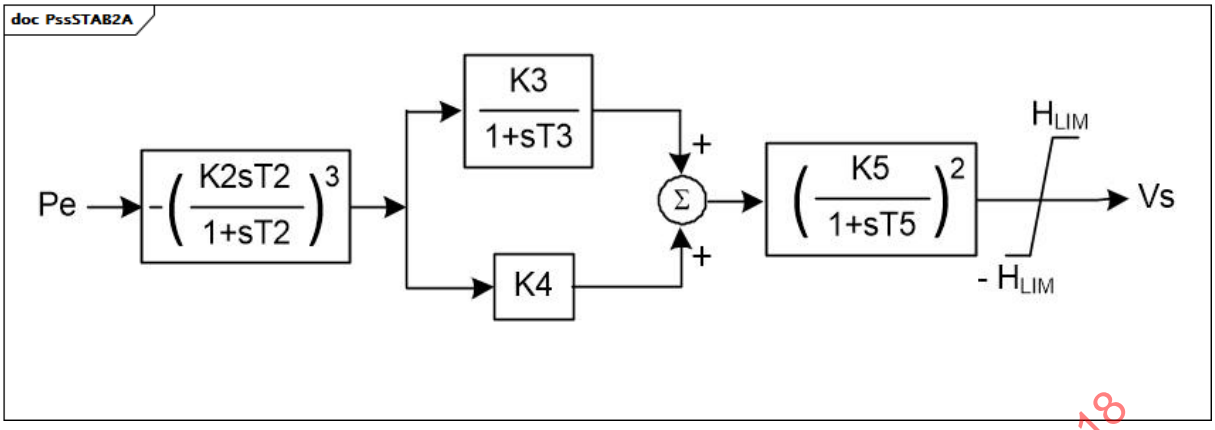

Figure 152 – PssSTAB2A

Figure 152: This diagram describes the PssSTAB2A power system stabilizer model.

Table 283 shows all attributes of PssSTAB2A.

Table 283 – Attributes of PowerSystemStabilizerDynamics::PssSTAB2A

name	mult	type	description
k2	0..1	PU	Gain (K2). Typical value = 1,0.
k3	0..1	PU	Gain (K3). Typical value = 0,25.
k4	0..1	PU	Gain (K4). Typical value = 0,075.
k5	0..1	PU	Gain (K5). Typical value = 2,5.
t2	0..1	Seconds	Time constant (T2). Typical value = 4,0.
t3	0..1	Seconds	Time constant (T3). Typical value = 2,0.
t5	0..1	Seconds	Time constant (T5). Typical value = 4,5.
hlim	0..1	PU	Stabilizer output limiter (HLIM). Typical value = 0,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 284 shows all association ends of PssSTAB2A with other classes.

Table 284 – Association ends of PowerSystemStabilizerDynamics::PssSTAB2A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.12.20 PssWECC

Dual input power system stabilizer, based on IEEE type 2, with modified output limiter defined by WECC (Western Electricity Coordinating Council, USA).

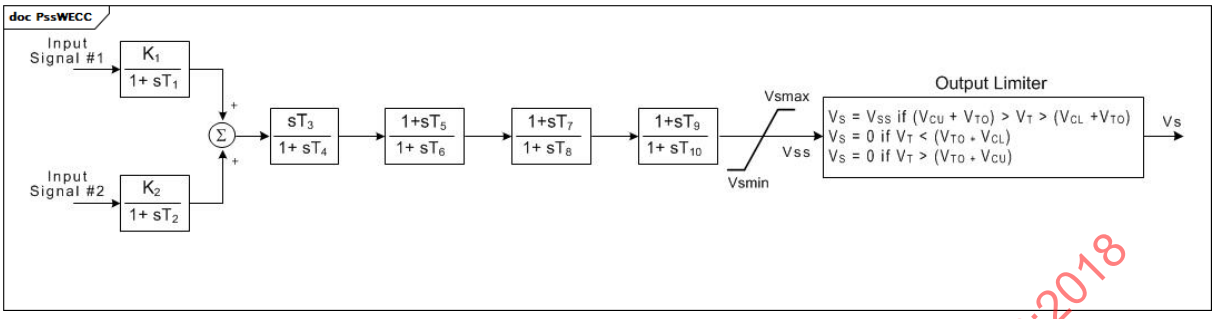

Figure 153 – PssWECC

Figure 153: This diagram describes the PssWECC power system stabilizer model.

Parameter details:

1) VT is the terminal voltage.
2) VTO is the initial terminal voltage.

Table 285 shows all attributes of PssWECC.

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Table 285 – Attributes of PowerSystemStabilizerDynamics::PssWECC

name	mult	type	description
inputSignal1Type	0..1	InputSignalKind	Type of input signal #1 (rotorAngularFrequencyDeviation, busFrequencyDeviation, generatorElectricalPower, generatorAcceleratingPower, busVoltage, or busVoltageDerivative – shall be different than PssWECC.inputSignal2Type). Typical value = rotorAngularFrequencyDeviation.
inputSignal2Type	0..1	InputSignalKind	Type of input signal #2 (rotorAngularFrequencyDeviation, busFrequencyDeviation, generatorElectricalPower, generatorAcceleratingPower, busVoltage, busVoltageDerivative – shall be different than PssWECC.inputSignal1Type). Typical value = busVoltageDerivative.
k1	0..1	PU	Input signal 1 gain (K1). Typical value = 1,13.
t1	0..1	Seconds	Input signal 1 transducer time constant (T1) (>= 0). Typical value = 0,037.
k2	0..1	PU	Input signal 2 gain (K2). Typical value = 0,0.
t2	0..1	Seconds	Input signal 2 transducer time constant (T2) (>= 0). Typical value = 0,0.
t3	0..1	Seconds	Stabilizer washout time constant (T3) (>= 0). Typical value = 9,5.
t4	0..1	Seconds	Stabilizer washout time lag constant (T4) (>= 0). Typical value = 9,5.
t5	0..1	Seconds	Lead time constant (T5) (>= 0). Typical value = 1,7.
t6	0..1	Seconds	Lag time constant (T6) (>= 0). Typical value = 1,5.
t7	0..1	Seconds	Lead time constant (T7) (>= 0). Typical value = 1,7.
t8	0..1	Seconds	Lag time constant (T8) (>= 0). Typical value = 1,5.
t10	0..1	Seconds	Lag time constant (T10) (>= 0). Typical value = 0.
t9	0..1	Seconds	Lead time constant (T9) (>= 0). Typical value = 0.
vsmax	0..1	PU	Maximum output signal (Vsmax) (> PssWECC.vsmin). Typical value = 0,05.
vsmin	0..1	PU	Minimum output signal (Vsmin) (< PssWECC.vsmax). Typical value = -0,05.
vcu	0..1	PU	Maximum value for voltage compensator output (VCU). Typical value = 0.
vcl	0..1	PU	Minimum value for voltage compensator output (VCL). Typical value = 0.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 286 shows all association ends of PssWECC with other classes.

Table 286 – Association ends of PowerSystemStabilizerDynamics::PssWECC with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.12.21 InputSignalKind enumeration

Types of input signals. In dynamics modelling, commonly represented by the i parameter.

Table 287 shows all literals of InputSignalKind.

Table 287 – Literals of PowerSystemStabilizerDynamics::InputSignalKind

literal	value	description
rotorSpeed		Input signal is rotor or shaft speed (angular frequency).
rotorAngularFrequencyDeviation		Input signal is rotor or shaft angular frequency deviation.
busFrequency		Input signal is bus voltage frequency. This could be a terminal frequency or remote frequency.
busFrequencyDeviation		Input signal is deviation of bus voltage frequency. This could be a terminal frequency deviation or remote frequency deviation.
generatorElectricalPower		Input signal is generator electrical power on rated S.
generatorAcceleratingPower		Input signal is generator accelerating power.
busVoltage		Input signal is bus voltage. This could be a terminal voltage or remote voltage.
busVoltageDerivative		Input signal is derivative of bus voltage. This could be a terminal voltage derivative or remote voltage derivative.
branchCurrent		Input signal is amplitude of remote branch current.
fieldCurrent		Input signal is generator field current.
generatorMechanicalPower		Input signal is generator mechanical power.

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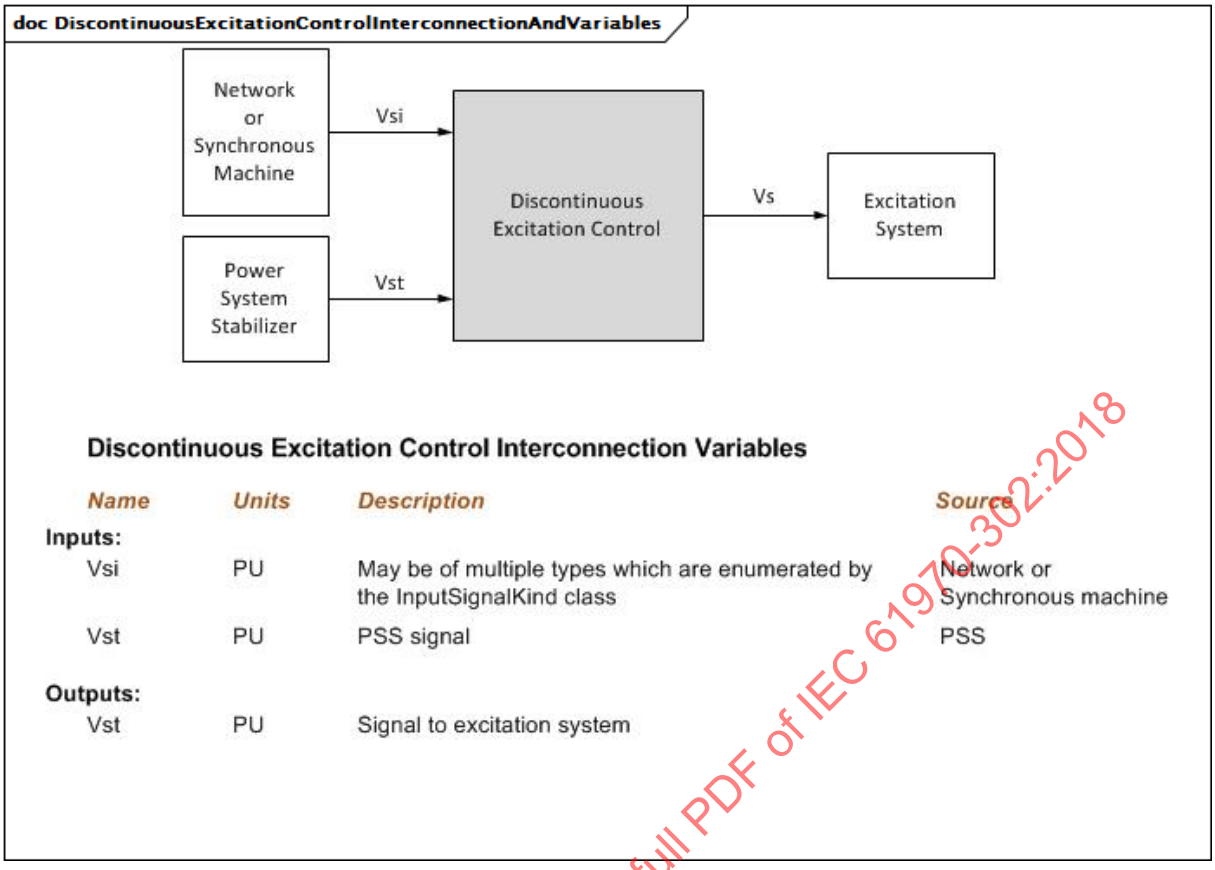
5.3.13 Package DiscontinuousExcitationControlDynamics

5.3.13.1 General

In certain system configurations, continuous excitation control with terminal voltage and power system stabilizing regulator input signals does not ensure that the potential of the excitation system for improving system stability is fully exploited. For these situations, discontinuous excitation control signals can be employed to enhance stability following large transient disturbances.

For additional information please refer to IEEE 421.5-2005, 12.



Discontinuous Excitation Control Interconnection Variables

Name	*Units*	*Description*	*Source*
Inputs:			
Vsi	PU	May be of multiple types which are enumerated by the InputSignalKind class	Network or Synchronous machine
Vst	PU	PSS signal	PSS
Outputs:			
Vst	PU	Signal to excitation system	

Figure 154 – DiscontinuousExcitationControlInterconnectionAndVariables

Figure 154: This diagram illustrates the inputs and outputs for a discontinuous excitation control.

Diagram details:

1) Vs is always initialized to zero by the excitation system model.
2) If bus voltage frequency is not available from network, the model can calculate it as derivative of the bus voltage angle.

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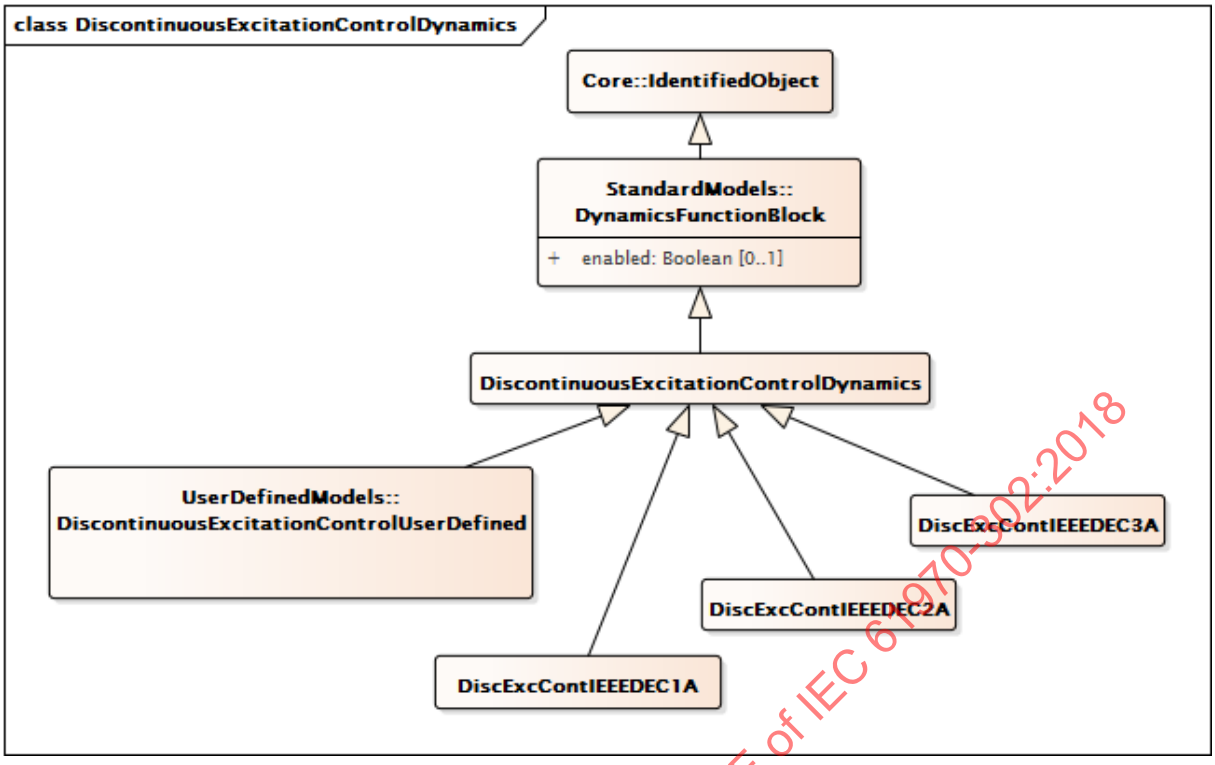

Figure 155 – Class diagram DiscontinuousExcitationControlDynamics::DiscontinuousExcitationControlDynamics

Figure 155: This diagram shows dynamic standard model discontinuous excitation control classes and their inheritance from the DiscontinuousExcitationControlDynamics class.

5.3.13.2 DiscontinuousExcitationControlDynamics

Discontinuous excitation control function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 288 shows all attributes of DiscontinuousExcitationControlDynamics.

Table 288 – Attributes of DiscontinuousExcitationControlDynamics::DiscontinuousExcitationControlDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 289 shows all association ends of DiscontinuousExcitationControlDynamics with other classes.

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Table 289 – Association ends of DiscontinuousExcitationControlDynamics::DiscontinuousExcitationControlDynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by this discontinuous excitation control system model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this discontinuous excitation control model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.13.3 DiscExcContIEEEDEC1A

IEEE type DEC1A discontinuous excitation control model that boosts generator excitation to a level higher than that demanded by the voltage regulator and stabilizer immediately following a system fault.

Reference: IEEE 421.5-2005, 12.2.

Table 290 shows all attributes of DiscExcContIEEEDEC1A.

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Table 290 – Attributes of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC1A

name	mult	type	description
vtlmt	0..1	PU	Voltage reference (VTLMT). Typical value = 1,1.
vomax	0..1	PU	Limiter (VOMAX) (> DiscExcContIEEEDEC1A.vomin). Typical value = 0,3.
vomin	0..1	PU	Limiter (VOMIN) (< DiscExcContIEEEDEC1A.vomax). Typical value = 0,1.
ketl	0..1	PU	Terminal voltage limiter gain (KETL). Typical value = 47.
vtc	0..1	PU	Terminal voltage level reference (VTC). Typical value = 0,95.
val	0..1	PU	Regulator voltage reference (VAL). Typical value = 5,5.
esc	0..1	PU	Speed change reference (ESC). Typical value = 0,0015.
kan	0..1	PU	Discontinuous controller gain (KAN). Typical value = 400.
tan	0..1	Seconds	Discontinuous controller time constant (TAN) (>= 0). Typical value = 0,08.
tw5	0..1	Seconds	DEC washout time constant (TW5) (>= 0). Typical value = 5.
vsmax	0..1	PU	Limiter (VSMAX)(> DiscExcContIEEEDEC1A.vsmin). Typical value = 0,2.
vsmin	0..1	PU	Limiter (VSMIN) (< DiscExcContIEEEDEC1A.vsmax). Typical value = -0,066.
td	0..1	Seconds	Time constant (TD) (>= 0). Typical value = 0,03.
tl1	0..1	Seconds	Time constant (TL1) (>= 0). Typical value = 0,025.
tl2	0..1	Seconds	Time constant (TL2) (>= 0). Typical value = 1,25.
vtm	0..1	PU	Voltage limits (VTM). Typical value = 1,13.
vtn	0..1	PU	Voltage limits (VTN). Typical value = 1,12.
vanmax	0..1	PU	Limiter for Van (VANMAX).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 291 shows all association ends of DiscExcContIEEEDEC1A with other classes.

Table 291 – Association ends of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC1A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: DiscontinuousExcitationControlDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: DiscontinuousExcitationControlDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.13.4 DiscExcContIEEEDEC2A

IEEE type DEC2A model for discontinuous excitation control. This system provides transient excitation boosting via an open-loop control as initiated by a trigger signal generated remotely.

Reference: IEEE 421.5-2005 12.3.

Table 292 shows all attributes of DiscExcContIEEEDEC2A.

Table 292 – Attributes of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC2A

name	mult	type	description
vk	0..1	PU	Discontinuous controller input reference (VK).
td1	0..1	Seconds	Discontinuous controller time constant (TD1) (>= 0).
td2	0..1	Seconds	Discontinuous controller washout time constant (TD2) (>= 0).
vdmin	0..1	PU	Limiter (VDMIN) (< DiscExcContIEEEDEC2A.vdmax).
vdmax	0..1	PU	Limiter (VDMAX) (> DiscExcContIEEEDEC2A.vdmin).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 293 shows all association ends of DiscExcContIEEEDEC2A with other classes.

Table 293 – Association ends of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC2A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: DiscontinuousExcitationControlDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: DiscontinuousExcitationControlDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.13.5 DiscExcContIEEEDEC3A

IEEE type DEC3A model. In some systems, the stabilizer output is disconnected from the regulator immediately following a severe fault to prevent the stabilizer from competing with action of voltage regulator during the first swing.

Reference: IEEE 421.5-2005 12.4.

Table 294 shows all attributes of DiscExcContIEEEDEC3A.

Table 294 – Attributes of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC3A

name	mult	type	description
vtmin	0..1	PU	Terminal undervoltage comparison level (VTMIN).
tdr	0..1	Seconds	Reset time delay (TDR) (>= 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 295 shows all association ends of DiscExcContIEEEDEC3A with other classes.

Table 295 – Association ends of DiscontinuousExcitationControlDynamics::DiscExcContIEEEDEC3A with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: DiscontinuousExcitationControlDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: DiscontinuousExcitationControlDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.14 Package PFVArControllerType1Dynamics

5.3.14.1 General

Excitation systems for synchronous machines are sometimes supplied with an optional means of automatically adjusting generator output reactive power (VAr) or power factor (PF) to a user-specified value. This can be accomplished with either a reactive power or power factor controller or regulator. A reactive power or power factor controller is defined as a PF/VAr controller in IEEE 421.1 as “a control function that acts through the reference adjuster to modify the voltage regulator set point to maintain the synchronous machine steady-state power factor or reactive power at a predetermined value.”

For additional information please refer to IEEE 421.5-2005, 11.

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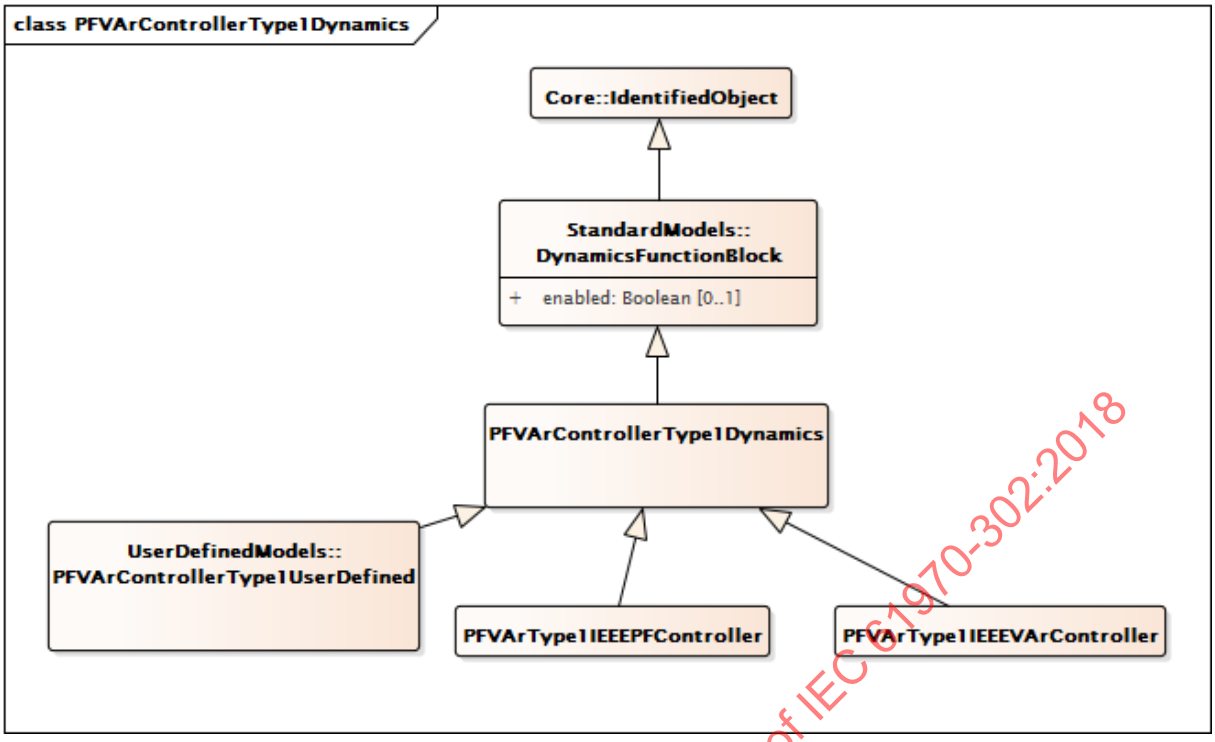

Figure 156 – Class diagram
PFVArControllerType1Dynamics::PFVArControllerType1Dynamics

Figure 156: This diagram shows dynamic standard model power factor or VAr controller type 1 classes and their inheritance from the PFVArControllerType1Dynamics class.

5.3.14.2 PFVArControllerType1Dynamics

Power factor or VAr controller type 1 function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 296 shows all attributes of PFVArControllerType1Dynamics.

Table 296 – Attributes of
PFVArControllerType1Dynamics::PFVArControllerType1Dynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 297 shows all association ends of PFVArControllerType1Dynamics with other classes.

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Table 297 – Association ends of PFVArControllerType1Dynamics::PFVArControllerType1Dynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by this power factor or VAr controller type 1 model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this power actor or VAr controller type 1 model is associated.
1..1	VoltageAdjusterDynamics	0..1	VoltageAdjusterDynamics	Voltage adjuster model associated with this power factor or VAr controller type 1 model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.14.3 PFVArType1IEEEPFController

IEEE PF controller type 1 which operates by moving the voltage reference directly.

Reference: IEEE 421.5-2005, 11.2.

Table 298 shows all attributes of PFVArType1IEEEPFController.

Table 298 – Attributes of PFVArControllerType1Dynamics::PFVArType1IEEEPFController

name	mult	type	description
ovex	0..1	Boolean	Overexcitation Flag (OVEX) true = overexcited false = underexcited.
tpfc	0..1	Seconds	PF controller time delay (TPFC) (>= 0). Typical value = 5.
vitmin	0..1	PU	Minimum machine terminal current needed to enable pf/var controller (VITMIN).
vpf	0..1	PU	Synchronous machine power factor (VPF).
vpfcbw	0..1	Float	PF controller deadband (VPFC_BW). Typical value = 0,05.
vpfref	0..1	PU	PF controller reference (VPFREF).
vvtmax	0..1	PU	Maximum machine terminal voltage needed for pf/var controller to be enabled (VVTMAX) (> PFVArType1IEEEPFController.vvtmin).
vvtmin	0..1	PU	Minimum machine terminal voltage needed to enable pf/var controller (VVTMIN) (< PFVArType1IEEEPFController.vvtmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 299 shows all association ends of PFVArType1IEEEPFController with other classes.

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Table 299 – Association ends of PFVArControllerType1Dynamics::PFVArType1IEEEPFController with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: PFVArControllerType1Dynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType1Dynamics
1..1	VoltageAdjusterDynamics	0..1	VoltageAdjusterDynamics	inherited from: PFVArControllerType1Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.14.4 PFVArType1IEEEVArController

IEEE VAR controller type 1 which operates by moving the voltage reference directly.

Reference: IEEE 421.5-2005, 11.3.

Table 300 shows all attributes of PFVArType1IEEEVArController.

Table 300 – Attributes of PFVArControllerType1Dynamics::PFVArType1IEEEVArController

name	mult	type	description
tvarc	0..1	Seconds	Var controller time delay (TVARC) (>= 0). Typical value = 5.
vvar	0..1	PU	Synchronous machine power factor (VVAR).
vvarcbw	0..1	Float	Var controller deadband (VVARC_BW). Typical value = 0,02.
vvarref	0..1	PU	Var controller reference (VVARREF).
vvtmax	0..1	PU	Maximum machine terminal voltage needed for pf/VAr controller to be enabled (VVTMAX) (> PVFArType1IEEEVArController.vvtmin).
vvtmin	0..1	PU	Minimum machine terminal voltage needed to enable pf/var controller (VVTMIN) (< PVFArType1IEEEVArController.vvtmax).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 301 shows all association ends of PFVArType1IEEEVArController with other classes.

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Table 301 – Association ends of PFVArControllerType1Dynamics::PFVArType1IEEEVArController with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: PFVArControllerType1Dynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType1Dynamics
1..1	VoltageAdjusterDynamics	0..1	VoltageAdjusterDynamics	inherited from: PFVArControllerType1Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.15 Package VoltageAdjusterDynamics

5.3.15.1 General

A voltage adjuster is a reference adjuster that uses inputs from a reactive power or power factor controller to modify the voltage regulator set point to maintain the synchronous machine steady-state power factor or reactive power at a predetermined value.

For additional information please refer to IEEE 421.5-2005, 11.

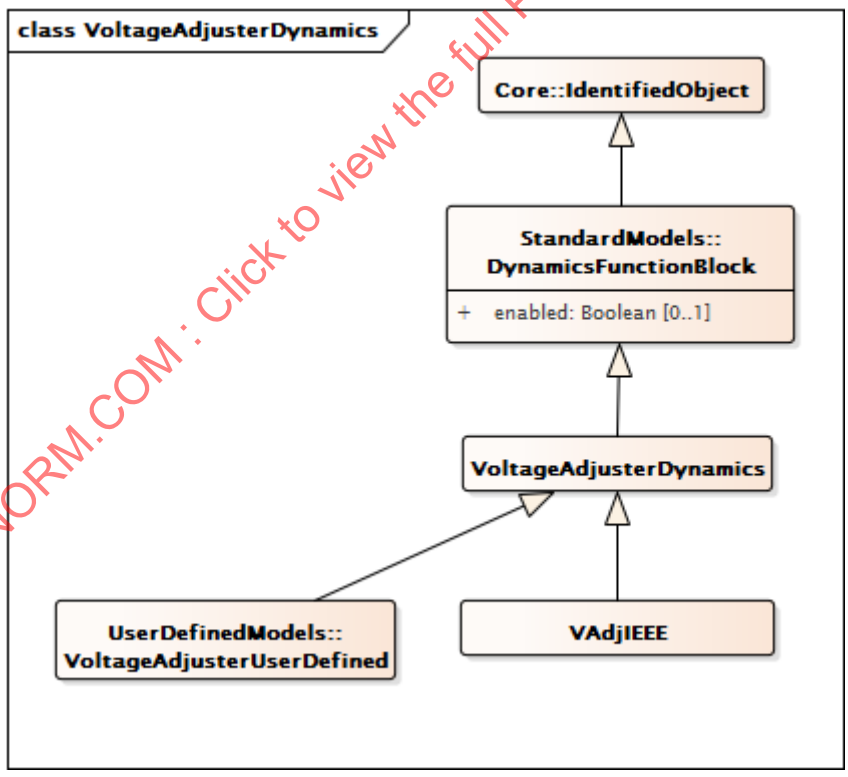

Figure 157 – Class diagram VoltageAdjusterDynamics::VoltageAdjusterDynamics

Figure 157: This diagram shows dynamic standard model voltage adjuster classes and their inheritance from the VoltageAdjusterDynamics class.

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5.3.15.2 VoltageAdjusterDynamics

Voltage adjuster function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 302 shows all attributes of VoltageAdjusterDynamics.

Table 302 – Attributes of VoltageAdjusterDynamics::VoltageAdjusterDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 303 shows all association ends of VoltageAdjusterDynamics with other classes.

Table 303 – Association ends of VoltageAdjusterDynamics::VoltageAdjusterDynamics with other classes

mult from	name	mult to	type	description
0..1	PFVArControllerType1Dynamics	1..1	PFVArControllerType1Dynamics	Power factor or VAr controller type 1 model with which this voltage adjuster is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.15.3 VAdjIEEE

IEEE voltage adjuster which is used to represent the voltage adjuster in either a power factor or VAr control system.

Reference: IEEE 421.5-2005, 11.1.

Table 304 shows all attributes of VAdjIEEE.

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Table 304 – Attributes of VoltageAdjusterDynamics::VAdjIEEE

name	mult	type	description
vadjf	0..1	Float	Set high to provide a continuous raise or lower (VADJF).
adjslew	0..1	Float	Rate at which output of adjuster changes (ADJ_SLEW). Unit = s / PU. Typical value = 300.
vadjmax	0..1	PU	Maximum output of the adjuster (VADJMAX) (> VAdjIEEE.vadjmin). Typical value = 1,1.
vadjmin	0..1	PU	Minimum output of the adjuster (VADJMIN) (< VAdjIEEE.vadjmax). Typical value = 0,9.
taon	0..1	Seconds	Time that adjuster pulses are on (TAON) (>= 0). Typical value = 0,1.
taoff	0..1	Seconds	Time that adjuster pulses are off (TAOFF) (>= 0). Typical value = 0,5.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 305 shows all association ends of VAdjIEEE with other classes.

Table 305 – Association ends of VoltageAdjusterDynamics::VAdjIEEE with other classes

mult from	name	mult to	type	description
0..1	PFVArControllerType1Dynamics	1..1	PFVArControllerType1Dynamics	inherited from: VoltageAdjusterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.16 Package PFVArControllerType2Dynamics

5.3.16.1 General

A var/pf regulator is defined as “a synchronous machine regulator that functions to maintain the power factor or reactive component of power at a predetermined value.”

For additional information please refer to IEEE 421.5-2005, 11.

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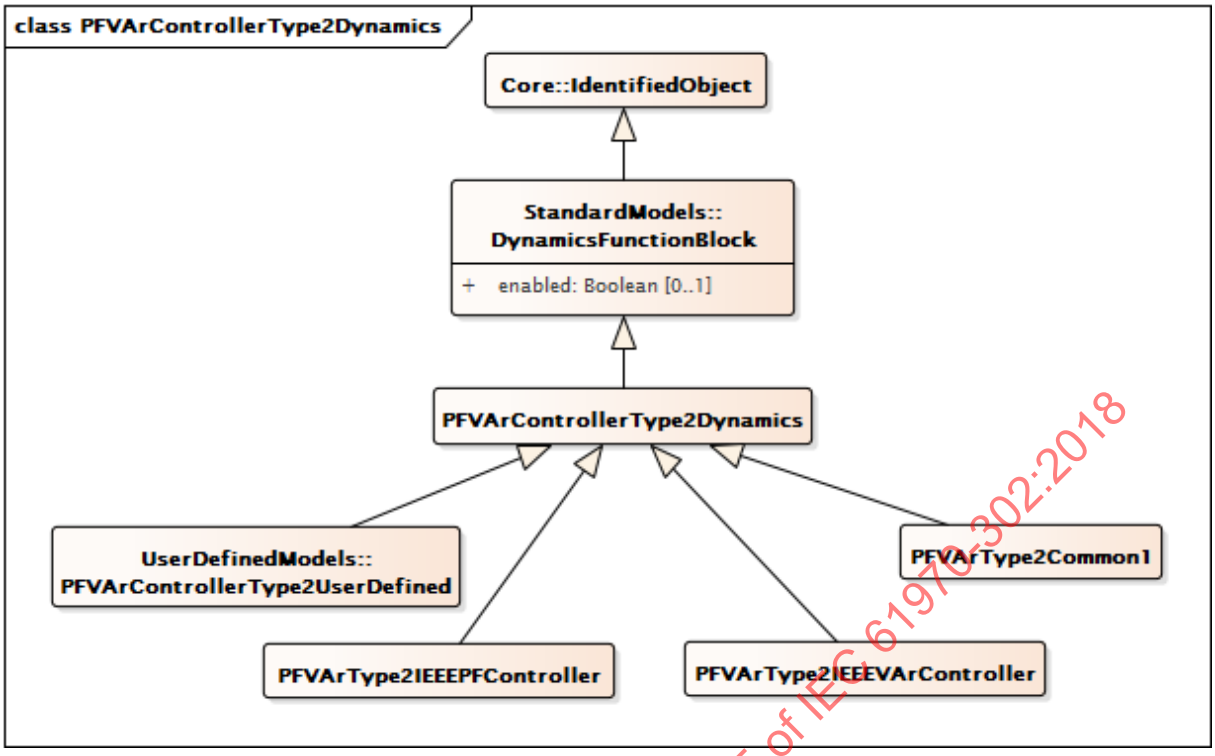

Figure 158 – Class diagram
PFVArControllerType2Dynamics::PFVArControllerType2Dynamics

Figure 158: This diagram shows dynamic standard model power factor or VAr controller type 2 classes and their inheritance from the PFVArControllerType2Dynamics class.

5.3.16.2 PFVArControllerType2Dynamics

Power factor or VAr controller type 2 function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 306 shows all attributes of PFVArControllerType2Dynamics.

Table 306 – Attributes of
PFVArControllerType2Dynamics::PFVArControllerType2Dynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 307 shows all association ends of PFVArControllerType2Dynamics with other classes.

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Table 307 – Association ends of PFVArControllerType2Dynamics::PFVArControllerType2Dynamics with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this power factor or VAr controller type 2 is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.16.3 PFVArType2IEEEPFController

IEEE PF controller type 2 which is a summing point type controller making up the outside loop of a two-loop system. This controller is implemented as a slow PI type controller. The voltage regulator forms the inner loop and is implemented as a fast controller.

Reference: IEEE 421.5-2005, 11.4.

Table 308 shows all attributes of PFVArType2IEEEPFController.

Table 308 – Attributes of PFVArControllerType2Dynamics::PFVArType2IEEEPFController

name	mult	type	description
pfref	0..1	PU	Power factor reference (PFREF).
vref	0..1	PU	Voltage regulator reference (VREF).
vclmt	0..1	PU	Maximum output of the pf controller (VCLMT). Typical value = 0,1.
kp	0..1	PU	Proportional gain of the pf controller (KP). Typical value = 1.
ki	0..1	PU	Integral gain of the pf controller (KI). Typical value = 1.
vs	0..1	Float	Generator sensing voltage (VS).
exlon	0..1	Boolean	Overexcitation or under excitation flag (EXLON) true = 1 (not in the overexcitation or underexcitation state, integral action is active) false = 0 (in the overexcitation or underexcitation state, so integral action is disabled to allow the limiter to play its role).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 309 shows all association ends of PFVArType2IEEEPFController with other classes.

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Table 309 – Association ends of PFVArControllerType2Dynamics::PFVArType2IEEEPFController with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.16.4 PFVArType2IEEEVArController

IEEE VAR controller type 2 which is a summing point type controller. It makes up the outside loop of a two-loop system. This controller is implemented as a slow PI type controller, and the voltage regulator forms the inner loop and is implemented as a fast controller.

Reference: IEEE 421.5-2005, 11.5.

Table 310 shows all attributes of PFVArType2IEEEVArController.

Table 310 – Attributes of PFVArControllerType2Dynamics::PFVArType2IEEEVArController

name	mult	type	description
qref	0..1	PU	Reactive power reference (QREF).
vref	0..1	PU	Voltage regulator reference (VREF).
vclmt	0..1	PU	Maximum output of the pf controller (VCLMT).
kp	0..1	PU	Proportional gain of the pf controller (KP).
ki	0..1	PU	Integral gain of the pf controller (KI).
vs	0..1	Float	Generator sensing voltage (VS).
exlon	0..1	Boolean	Overexcitation or under excitation flag (EXLON) true = 1 (not in the overexcitation or underexcitation state, integral action is active) false = 0 (in the overexcitation or underexcitation state, so integral action is disabled to allow the limiter to play its role).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 311 shows all association ends of PFVArType2IEEEVArController with other classes.

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Table 311 – Association ends of PFVArControllerType2Dynamics::PFVArType2IEEEVArController with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.16.5 PFVArType2Common1

Power factor / reactive power regulator. This model represents the power factor or reactive power controller such as the Basler SCP-250. The controller measures power factor or reactive power (PU on generator rated power) and compares it with the operator's set point.

[Footnote: Basler SCP-250 is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this product.]

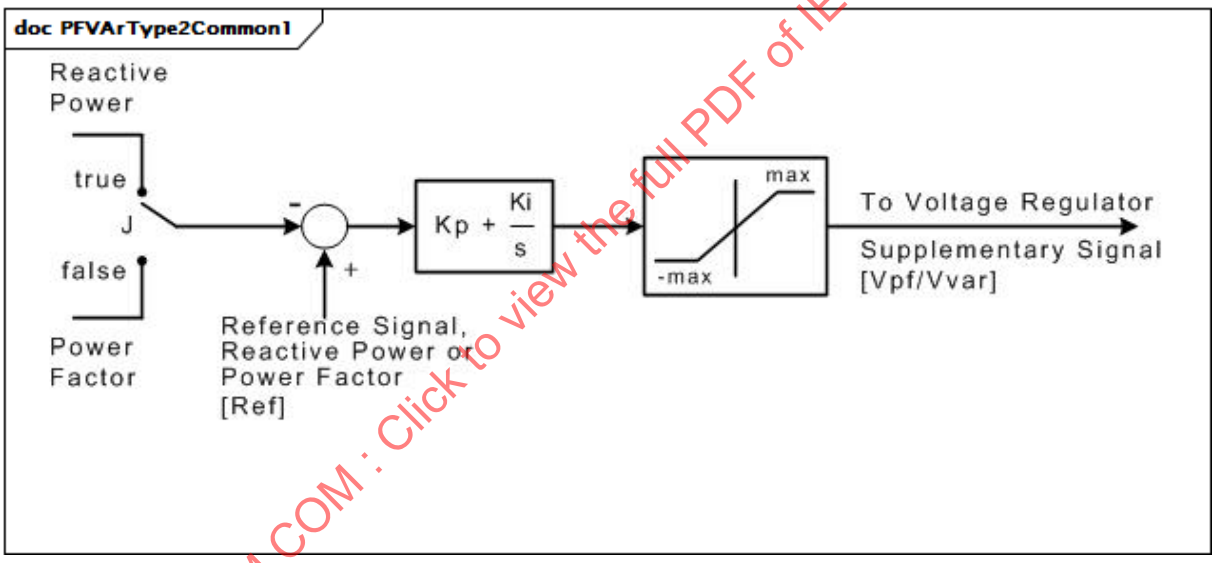

Figure 159 – PFVArType2Common1

Figure 159: This diagram describes the PFVArType2Common1 power factor / reactive power regulator.

Table 312 shows all attributes of PFVArType2Common1.

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Table 312 – Attributes of PFVArControllerType2Dynamics::PFVArType2Common1

name	mult	type	description
j	0..1	Boolean	Selector (J). true = control mode for reactive power false = control mode for power factor.
kp	0..1	PU	Proportional gain (Kp).
ki	0..1	PU	Reset gain (Ki).
max	0..1	PU	Output limit (max).
ref	0..1	PU	Reference value of reactive power or power factor (Ref). The reference value is initialised by this model. This initialisation can override the value exchanged by this attribute to represent a plant operator's change of the reference setting.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 313 shows all association ends of PFVArType2Common1 with other classes.

Table 313 – Association ends of PFVArControllerType2Dynamics::PFVArType2Common1 with other classes

mult from	name	mult to	type	description
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.17 Package VoltageCompensatorDynamics

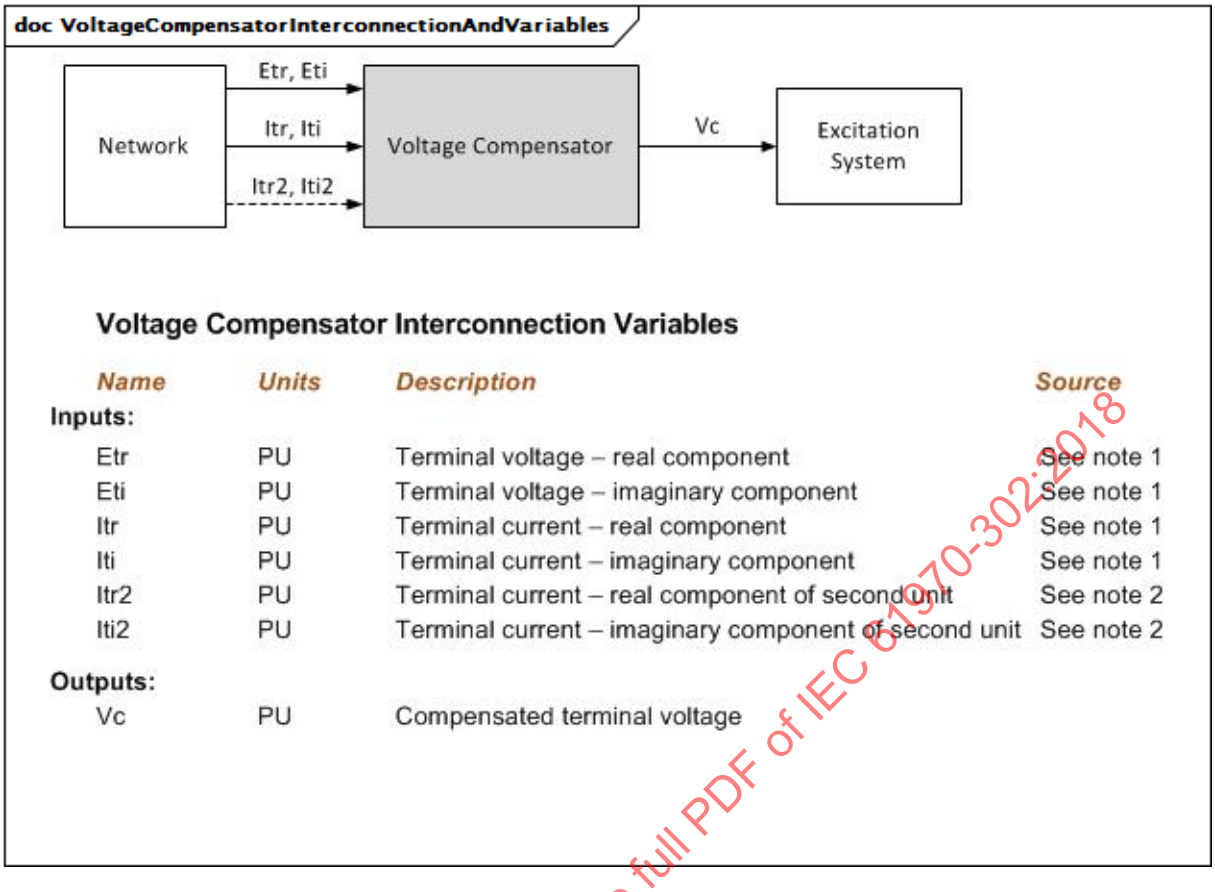
5.3.17.1 General

Synchronous machine terminal voltage transducer and current compensator models adjust the terminal voltage feedback to the excitation system by adding a quantity that is proportional to the terminal current of the generator. It is linked to a specific generator (synchronous machine).

Several types of compensation are available on most excitation systems. Synchronous machine active and reactive current compensation are the most common. Either reactive droop compensation and/or line-drop compensation can be used, simulating an impedance drop and effectively regulating at some point other than the terminals of the machine. The impedance or range of adjustment and type of compensation should be specified for different types.

Care shall be taken to ensure that a consistent PU system is utilized for the compensator parameters and the synchronous machine current base.

For further information see IEEE 421.5-2005, 4.



Voltage Compensator Interconnection Variables

Name	*Units*	*Description*	*Source*
Inputs:			
Etr	PU	Terminal voltage – real component	See note 1
Eti	PU	Terminal voltage – imaginary component	See note 1
Itr	PU	Terminal current – real component	See note 1
Iti	PU	Terminal current – imaginary component	See note 1
Itr2	PU	Terminal current – real component of second unit	See note 2
Iti2	PU	Terminal current – imaginary component of second unit	See note 2
Outputs:			
Vc	PU	Compensated terminal voltage	

Figure 160 – VoltageCompensatorInterconnectionAndVariables

Figure 160: This diagram illustrates the inputs and outputs for a voltage compensator.

Diagram details:

1) The source of the generator complex voltage components is application-dependent. It can come from the generator or from the network equations.
2) Itr2 and Iti2 relate to a second generator connected to the same terminal bus, usually the other unit of a cross-compound pair. These inputs are not used by all voltage compensation models.

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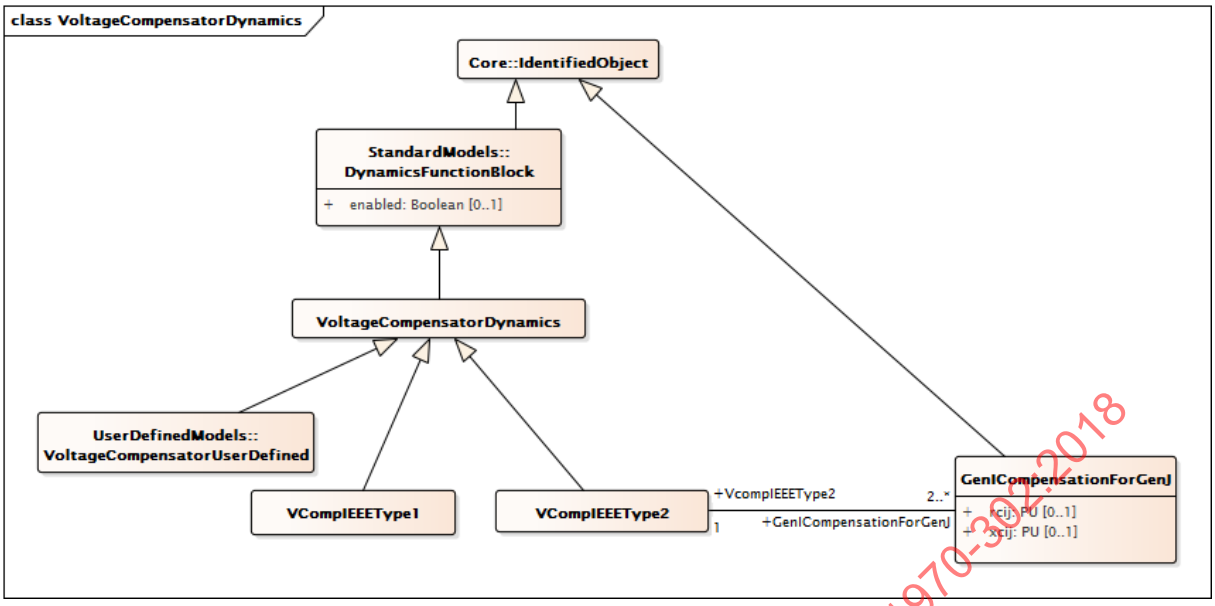

Figure 161 – Class diagram VoltageCompensatorDynamics::VoltageCompensatorDynamics

Figure 161: This diagram shows dynamic standard model voltage compensator classes and their inheritance from the VoltageCompensatorDynamics class.

5.3.17.2 VoltageCompensatorDynamics

Voltage compensator function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 314 shows all attributes of VoltageCompensatorDynamics.

Table 314 – Attributes of VoltageCompensatorDynamics::VoltageCompensatorDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 315 shows all association ends of VoltageCompensatorDynamics with other classes.

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Table 315 – Association ends of VoltageCompensatorDynamics::VoltageCompensatorDynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by this voltage compensator model.
1..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	Excitation system model with which this voltage compensator is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.17.3 VCompIEEEType1

Terminal voltage transducer and load compensator as defined in IEEE 421.5-2005, 4. This model is common to all excitation system models described in the IEEE Standard.

Parameter details:

1) If Rc and Xc are set to zero, the load compensation is not employed and the behaviour is as a simple sensing circuit.
2) If all parameters (Rc, Xc and Tr) are set to zero, the standard model VCompIEEEType1 is bypassed.

Reference: IEEE 421.5-2005 4.

Table 316 shows all attributes of VCompIEEEType1.

Table 316 – Attributes of VoltageCompensatorDynamics::VCompIEEEType1

name	mult	type	description
rc	0..1	PU	Resistive component of compensation of a generator (Rc) (>= 0).
xc	0..1	PU	Reactive component of compensation of a generator (Xc) (>= 0).
tr	0..1	Seconds	Time constant which is used for the combined voltage sensing and compensation signal (Tr) (>= 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 317 shows all association ends of VCompIEEEType1 with other classes.

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Table 317 – Association ends of VoltageCompensatorDynamics::VCompIEEEType1 with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: VoltageCompensatorDynamics
1..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: VoltageCompensatorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.17.4 VCompIEEEType2

Terminal voltage transducer and load compensator as defined in IEEE 421.5-2005, 4. This model is designed to cover the following types of compensation:

– reactive droop;
– transformer-drop or line-drop compensation;
– reactive differential compensation known also as cross-current compensation.

Reference: IEEE 421.5-2005, 4.

Table 318 shows all attributes of VCompIEEEType2.

Table 318 – Attributes of VoltageCompensatorDynamics::VCompIEEEType2

name	mult	type	description
tr	0..1	Seconds	Time constant which is used for the combined voltage sensing and compensation signal (Tr) (>= 0).
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 319 shows all association ends of VCompIEEEType2 with other classes.

Table 319 – Association ends of VoltageCompensatorDynamics::VCompIEEEType2 with other classes

mult from	name	mult to	type	description
1..1	GenICompensationForGenJ	2..*	GenICompensationForGenJ	Compensation of this voltage compensator's generator for current flow out of another generator.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: VoltageCompensatorDynamics
1..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: VoltageCompensatorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.17.5 GenICompensationForGenJ

Resistive and reactive components of compensation for generator associated with IEEE type 2 voltage compensator for current flow out of another generator in the interconnection.

Table 320 shows all attributes of GenICompensationForGenJ.

Table 320 – Attributes of VoltageCompensatorDynamics::GenICompensationForGenJ

name	mult	type	description
rcij	0..1	PU	Resistive component of compensation of generator associated with this IEEE type 2 voltage compensator for current flow out of another generator (Rcij).
xcij	0..1	PU	Reactive component of compensation of generator associated with this IEEE type 2 voltage compensator for current flow out of another generator (Xcij).
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 321 shows all association ends of GenICompensationForGenJ with other classes.

Table 321 – Association ends of VoltageCompensatorDynamics::GenICompensationForGenJ with other classes

mult from	name	mult to	type	description
0..*	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	Standard synchronous machine out of which current flow is being compensated for.
2..*	VcompIEEEType2	1..1	VCompIEEEType2	The standard IEEE type 2 voltage compensator of this compensation.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18 Package WindDynamics

5.3.18.1 General

Wind turbines are generally divided into four types, which are currently significant in power systems. The four types have the following characteristics:

- type 1: wind turbine with directly grid connected asynchronous generator with fixed rotor resistance (typically squirrel cage);
- type 2: wind turbine with directly grid connected asynchronous generator with variable rotor resistance;
- type 3: wind turbines with doubly-fed asynchronous generators (directly connected stator and rotor connected through power converter);
- type 4: wind turbines connected to the grid through a full size power converter.

Models included in this package are according to IEC 61400-27-1:2015.

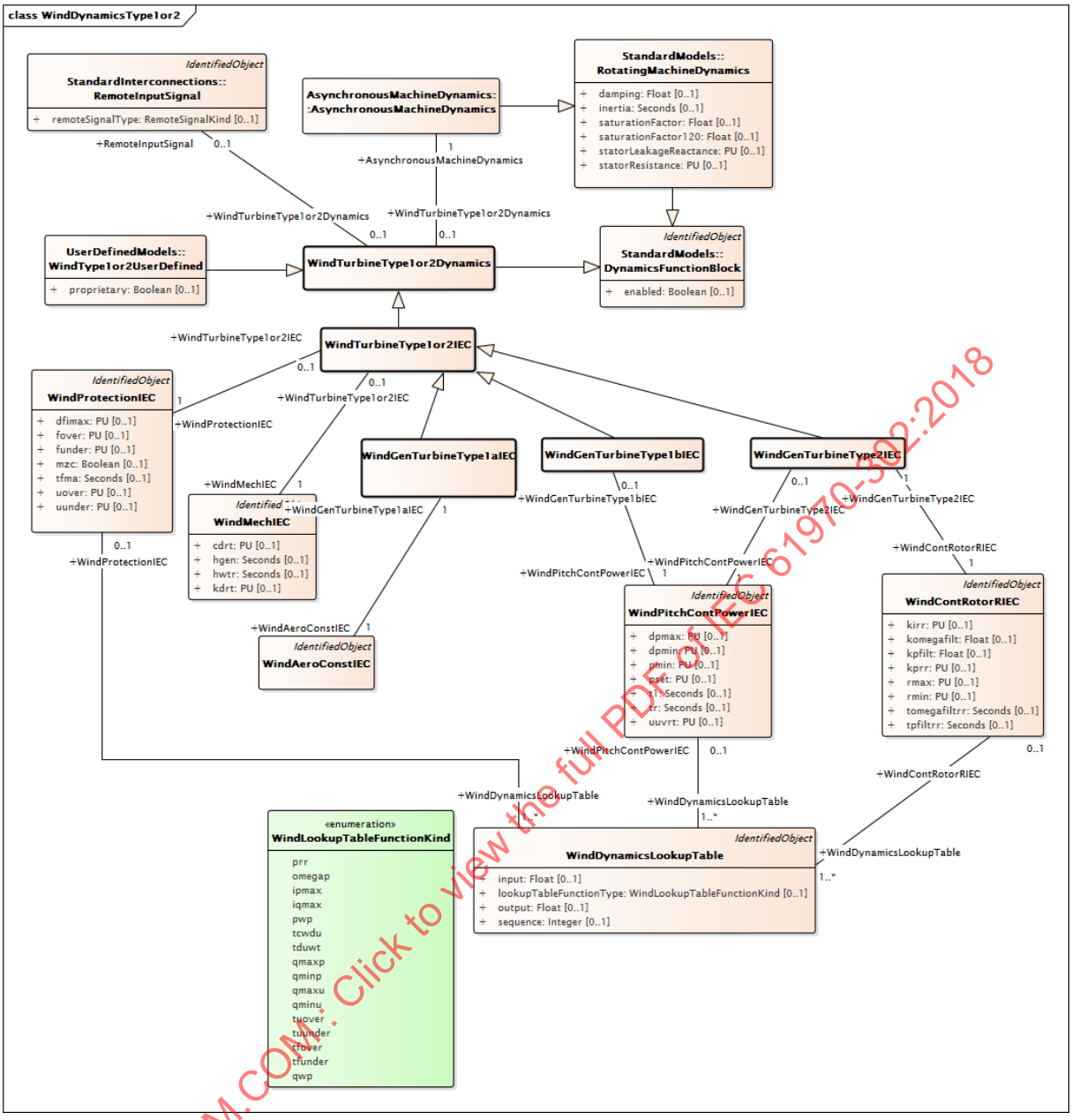

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Figure 162 – Class diagram WindDynamics::WindDynamicsType1or2

Figure 162: This diagram shows dynamic standard model wind classes (for wind turbines type 1 and type 2) and their relationships. Note that classes in the Wind package are not grouped by function block classes. This is because specific standard model classes, not abstract function block classes, are specified in the wind interconnection models.

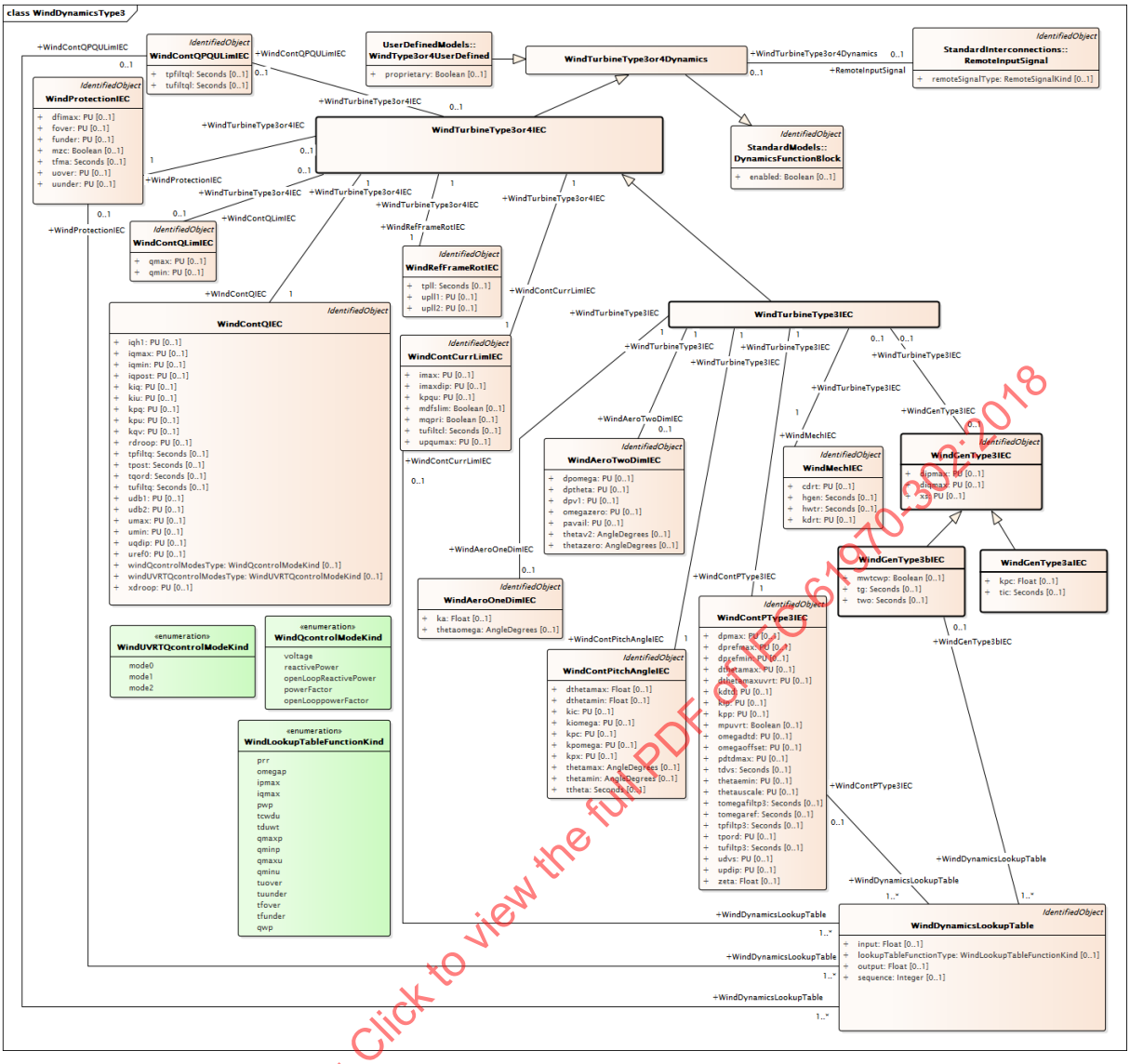

Figure 163 – Class diagram WindDynamics::WindDynamicsType3

Figure 163: This diagram shows dynamic standard model wind classes for wind turbines type 3 and their relationships. Note that classes in the Wind package are not grouped by function block classes. This is because specific standard model classes, not abstract function block classes, are specified in the wind interconnection models.

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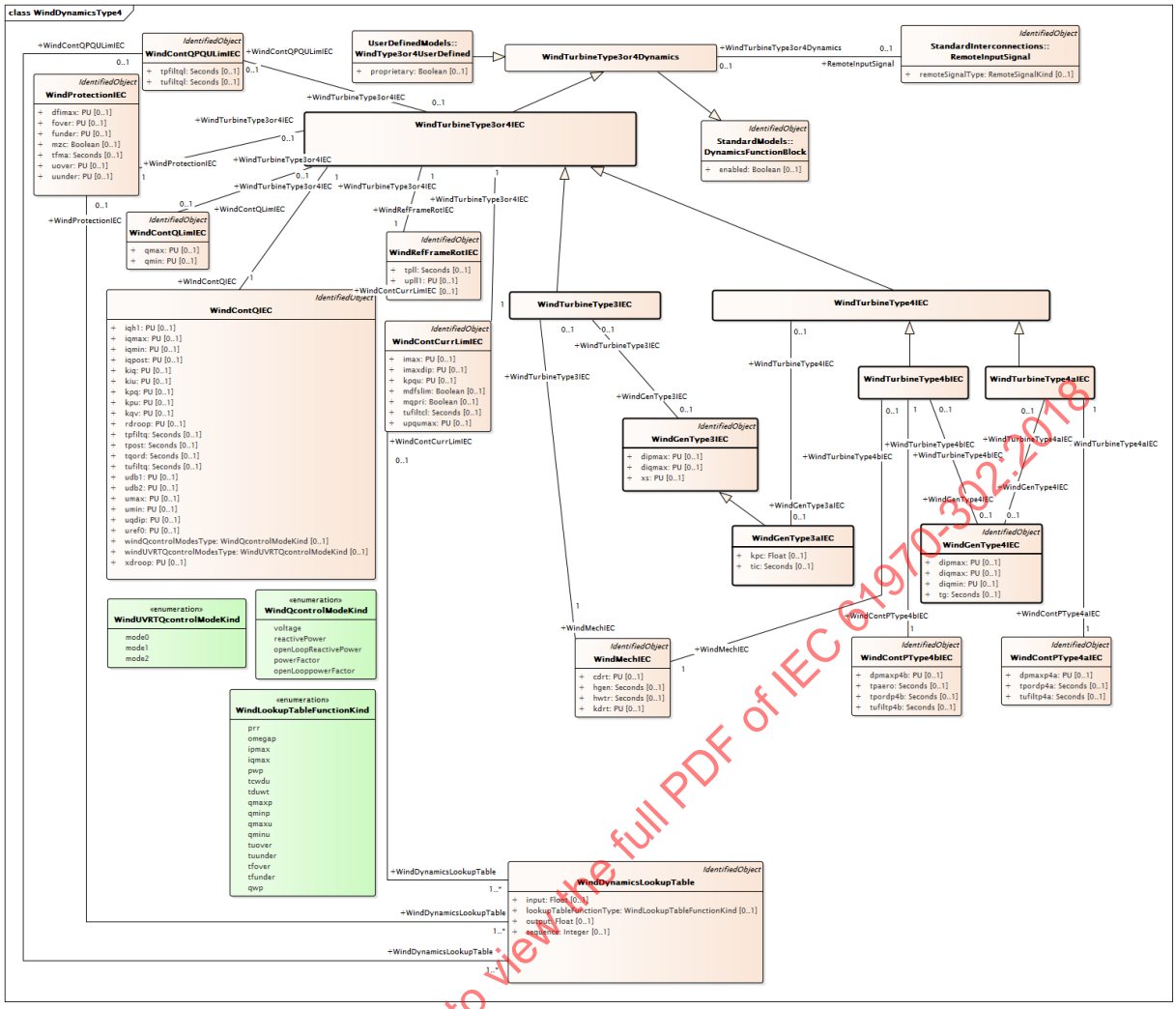

Figure 164 – Class diagram WindDynamics::WindDynamicsType4

Figure 164: This diagram shows dynamic standard model wind classes for wind turbines type 4 and their relationships. Note that classes in the Wind package are not grouped by function block classes. This is because specific standard model classes, not abstract function block classes, are specified in the wind interconnection models.

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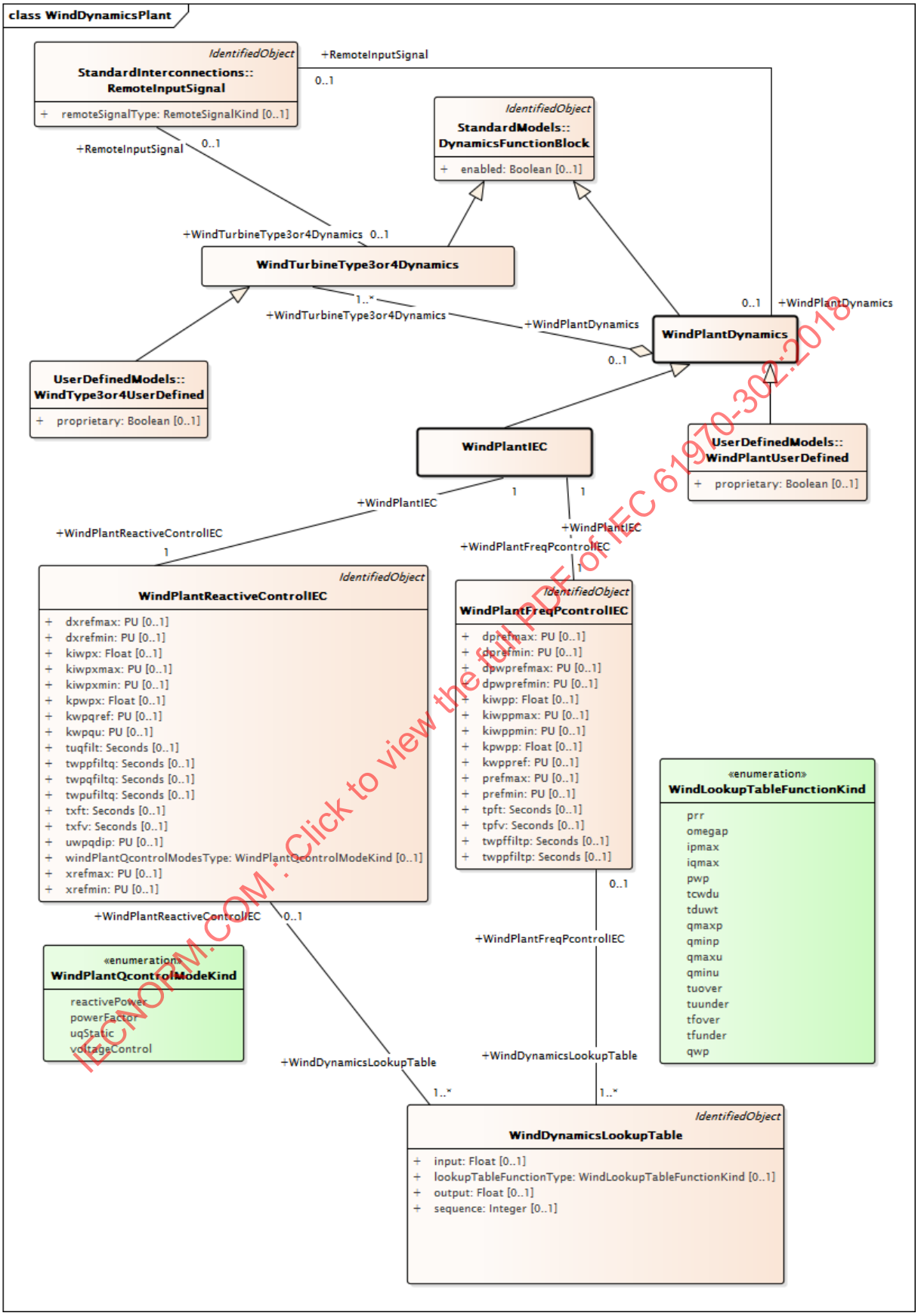

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Figure 165 – Class diagram WindDynamics::WindDynamicsPlant

Figure 165: This diagram shows dynamic standard model wind classes for wind plant. Note that classes in the Wind package are not grouped by function block classes. This is because

specific standard model classes, not abstract function block classes, are specified in the wind interconnection models.

5.3.18.2 WindPlantIEC

Simplified IEC type plant level model.

Reference: IEC 61400-27-1:2015, Annex D.

Table 322 shows all attributes of WindPlantIEC.

Table 322 – Attributes of WindDynamics::WindPlantIEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 323 shows all association ends of WindPlantIEC with other classes.

Table 323 – Association ends of WindDynamics::WindPlantIEC with other classes

mult from	name	mult to	type	description
1..1	WindPlantReactiveControlIEC	1..1	WindPlantReactiveControlIEC	Wind plant model with which this wind reactive control is associated.
1..1	WindPlantFreqPcontrolIEC	1..1	WindPlantFreqPcontrolIEC	Wind plant frequency and active power control model associated with this wind plant.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindPlantDynamics
0..1	WindTurbineType3or4Dynamics	1..*	WindTurbineType3or4Dynamics	inherited from: WindPlantDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.3 WindPlantDynamics

Parent class supporting relationships to wind turbines type 3 and type 4 and wind plant IEC and user-defined wind plants including their control models.

Table 324 shows all attributes of WindPlantDynamics.

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Table 324 – Attributes of WindDynamics::WindPlantDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 325 shows all association ends of WindPlantDynamics with other classes.

Table 325 – Association ends of WindDynamics::WindPlantDynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	The remote signal with which this power plant is associated.
0..1	WindTurbineType3or4Dynamics	1..*	WindTurbineType3or4Dynamics	The wind turbine type 3 or type 4 associated with this wind plant.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.4 WindTurbineType1or2Dynamics

Parent class supporting relationships to wind turbines type 1 and type 2 and their control models. Generator model for wind turbine of type 1 or type 2 is a standard asynchronous generator model.

Table 326 shows all attributes of WindTurbineType1or2Dynamics.

Table 326 – Attributes of WindDynamics::WindTurbineType1or2Dynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 327 shows all association ends of WindTurbineType1or2Dynamics with other classes.

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Table 327 – Association ends of WindDynamics::WindTurbineType1or2Dynamics with other classes

mult from	name	mult to	type	description
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by this wind generator type 1 or type 2 model.
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	Asynchronous machine model with which this wind generator type 1 or type 2 model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.5 WindTurbineType3or4Dynamics

Parent class supporting relationships to wind turbines type 3 and type 4 and wind plant including their control models.

Table 328 shows all attributes of WindTurbineType3or4Dynamics.

Table 328 – Attributes of WindDynamics::WindTurbineType3or4Dynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 329 shows all association ends of WindTurbineType3or4Dynamics with other classes.

Table 329 – Association ends of WindDynamics::WindTurbineType3or4Dynamics with other classes

mult from	name	mult to	type	description
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	The power electronics connection associated with this wind turbine type 3 or type 4 dynamics model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	Remote input signal used by these wind turbine type 3 or type 4 models.
1..*	WindPlantDynamics	0..1	WindPlantDynamics	The wind plant with which the wind turbines type 3 or type 4 are associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.6 WindTurbineType1or2IEC

Parent class supporting relationships to IEC wind turbines type 1 and type 2 including their control models.

Generator model for wind turbine of IEC type 1 or type 2 is a standard asynchronous generator model.

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Reference: IEC 61400-27-1:2015, 5.5.2 and 5.5.3.

Table 330 shows all attributes of WindTurbineType1or2IEC.

Table 330 – Attributes of WindDynamics::WindTurbineType1or2IEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 331 shows all association ends of WindTurbineType1or2IEC with other classes.

Table 331 – Association ends of WindDynamics::WindTurbineType1or2IEC with other classes

mult from	name	mult to	type	description
0..1	WindProtectionIEC	1..1	WindProtectionIEC	Wind turbune protection model associated with this wind generator type 1 or type 2 model.
0..1	WindMechIEC	1..1	WindMechIEC	Wind mechanical model associated with this wind generator type 1 or type 2 model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType1or2Dynamics
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	inherited from: WindTurbineType1or2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.7 WindTurbineType3or4IEC

Parent class supporting relationships to IEC wind turbines type 3 and type 4 including their control models.

Table 332 shows all attributes of WindTurbineType3or4IEC.

Table 332 – Attributes of WindDynamics::WindTurbineType3or4IEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 333 shows all association ends of WindTurbineType3or4IEC with other classes.

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Table 333 – Association ends of WindDynamics::WindTurbineType3or4IEC with other classes

mult from	name	mult to	type	description
0..1	WindContQPQULimIEC	0..1	WindContQPQULimIEC	QP and QU limitation model associated with this wind generator type 3 or type 4 model.
1..1	WindContCurrLimIEC	1..1	WindContCurrLimIEC	Wind control current limitation model associated with this wind turbine type 3 or type 4 model.
0..1	WindProtectionIEC	1..1	WindProtectionIEC	Wind turbune protection model associated with this wind generator type 3 or type 4 model.
1..1	WIndContQIEC	1..1	WindContQIEC	Wind control Q model associated with this wind turbine type 3 or type 4 model.
1..1	WindRefFrameRotIEC	1..1	WindRefFrameRotIEC	Reference frame rotation model associated with this wind turbine type 3 or type 4 model.
0..1	WindContQLimIEC	0..1	WindContQLimIEC	Constant Q limitation model associated with this wind generator type 3 or type 4 model.
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.8 WindTurbineType3IEC

Parent class supporting relationships to IEC wind turbines type 3 including their control models.

Table 334 shows all attributes of WindTurbineType3IEC.

Table 334 – Attributes of WindDynamics::WindTurbineType3IEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 335 shows all association ends of WindTurbineType3IEC with other classes.

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Table 335 – Association ends of WindDynamics::WindTurbineType3IEC with other classes

mult from	name	mult to	type	description
1..1	WindAeroTwoDimIEC	0..1	WindAeroTwoDimIEC	Wind aerodynamic model associated with this wind turbine type 3 model.
0..1	WindMechIEC	1..1	WindMechIEC	Wind mechanical model associated with this wind turbine type 3 model.
1..1	WindContPitchAngleIEC	1..1	WindContPitchAngleIEC	Wind control pitch angle model associated with this wind turbine type 3.
0..1	WindGenType3IEC	0..1	WindGenType3IEC	Wind generator type 3 model associated with this wind turbine type 3 model.
1..1	WindContPType3IEC	1..1	WindContPType3IEC	Wind control P type 3 model associated with this wind turbine type 3 model.
1..1	WindAeroOneDimIEC	0..1	WindAeroOneDimIEC	Wind aerodynamic model associated with this wind generator type 3 model.
0..1	WindContQPQULimIEC	0..1	WindContQPQULimIEC	inherited from: WindTurbineType3or4IEC
1..1	WindContCurrLimIEC	1..1	WindContCurrLimIEC	inherited from: WindTurbineType3or4IEC
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType3or4IEC
1..1	WIndContQIEC	1..1	WindContQIEC	inherited from: WindTurbineType3or4IEC
1..1	WindRefFrameRotIEC	1..1	WindRefFrameRotIEC	inherited from: WindTurbineType3or4IEC
0..1	WindContQLimIEC	0..1	WindContQLimIEC	inherited from: WindTurbineType3or4IEC
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.9 WindTurbineType4IEC

Parent class supporting relationships to IEC wind turbines type 4 including their control models.

Table 336 shows all attributes of WindTurbineType4IEC.

Table 336 – Attributes of WindDynamics::WindTurbineType4IEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 337 shows all association ends of WindTurbineType4IEC with other classes.

Table 337 – Association ends of WindDynamics::WindTurbineType4IEC with other classes

mult from	name	mult to	type	description
0..1	WindGenType3aIEC	0..1	WindGenType3aIEC	Wind generator type 3A model associated with this wind turbine type 4 model.
0..1	WindContQPQULimIEC	0..1	WindContQPQULimIEC	inherited from: WindTurbineType3or4IEC
1..1	WindContCurrLimIEC	1..1	WindContCurrLimIEC	inherited from: WindTurbineType3or4IEC
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType3or4IEC
1..1	WIndContQIEC	1..1	WindContQIEC	inherited from: WindTurbineType3or4IEC
1..1	WindRefFrameRotIEC	1..1	WindRefFrameRotIEC	inherited from: WindTurbineType3or4IEC
0..1	WindContQLimIEC	0..1	WindContQLimIEC	inherited from: WindTurbineType3or4IEC
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.10 WindGenTurbineType1aIEC

Wind turbine IEC type 1A.

Reference: IEC 61400-27-1:2015, 5.5.2.2.

Table 338 shows all attributes of WindGenTurbineType1aIEC.

Table 338 – Attributes of WindDynamics::WindGenTurbineType1aIEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 339 shows all association ends of WindGenTurbineType1aIEC with other classes.

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Table 339 – Association ends of WindDynamics::WindGenTurbineType1aIEC with other classes

mult from	name	mult to	type	description
1..1	WindAeroConstIEC	1..1	WindAeroConstIEC	Wind aerodynamic model associated with this wind turbine type 1A model.
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType1or2IEC
0..1	WindMechIEC	1..1	WindMechIEC	inherited from: WindTurbineType1or2IEC
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType1or2Dynamics
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	inherited from: WindTurbineType1or2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.11 WindGenTurbineType1bIEC

Wind turbine IEC type 1B.

Reference: IEC 61400-27-1:2015, 5.5.2.3.

Table 340 shows all attributes of WindGenTurbineType1bIEC.

Table 340 – Attributes of WindDynamics::WindGenTurbineType1bIEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 341 shows all association ends of WindGenTurbineType1bIEC with other classes.

Table 341 – Association ends of WindDynamics::WindGenTurbineType1bIEC with other classes

mult from	name	mult to	type	description
0..1	WindPitchContPowerIEC	1..1	WindPitchContPowerIEC	Pitch control power model associated with this wind turbine type 1B model.
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType1or2IEC
0..1	WindMechIEC	1..1	WindMechIEC	inherited from: WindTurbineType1or2IEC
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType1or2Dynamics
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	inherited from: WindTurbineType1or2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.12 WindGenTurbineType2IEC

Wind turbine IEC type 2.

Reference: IEC 61400-27-1:2015, 5.5.3.

Table 342 shows all attributes of WindGenTurbineType2IEC.

Table 342 – Attributes of WindDynamics::WindGenTurbineType2IEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 343 shows all association ends of WindGenTurbineType2IEC with other classes.

Table 343 – Association ends of WindDynamics::WindGenTurbineType2IEC with other classes

mult from	name	mult to	type	description
1..1	WindContRotorRIEC	1..1	WindContRotorRIEC	Wind control rotor resistance model associated with wind turbine type 2 model.
0..1	WindPitchContPowerIEC	1..1	WindPitchContPowerIEC	Pitch control power model associated with this wind turbine type 2 model.
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType1or2IEC
0..1	WindMechIEC	1..1	WindMechIEC	inherited from: WindTurbineType1or2IEC
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType1or2Dynamics
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	inherited from: WindTurbineType1or2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.13 WindGenType3IEC

Parent class supporting relationships to IEC wind turbines type 3 generator models of IEC type 3A and 3B.

Table 344 shows all attributes of WindGenType3IEC.

Table 344 – Attributes of WindDynamics::WindGenType3IEC

name	mult	type	description
dipmax	0..1	PU	Maximum active current ramp rate (dipmax). It is a project-dependent parameter.
diqmax	0..1	PU	Maximum reactive current ramp rate (diqmax). It is a project-dependent parameter.
xs	0..1	PU	Electromagnetic transient reactance (xS). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 345 shows all association ends of WindGenType3IEC with other classes.

Table 345 – Association ends of WindDynamics::WindGenType3IEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType3IEC	0..1	WindTurbineType3IEC	Wind turbine type 3 model with which this wind generator type 3 is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.14 WindTurbineType4aIEC

Wind turbine IEC type 4A.

Reference: IEC 61400-27-1:2015, 5.5.5.2.

Table 346 shows all attributes of WindTurbineType4aIEC.

Table 346 – Attributes of WindDynamics::WindTurbineType4aIEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 347 shows all association ends of WindTurbineType4aIEC with other classes.

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Table 347 – Association ends of WindDynamics::WindTurbineType4aIEC with other classes

mult from	name	mult to	type	description
1..1	WindContPType4aIEC	1..1	WindContPType4aIEC	Wind control P type 4A model associated with this wind turbine type 4A model.
0..1	WindGenType4IEC	0..1	WindGenType4IEC	Wind generator type 4 model associated with this wind turbine type 4A model.
0..1	WindGenType3aIEC	0..1	WindGenType3aIEC	inherited from: WindTurbineType4IEC
0..1	WindContQPQULimIEC	0..1	WindContQPQULimIEC	inherited from: WindTurbineType3or4IEC
1..1	WindContCurrLimIEC	1..1	WindContCurrLimIEC	inherited from: WindTurbineType3or4IEC
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType3or4IEC
1..1	WIndContQIEC	1..1	WindContQIEC	inherited from: WindTurbineType3or4IEC
1..1	WindRefFrameRotIEC	1..1	WindRefFrameRotIEC	inherited from: WindTurbineType3or4IEC
0..1	WindContQLimIEC	0..1	WindContQLimIEC	inherited from: WindTurbineType3or4IEC
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.15 WindTurbineType4bIEC

Wind turbine IEC type 4B.

Reference: IEC 61400-27-1:2015, 5.5.5.3.

Table 348 shows all attributes of WindTurbineType4bIEC.

Table 348 – Attributes of WindDynamics::WindTurbineType4bIEC

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 349 shows all association ends of WindTurbineType4bIEC with other classes.

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Table 349 – Association ends of WindDynamics::WindTurbineType4bIEC with other classes

mult from	name	mult to	type	description
0..1	WindGenType4IEC	0..1	WindGenType4IEC	Wind generator type 4 model associated with this wind turbine type 4B model.
0..1	WindMechIEC	1..1	WindMechIEC	Wind mechanical model associated with this wind turbine type 4B model.
1..1	WindContPType4bIEC	1..1	WindContPType4bIEC	Wind control P type 4B model associated with this wind turbine type 4B model.
0..1	WindGenType3aIEC	0..1	WindGenType3aIEC	inherited from: WindTurbineType4IEC
0..1	WindContQPQULimIEC	0..1	WindContQPQULimIEC	inherited from: WindTurbineType3or4IEC
1..1	WindContCurrLimIEC	1..1	WindContCurrLimIEC	inherited from: WindTurbineType3or4IEC
0..1	WindProtectionIEC	1..1	WindProtectionIEC	inherited from: WindTurbineType3or4IEC
1..1	WIndContQIEC	1..1	WindContQIEC	inherited from: WindTurbineType3or4IEC
1..1	WindRefFrameRotIEC	1..1	WindRefFrameRotIEC	inherited from: WindTurbineType3or4IEC
0..1	WindContQLimIEC	0..1	WindContQLimIEC	inherited from: WindTurbineType3or4IEC
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.16 WindGenType3aIEC

IEC type 3A generator set model.

Reference: IEC 61400-27-1:2015, 5.6.3.2.

Table 350 shows all attributes of WindGenType3aIEC.

Table 350 – Attributes of WindDynamics::WindGenType3aIEC

name	mult	type	description
kpc	0..1	Float	Current PI controller proportional gain (KPc). It is a type-dependent parameter.
tic	0..1	Seconds	Current PI controller integration time constant (TIc) (>= 0). It is a type-dependent parameter.
dipmax	0..1	PU	inherited from: WindGenType3IEC
diqmax	0..1	PU	inherited from: WindGenType3IEC
xs	0..1	PU	inherited from: WindGenType3IEC
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 351 shows all association ends of WindGenType3aIEC with other classes.

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Table 351 – Association ends of WindDynamics::WindGenType3aIEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType4IEC	0..1	WindTurbineType4IEC	Wind turbine type 4 model with which this wind generator type 3A model is associated.
0..1	WindTurbineType3IEC	0..1	WindTurbineType3IEC	inherited from: WindGenType3IEC
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.17 WindGenType3bIEC

IEC type 3B generator set model.

Reference: IEC 61400-27-1:2015, 5.6.3.3.

Table 352 shows all attributes of WindGenType3bIEC.

Table 352 – Attributes of WindDynamics::WindGenType3bIEC

name	mult	type	description
mwtcwp	0..1	Boolean	Crowbar control mode (MWTcwp). It is a case-dependent parameter. true = 1 in the IEC model false = 0 in the IEC model.
tg	0..1	Seconds	Current generation time constant (Tg) (>= 0). It is a type-dependent parameter.
two	0..1	Seconds	Time constant for crowbar washout filter (Two) (>= 0). It is a case-dependent parameter.
dipmax	0..1	PU	inherited from: WindGenType3IEC
diqmax	0..1	PU	inherited from: WindGenType3IEC
xs	0..1	PU	inherited from: WindGenType3IEC
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 353 shows all association ends of WindGenType3bIEC with other classes.

Table 353 – Association ends of WindDynamics::WindGenType3bIEC with other classes

mult from	name	mult to	type	description
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this generator type 3B model.
0..1	WindTurbineType3IEC	0..1	WindTurbineType3IEC	inherited from: WindGenType3IEC
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.18 WindGenType4IEC

IEC type 4 generator set model.

Reference: IEC 61400-27-1:2015, 5.6.3.4.

Table 354 shows all attributes of WindGenType4IEC.

Table 354 – Attributes of WindDynamics::WindGenType4IEC

name	mult	type	description
dipmax	0..1	PU	Maximum active current ramp rate (dipmax). It is a project-dependent parameter.
diqmin	0..1	PU	Minimum reactive current ramp rate (diqmin). It is a project-dependent parameter.
diqmax	0..1	PU	Maximum reactive current ramp rate (diqmax). It is a project-dependent parameter.
tg	0..1	Seconds	Time constant (Tg) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 355 shows all association ends of WindGenType4IEC with other classes.

Table 355 – Association ends of WindDynamics::WindGenType4IEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType4aIEC	0..1	WindTurbineType4aIEC	Wind turbine type 4A model with which this wind generator type 4 model is associated.
0..1	WindTurbineType4bIEC	0..1	WindTurbineType4bIEC	Wind turbine type 4B model with which this wind generator type 4 model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.19 WindRefFrameRotIEC

Reference frame rotation model.

Reference: IEC 61400-27-1:2015, 5.6.3.5.

Table 356 shows all attributes of WindRefFrameRotIEC.

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Table 356 – Attributes of WindDynamics::WindRefFrameRotIEC

name	mult	type	description
tpll	0..1	Seconds	Time constant for PLL first order filter model (TPLL) (>= 0). It is a type-dependent parameter.
upll1	0..1	PU	Voltage below which the angle of the voltage is filtered and possibly also frozen (uPLL1). It is a type-dependent parameter.
upll2	0..1	PU	Voltage (uPLL2) below which the angle of the voltage is frozen if uPLL2 is smaller or equal to uPLL1 . It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 357 shows all association ends of WindRefFrameRotIEC with other classes.

Table 357 – Association ends of WindDynamics::WindRefFrameRotIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType3or4IEC	1..1	WindTurbineType3or4IEC	Wind turbine type 3 or type 4 model with which this reference frame rotation model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.20 WindAeroConstIEC

Constant aerodynamic torque model which assumes that the aerodynamic torque is constant.

Reference: IEC 61400-27-1:2015, 5.6.1.1.

Table 358 shows all attributes of WindAeroConstIEC.

Table 358 – Attributes of WindDynamics::WindAeroConstIEC

name	mult	type	description
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 359 shows all association ends of WindAeroConstIEC with other classes.

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Table 359 – Association ends of WindDynamics::WindAeroConstIEC with other classes

mult from	name	mult to	type	description
1..1	WindGenTurbineType1aIEC	1..1	WindGenTurbineType1aIEC	Wind turbine type 1A model with which this wind aerodynamic model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.21 WindAeroOneDimIEC

One-dimensional aerodynamic model.

Reference: IEC 61400-27-1:2015, 5.6.1.2.

Table 360 shows all attributes of WindAeroOneDimIEC.

Table 360 – Attributes of WindDynamics::WindAeroOneDimIEC

name	mult	type	description
ka	0..1	Float	Aerodynamic gain (ka). It is a type-dependent parameter.
thetaomega	0..1	AngleDegrees	Initial pitch angle (thetaomega0). It is a case-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 361 shows all association ends of WindAeroOneDimIEC with other classes.

Table 361 – Association ends of WindDynamics::WindAeroOneDimIEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType3IEC	1..1	WindTurbineType3IEC	Wind turbine type 3 model with which this wind aerodynamic model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.22 WindAeroTwoDimIEC

Two-dimensional aerodynamic model.

Reference: IEC 61400-27-1:2015, 5.6.1.3.

Table 362 shows all attributes of WindAeroTwoDimIEC.

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Table 362 – Attributes of WindDynamics::WindAeroTwoDimIEC

name	mult	type	description
dpomega	0..1	PU	Partial derivative of aerodynamic power with respect to changes in WTR speed (dpomega). It is a type-dependent parameter.
dptheta	0..1	PU	Partial derivative of aerodynamic power with respect to changes in pitch angle (dptheta). It is a type-dependent parameter.
dpv1	0..1	PU	Partial derivative (dpv1). It is a type-dependent parameter.
omegazero	0..1	PU	Rotor speed if the wind turbine is not derated (omega0). It is a type-dependent parameter.
pavail	0..1	PU	Available aerodynamic power (pavail). It is a case-dependent parameter.
thetav2	0..1	AngleDegrees	Blade angle at twice rated wind speed (thetav2). It is a type-dependent parameter.
thetazero	0..1	AngleDegrees	Pitch angle if the wind turbine is not derated (theta0). It is a case-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 363 shows all association ends of WindAeroTwoDimIEC with other classes.

Table 363 – Association ends of WindDynamics::WindAeroTwoDimIEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType3IEC	1..1	WindTurbineType3IEC	Wind turbine type 3 model with which this wind aerodynamic model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.23 WindMechIEC

Two mass model.

Reference: IEC 61400-27-1:2015, 5.6.2.1.

Table 364 shows all attributes of WindMechIEC.

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Table 364 – Attributes of WindDynamics::WindMechIEC

name	mult	type	description
cdrt	0..1	PU	Drive train damping (cdrt). It is a type-dependent parameter.
hgen	0..1	Seconds	Inertia constant of generator (Hgen) (>= 0). It is a type-dependent parameter.
hwtr	0..1	Seconds	Inertia constant of wind turbine rotor (HWTR) (>= 0). It is a type-dependent parameter.
kdrt	0..1	PU	Drive train stiffness (kdrt). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 365 shows all association ends of WindMechIEC with other classes.

Table 365 – Association ends of WindDynamics::WindMechIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType1or2IEC	0..1	WindTurbineType1or2IEC	Wind generator type 1 or type 2 model with which this wind mechanical model is associated.
1..1	WindTurbineType3IEC	0..1	WindTurbineType3IEC	Wind turbine type 3 model with which this wind mechanical model is associated.
1..1	WindTurbineType4bIEC	0..1	WindTurbineType4bIEC	Wind turbine type 4B model with which this wind mechanical model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.24 WindPitchContPowerIEC

Pitch control power model.

Reference: IEC 61400-27-1:2015, 5.6.5.1.

Table 366 shows all attributes of WindPitchContPowerIEC.

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Table 366 – Attributes of WindDynamics::WindPitchContPowerIEC

name	mult	type	description
dpmax	0..1	PU	Rate limit for increasing power (dpmax) (> WindPitchContPowerIEC.dpmin). It is a type-dependent parameter.
dpmin	0..1	PU	Rate limit for decreasing power (dpmin) (< WindPitchContPowerIEC.dpmax). It is a type-dependent parameter.
pmin	0..1	PU	Minimum power setting (pmin). It is a type-dependent parameter.
pset	0..1	PU	If pinit < pset then power will be ramped down to pmin. It is (pset) in the IEC 61400-27-1:2015. It is a type-dependent parameter.
t1	0..1	Seconds	Lag time constant (T1) (>= 0). It is a type-dependent parameter.
tr	0..1	Seconds	Voltage measurement time constant (Tr) (>= 0). It is a type-dependent parameter.
uuvrt	0..1	PU	Dip detection threshold (uUVRT). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 367 shows all association ends of WindPitchContPowerIEC with other classes.

Table 367 – Association ends of WindDynamics::WindPitchContPowerIEC with other classes

mult from	name	mult to	type	description
1..1	WindGenTurbineType2IEC	0..1	WindGenTurbineType2IEC	Wind turbine type 2 model with which this pitch control power model is associated.
1..1	WindGenTurbineType1bIEC	0..1	WindGenTurbineType1bIEC	Wind turbine type 1B model with which this pitch control power model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this pitch control power model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.25 WindContRotorRIEC

Rotor resistance control model.

Reference: IEC 61400-27-1:2015, 5.6.5.3.

Table 368 shows all attributes of WindContRotorRIEC.

Table 368 – Attributes of WindDynamics::WindContRotorRIEC

name	mult	type	description
kirr	0..1	PU	Integral gain in rotor resistance PI controller (KIrr). It is a type-dependent parameter.
komegafilt	0..1	Float	Filter gain for generator speed measurement (Komegafilt). It is a type-dependent parameter.
kpfilt	0..1	Float	Filter gain for power measurement (Kpfilt). It is a type-dependent parameter.
kprr	0..1	PU	Proportional gain in rotor resistance PI controller (KPrr). It is a type-dependent parameter.
rmax	0..1	PU	Maximum rotor resistance (rmax) (> WindContRotorRIEC.rmin). It is a type-dependent parameter.
rmin	0..1	PU	Minimum rotor resistance (rmin) (< WindContRotorRIEC.rmax). It is a type-dependent parameter.
tomegafiltrr	0..1	Seconds	Filter time constant for generator speed measurement (Tomegafiltrr) (>= 0). It is a type-dependent parameter.
tpfiltrr	0..1	Seconds	Filter time constant for power measurement (Tpfiltrr) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 369 shows all association ends of WindContRotorRIEC with other classes.

Table 369 – Association ends of WindDynamics::WindContRotorRIEC with other classes

mult from	name	mult to	type	description
1..1	WindGenTurbineType2IEC	1..1	WindGenTurbineType2IEC	Wind turbine type 2 model with whitch this wind control rotor resistance model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this rotor resistance control model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.26 WindContPType3IEC

P control model type 3.

Reference: IEC 61400-27-1:2015, 5.6.5.4.

Table 370 shows all attributes of WindContPType3IEC.

Table 370 – Attributes of WindDynamics::WindContPType3IEC

name	mult	type	description
dpmax	0..1	PU	Maximum wind turbine power ramp rate (dpmax). It is a type-dependent parameter.
dprefmax	0..1	PU	Maximum ramp rate of wind turbine reference power (dprefmax). It is a project-dependent parameter.
dprefmin	0..1	PU	Minimum ramp rate of wind turbine reference power (dprefmin). It is a project-dependent parameter.
dthetamax	0..1	PU	Ramp limitation of torque, required in some grid codes (dtmax). It is a project-dependent parameter.
dthetamaxuvrt	0..1	PU	Limitation of torque rise rate during UVRT (dthetamaxUVRT). It is a project-dependent parameter.
kdtd	0..1	PU	Gain for active drive train damping (KDTD). It is a type-dependent parameter.
kip	0..1	PU	PI controller integration parameter (KIp). It is a type-dependent parameter.
kpp	0..1	PU	PI controller proportional gain (KPp). It is a type-dependent parameter.
mpuvrt	0..1	Boolean	Enable UVRT power control mode (MpUVRT). It is a project-dependent parameter. true = voltage control (1 in the IEC model) false = reactive power control (0 in the IEC model).
omegaoffset	0..1	PU	Offset to reference value that limits controller action during rotor speed changes (omegaoffset). It is a case-dependent parameter.
pdtdmax	0..1	PU	Maximum active drive train damping power (pDTDmax). It is a type-dependent parameter.
tdvs	0..1	Seconds	Time delay after deep voltage sags (TDVS) (>= 0). It is a project-dependent parameter.
thetaemin	0..1	PU	Minimum electrical generator torque (temin). It is a type-dependent parameter.
thetauscale	0..1	PU	Voltage scaling factor of reset-torque (tuscale). It is a project-dependent parameter.
tomegafiltp3	0..1	Seconds	Filter time constant for generator speed measurement (Tomegafiltp3) (>= 0). It is a type-dependent parameter.
tpfiltp3	0..1	Seconds	Filter time constant for power measurement (Tpfiltp3) (>= 0). It is a type-dependent parameter.
tpord	0..1	PU	Time constant in power order lag (Tpord). It is a type-dependent parameter.
tufiltp3	0..1	Seconds	Filter time constant for voltage measurement (Tufiltp3) (>= 0). It is a type-dependent parameter.
tomegaref	0..1	Seconds	Time constant in speed reference filter (Tomega,ref) (>= 0). It is a type-dependent parameter.
udvs	0..1	PU	Voltage limit for hold UVRT status after deep voltage sags (uDVS). It is a project-dependent parameter.
updip	0..1	PU	Voltage dip threshold for P-control (uPdip). Part of turbine control, often different (e.g 0.8) from converter thresholds. It is a project-dependent parameter.
omegadtd	0..1	PU	Active drive train damping frequency (omegaDTD). It can be calculated from two mass model parameters. It is a type-dependent parameter.
zeta	0..1	Float	Coefficient for active drive train damping (zeta). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 371 shows all association ends of WindContPType3IEC with other classes.

Table 371 – Association ends of WindDynamics::WindContPType3IEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType3IEC	1..1	WindTurbineType3IEC	Wind turbine type 3 model with which this wind control P type 3 model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this P control type 3 model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.27 WindContPType4aIEC

P control model type 4A.

Reference: IEC 61400-27-1:2015, 5.6.5.5.

Table 372 shows all attributes of WindContPType4aIEC.

Table 372 – Attributes of WindDynamics::WindContPType4aIEC

name	mult	type	description
dpmaxp4a	0..1	PU	Maximum wind turbine power ramp rate (dpmaxp4A). It is a project-dependent parameter.
tpordp4a	0..1	Seconds	Time constant in power order lag (Tpordp4A) (>= 0). It is a type-dependent parameter.
tufiltp4a	0..1	Seconds	Voltage measurement filter time constant (Tufiltp4A) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 373 shows all association ends of WindContPType4aIEC with other classes.

Table 373 – Association ends of WindDynamics::WindContPType4aIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType4aIEC	1..1	WindTurbineType4aIEC	Wind turbine type 4A model with which this wind control P type 4A model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.28 WindContPType4bIEC

P control model type 4B.

Reference: IEC 61400-27-1:2015, 5.6.5.6.

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Table 374 shows all attributes of WindContPType4bIEC.

Table 374 – Attributes of WindDynamics::WindContPType4bIEC

name	mult	type	description
dpmaxp4b	0..1	PU	Maximum wind turbine power ramp rate (dpmaxp4B). It is a project-dependent parameter.
tpaero	0..1	Seconds	Time constant in aerodynamic power response (Tpaero) (>= 0). It is a type-dependent parameter.
tpordp4b	0..1	Seconds	Time constant in power order lag (Tpordp4B) (>= 0). It is a type-dependent parameter.
tufiltp4b	0..1	Seconds	Voltage measurement filter time constant (Tufiltp4B) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 375 shows all association ends of WindContPType4bIEC with other classes.

Table 375 – Association ends of WindDynamics::WindContPType4bIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType4bIEC	1..1	WindTurbineType4bIEC	Wind turbine type 4B model with which this wind control P type 4B model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.29 WindContQIEC

Q control model.

Reference: IEC 61400-27-1:2015, 5.6.5.7.

Table 376 shows all attributes of WindContQIEC.

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Table 376 – Attributes of WindDynamics::WindContQIEC

name	mult	type	description
iqh1	0..1	PU	Maximum reactive current injection during dip (iqh1). It is a type-dependent parameter.
iqmax	0..1	PU	Maximum reactive current injection (iqmax) (> WindContQIEC.iqmin). It is a type-dependent parameter.
iqmin	0..1	PU	Minimum reactive current injection (iqmin) (< WindContQIEC.iqmax). It is a type-dependent parameter.
iqpost	0..1	PU	Post fault reactive current injection (iqpost). It is a project-dependent parameter.
kiq	0..1	PU	Reactive power PI controller integration gain (KI,q). It is a type-dependent parameter.
kiu	0..1	PU	Voltage PI controller integration gain (KI,u). It is a type-dependent parameter.
kpq	0..1	PU	Reactive power PI controller proportional gain (KP,q). It is a type-dependent parameter.
kpu	0..1	PU	Voltage PI controller proportional gain (KP,u). It is a type-dependent parameter.
kqv	0..1	PU	Voltage scaling factor for UVRT current (Kqv). It is a project-dependent parameter.
rdroop	0..1	PU	Resistive component of voltage drop impedance (rdroop) (>= 0). It is a project-dependent parameter.
tpfiltq	0..1	Seconds	Power measurement filter time constant (Tpfiltq) (>= 0). It is a type-dependent parameter.
tpost	0..1	Seconds	Length of time period where post fault reactive power is injected (Tpost) (>= 0). It is a project-dependent parameter.
tqord	0..1	Seconds	Time constant in reactive power order lag (Tqord) (>= 0). It is a type-dependent parameter.
tufiltq	0..1	Seconds	Voltage measurement filter time constant (Tufiltq) (>= 0). It is a type-dependent parameter.
udb1	0..1	PU	Voltage deadband lower limit (udb1). It is a type-dependent parameter.
udb2	0..1	PU	Voltage deadband upper limit (udb2). It is a type-dependent parameter.
umax	0..1	PU	Maximum voltage in voltage PI controller integral term (umax) (> WindContQIEC.umin). It is a type-dependent parameter.
umin	0..1	PU	Minimum voltage in voltage PI controller integral term (umin) (< WindContQIEC.umax). It is a type-dependent parameter.
uqdip	0..1	PU	Voltage threshold for UVRT detection in Q control (uqdip). It is a type-dependent parameter.
uref0	0..1	PU	User-defined bias in voltage reference (uref0). It is a case-dependent parameter.
windQcontrolModesType	0..1	WindQcontrolModeKind	Types of general wind turbine Q control modes (MqG). It is a project-dependent parameter.
windUVRTQcontrolModesType	0..1	WindUVRTQcontrolModeKind	Types of UVRT Q control modes (MqUVRT). It is a project-dependent parameter.
xdroop	0..1	PU	Inductive component of voltage drop impedance (xdroop) (>= 0). It is a project-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 377 shows all association ends of WindContQIEC with other classes.

Table 377 – Association ends of WindDynamics::WindContQIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType3or4IEC	1..1	WindTurbineType3or4IEC	Wind turbine type 3 or type 4 model with which this reactive control model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.30 WindContCurrLimIEC

Current limitation model. The current limitation model combines the physical limits and the control limits.

Reference: IEC 61400-27-1:2015, 5.6.5.8.

Table 378 shows all attributes of WindContCurrLimIEC.

Table 378 – Attributes of WindDynamics::WindContCurrLimIEC

name	mult	type	description
imax	0..1	PU	Maximum continuous current at the wind turbine terminals (imax). It is a type-dependent parameter.
imaxdip	0..1	PU	Maximum current during voltage dip at the wind turbine terminals (imaxdip). It is a project-dependent parameter.
kpqu	0..1	PU	Partial derivative of reactive current limit (Kpqu) versus voltage. It is a type-dependent parameter.
mdfslim	0..1	Boolean	Limitation of type 3 stator current (MDFSLim). MDFSLim = 1 for wind turbines type 4. It is a type-dependent parameter. false= total current limitation (0 in the IEC model) true=stator current limitation (1 in the IEC model).
mqpri	0..1	Boolean	Prioritisation of Q control during UVRT (Mqpri). It is a project-dependent parameter. true = reactive power priority (1 in the IEC model) false = active power priority (0 in the IEC model).
tufiltcl	0..1	Seconds	Voltage measurement filter time constant (Tufiltcl) (>= 0). It is a type-dependent parameter.
upqumax	0..1	PU	Wind turbine voltage in the operation point where zero reactive current can be delivered (upqumax). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 379 shows all association ends of WindContCurrLimIEC with other classes.

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Table 379 – Association ends of WindDynamics::WindContCurrLimIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType3or4IEC	1..1	WindTurbineType3or4IEC	Wind turbine type 3 or type 4 model with which this wind control current limitation model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this current control limitation model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.31 WindContQLimIEC

Constant Q limitation model.

Reference: IEC 61400-27-1:2015, 5.6.5.9.

Table 380 shows all attributes of WindContQLimIEC.

Table 380 – Attributes of WindDynamics::WindContQLimIEC

name	mult	type	description
qmax	0..1	PU	Maximum reactive power (qmax) (> WindContQLimIEC.qmin). It is a type-dependent parameter.
qmin	0..1	PU	Minimum reactive power (qmin) (< WindContQLimIEC.qmax). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 381 shows all association ends of WindContQLimIEC with other classes.

Table 381 – Association ends of WindDynamics::WindContQLimIEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType3or4IEC	0..1	WindTurbineType3or4IEC	Wind generator type 3 or type 4 model with which this constant Q limitation model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.32 WindContQPQULimIEC

QP and QU limitation model.

Reference: IEC 61400-27-1:2015, 5.6.5.10.

Table 382 shows all attributes of WindContQPQULimIEC.

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Table 382 – Attributes of WindDynamics::WindContQPQULimIEC

name	mult	type	description
tpfiltql	0..1	Seconds	Power measurement filter time constant for Q capacity (Tpfiltql) (>= 0). It is a type-dependent parameter.
tufiltql	0..1	Seconds	Voltage measurement filter time constant for Q capacity (Tufiltql) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 383 shows all association ends of WindContQPQULimIEC with other classes.

Table 383 – Association ends of WindDynamics::WindContQPQULimIEC with other classes

mult from	name	mult to	type	description
0..1	WindTurbineType3or4IEC	0..1	WindTurbineType3or4IEC	Wind generator type 3 or type 4 model with which this QP and QU limitation model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this QP and QU limitation model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.33 WindContPitchAngleIEC

Pitch angle control model.

Reference: IEC 61400-27-1:2015, 5.6.5.2.

Table 384 shows all attributes of WindContPitchAngleIEC.

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Table 384 – Attributes of WindDynamics::WindContPitchAngleIEC

name	mult	type	description
dthetamax	0..1	Float	Maximum pitch positive ramp rate (dthetamax) (> WindContPitchAngleIEC.dthetamin). It is a type-dependent parameter. Unit = degrees / s.
dthetamin	0..1	Float	Maximum pitch negative ramp rate (dthetamin) (< WindContPitchAngleIEC.dthetamax). It is a type-dependent parameter. Unit = degrees / s.
kic	0..1	PU	Power PI controller integration gain (KIc). It is a type-dependent parameter.
kiomega	0..1	PU	Speed PI controller integration gain (KIomega). It is a type-dependent parameter.
kpc	0..1	PU	Power PI controller proportional gain (KPc). It is a type-dependent parameter.
kpomega	0..1	PU	Speed PI controller proportional gain (KPomega). It is a type-dependent parameter.
kpx	0..1	PU	Pitch cross coupling gain (KPX). It is a type-dependent parameter.
thetamax	0..1	AngleDegrees	Maximum pitch angle (thetamax) (> WindContPitchAngleIEC.thetamin). It is a type-dependent parameter.
thetamin	0..1	AngleDegrees	Minimum pitch angle (thetamin) (< WindContPitchAngleIEC.thetamax). It is a type-dependent parameter.
ttheta	0..1	Seconds	Pitch time constant (ttheta) (>= 0). It is a type-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 385 shows all association ends of WindContPitchAngleIEC with other classes.

Table 385 – Association ends of WindDynamics::WindContPitchAngleIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType3IEC	1..1	WindTurbineType3IEC	Wind turbine type 3 model with which this pitch control model is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.34 WindProtectionIEC

The grid protection model includes protection against over- and under-voltage, and against over- and under-frequency.

Reference: IEC 61400-27-1:2015, 5.6.6.

Table 386 shows all attributes of WindProtectionIEC.

Table 386 – Attributes of WindDynamics::WindProtectionIEC

name	mult	type	description
dfimax	0..1	PU	Maximum rate of change of frequency (dFmax). It is a type-dependent parameter.
fover	0..1	PU	Wind turbine over frequency protection activation threshold (fover). It is a project-dependent parameter.
funder	0..1	PU	Wind turbine under frequency protection activation threshold (funder). It is a project-dependent parameter.
mzc	0..1	Boolean	Zero crossing measurement mode (Mzc). It is a type-dependent parameter. true = WT protection system uses zero crossings to detect frequency (1 in the IEC model) false = WT protection system does not use zero crossings to detect frequency (0 in the IEC model).
tfma	0..1	Seconds	Time interval of moving average window (TfMA) (>= 0). It is a type-dependent parameter.
uover	0..1	PU	Wind turbine over voltage protection activation threshold (uover). It is a project-dependent parameter.
uunder	0..1	PU	Wind turbine under voltage protection activation threshold (uunder). It is a project-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 387 shows all association ends of WindProtectionIEC with other classes.

Table 387 – Association ends of WindDynamics::WindProtectionIEC with other classes

mult from	name	mult to	type	description
1..1	WindTurbineType1or2IEC	0..1	WindTurbineType1or2IEC	Wind generator type 1 or type 2 model with which this wind turbine protection model is associated.
1..1	WindTurbineType3or4IEC	0..1	WindTurbineType3or4IEC	Wind generator type 3 or type 4 model with which this wind turbine protection model is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this grid protection model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.35 WindPlantReactiveControlIEC

Simplified plant voltage and reactive power control model for use with type 3 and type 4 wind turbine models.

Reference: IEC 61400-27-1:2015, Annex D.

Table 388 shows all attributes of WindPlantReactiveControlIEC.

Table 388 – Attributes of WindDynamics::WindPlantReactiveControlIEC

name	mult	type	description
dxrefmax	0..1	PU	Maximum positive ramp rate for wind turbine reactive power/voltage reference (dxrefmax) (> WindPlantReactiveControlIEC.dxrefmin). It is a project-dependent parameter.
dxrefmin	0..1	PU	Maximum negative ramp rate for wind turbine reactive power/voltage reference (dxrefmin) (< WindPlantReactiveControlIEC.dxrefmax). It is a project-dependent parameter.
kiwpx	0..1	Float	Plant Q controller integral gain (KIWPx). It is a project-dependent parameter.
kiwpxmax	0..1	PU	Maximum reactive power/voltage reference from integration (KIWPxmax) (> WindPlantReactiveControlIEC.kiwpxmin). It is a project-dependent parameter.
kiwpxmin	0..1	PU	Minimum reactive power/voltage reference from integration (KIWPxmin) (< WindPlantReactiveControlIEC.kiwpxmax). It is a project-dependent parameter.
kpwpx	0..1	Float	Plant Q controller proportional gain (KPWPx). It is a project-dependent parameter.
kwpqref	0..1	PU	Reactive power reference gain (KWPqref). It is a project-dependent parameter.
kwpqu	0..1	PU	Plant voltage control droop (KWPqu). It is a project-dependent parameter.
tuqfilt	0..1	Seconds	Filter time constant for voltage-dependent reactive power (Tuqfilt) (>= 0). It is a project-dependent parameter.
twppfiltq	0..1	Seconds	Filter time constant for active power measurement (TWPpfiltq) (>= 0). It is a project-dependent parameter.
twpqfiltq	0..1	Seconds	Filter time constant for reactive power measurement (TWPqfiltq) (>= 0). It is a project-dependent parameter.
twpufiltq	0..1	Seconds	Filter time constant for voltage measurement (TWPufiltq) (>= 0). It is a project-dependent parameter.
txft	0..1	Seconds	Lead time constant in reference value transfer function (Txft) (>= 0). It is a project-dependent parameter.
txfv	0..1	Seconds	Lag time constant in reference value transfer function (Txfv) (>= 0). It is a project-dependent parameter.
uwpqdip	0..1	PU	Voltage threshold for UVRT detection in Q control (uWPqdip). It is a project-dependent parameter.
windPlantQcontrolModesType	0..1	WindPlantQcontrolModeKind	Reactive power/voltage controller mode (MWPqmode). It is a case-dependent parameter.
xrefmax	0..1	PU	Maximum xWTref (qWTref or delta uWTref) request from the plant controller (xrefmax) (> WindPlantReactiveControlIEC.xrefmin). It is a case-dependent parameter.
xrefmin	0..1	PU	Minimum xWTref (qWTref or delta uWTref) request from the plant controller (xrefmin) (< WindPlantReactiveControlIEC.xrefmax). It is a project-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 389 shows all association ends of WindPlantReactiveControlIEC with other classes.

Table 389 – Association ends of WindDynamics::WindPlantReactiveControlIEC with other classes

mult from	name	mult to	type	description
1..1	WindPlantIEC	1..1	WindPlantIEC	Wind plant reactive control model associated with this wind plant.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this voltage and reactive power wind plant model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.36 WindPlantFreqPcontrolIEC

Frequency and active power controller model.

Reference: IEC 61400-27-1:2015, Annex D.

Table 390 shows all attributes of WindPlantFreqPcontrolIEC.

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Table 390 – Attributes of WindDynamics::WindPlantFreqPcontrolIEC

name	mult	type	description
dprefmax	0..1	PU	Maximum ramp rate of pWTref request from the plant controller to the wind turbines (dprefmax) (> WindPlantFreqPcontrolIEC.dprefmin). It is a case-dependent parameter.
dprefmin	0..1	PU	Minimum (negative) ramp rate of pWTref request from the plant controller to the wind turbines (dprefmin) (< WindPlantFreqPcontrolIEC.dprefmax). It is a project-dependent parameter.
dpwprefmax	0..1	PU	Maximum positive ramp rate for wind plant power reference (dpWPrefmax) (> WindPlantFreqPcontrolIEC.dpwprefmin). It is a project-dependent parameter.
dpwprefmin	0..1	PU	Maximum negative ramp rate for wind plant power reference (dpWPrefmin) (< WindPlantFreqPcontrolIEC.dpwprefmax). It is a project-dependent parameter.
kiwpp	0..1	Float	Plant P controller integral gain (KIWPp). It is a project-dependent parameter.
kiwppmax	0..1	PU	Maximum PI integrator term (KIWPpmax) (> WindPlantFreqPcontrolIEC.kiwppmin). It is a project-dependent parameter.
kiwppmin	0..1	PU	Minimum PI integrator term (KIWPpmin) (< WindPlantFreqPcontrolIEC.kiwppmax). It is a project-dependent parameter.
kpwpp	0..1	Float	Plant P controller proportional gain (KPWPp). It is a project-dependent parameter.
kwppref	0..1	PU	Power reference gain (KWPpref). It is a project-dependent parameter.
prefmax	0..1	PU	Maximum pWTref request from the plant controller to the wind turbines (prefmax) (> WindPlantFreqPcontrolIEC.prefmin). It is a project-dependent parameter.
prefmin	0..1	PU	Minimum pWTref request from the plant controller to the wind turbines (prefmin) (< WindPlantFreqPcontrolIEC.prefmax). It is a project-dependent parameter.
tpft	0..1	Seconds	Lead time constant in reference value transfer function (Tpft) (>= 0). It is a project-dependent parameter.
tpfv	0..1	Seconds	Lag time constant in reference value transfer function (Tpfv) (>= 0). It is a project-dependent parameter.
twpffiltp	0..1	Seconds	Filter time constant for frequency measurement (TWPffiltp) (>= 0). It is a project-dependent parameter.
twppfiltp	0..1	Seconds	Filter time constant for active power measurement (TWPpfiltp) (>= 0). It is a project-dependent parameter.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 391 shows all association ends of WindPlantFreqPcontrolIEC with other classes.

Table 391 – Association ends of WindDynamics::WindPlantFreqPcontrolIEC with other classes

mult from	name	mult to	type	description
1..1	WindPlantIEC	1..1	WindPlantIEC	Wind plant model with which this wind plant frequency and active power control is associated.
0..1	WindDynamicsLookupTable	1..*	WindDynamicsLookupTable	The wind dynamics lookup table associated with this frequency and active power wind plant model.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.18.37 WindDynamicsLookupTable

Look up table for the purpose of wind standard models.

Table 392 shows all attributes of WindDynamicsLookupTable.

Table 392 – Attributes of WindDynamics::WindDynamicsLookupTable

name	mult	type	description
input	0..1	Float	Input value (x) for the lookup table function.
lookupTableFunctionType	0..1	WindLookupTableFunctionKind	Type of the lookup table function.
output	0..1	Float	Output value (y) for the lookup table function.
sequence	0..1	Integer	Sequence numbers of the pairs of the input (x) and the output (y) of the lookup table function.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 393 shows all association ends of WindDynamicsLookupTable with other classes.

Table 393 – Association ends of WindDynamics::WindDynamicsLookupTable with other classes

mult from	name	mult to	type	description
1..*	WindGenType3bIEC	0..1	WindGenType3bIEC	The generator type 3B model with which this wind dynamics lookup table is associated.
1..*	WindPitchContPowerIEC	0..1	WindPitchContPowerIEC	The pitch control power model with which this wind dynamics lookup table is associated.
1..*	WindContRotorRIEC	0..1	WindContRotorRIEC	The rotor resistance control model with which this wind dynamics lookup table is associated.
1..*	WindContPType3IEC	0..1	WindContPType3IEC	The P control type 3 model with which this wind dynamics lookup table is associated.
1..*	WindContCurrLimIEC	0..1	WindContCurrLimIEC	The current control limitation model with which this wind dynamics lookup table is associated.
1..*	WindContQPQULimIEC	0..1	WindContQPQULimIEC	The QP and QU limitation model with which this wind dynamics lookup table is associated.
1..*	WindProtectionIEC	0..1	WindProtectionIEC	The grid protection model with which this wind dynamics lookup table is associated.
1..*	WindPlantReactiveControlIEC	0..1	WindPlantReactiveControlIEC	The voltage and reactive power wind plant control model with which this wind dynamics lookup table is associated.
1..*	WindPlantFreqPcontrolIEC	0..1	WindPlantFreqPcontrolIEC	The frequency and active power wind plant control model with which this wind dynamics lookup table is associated.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.3.18.38 WindQcontrolModeKind enumeration

General wind turbine Q control modes MqG.

Table 394 shows all literals of WindQcontrolModeKind.

Table 394 – Literals of WindDynamics::WindQcontrolModeKind

literal	value	description
voltage		Voltage control (MqG equals 0).
reactivePower		Reactive power control (MqG equals 1).
openLoopReactivePower		Open loop reactive power control (only used with closed loop at plant level) (MqG equals 2).
powerFactor		Power factor control (MqG equals 3).
openLooppowerFactor		Open loop power factor control (MqG equals 4).

5.3.18.39 WindUVRTQcontrolModeKind enumeration

UVRT Q control modes MqUVRT.

Table 395 shows all literals of WindUVRTQcontrolModeKind.

Table 395 – Literals of WindDynamics::WindUVRTQcontrolModeKind

literal	value	description
mode0		Voltage-dependent reactive current injection (MqUVRT equals 0).
mode1		Reactive current injection controlled as the pre-fault value plus an additional voltage dependent reactive current injection (MqUVRT equals 1).
mode2		Reactive current injection controlled as the pre-fault value plus an additional voltage-dependent reactive current injection during fault, and as the pre-fault value plus an additional constant reactive current injection post fault (MqUVRT equals 2).

5.3.18.40 WindLookupTableFunctionKind enumeration

Function of the lookup table.

Table 396 shows all literals of WindLookupTableFunctionKind.

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Table 396 – Literals of WindDynamics::WindLookupTableFunctionKind

literal	value	description
prr		Power versus speed change (negative slip) lookup table (prr(deltaomega)). It is used for the rotor resistance control model, IEC 61400-27-1:2015, 5.6.5.3.
omegap		Power vs. speed lookup table (omega(p)). It is used for the P control model type 3, IEC 61400-27-1:2015, 5.6.5.4.
ipmax		Lookup table for voltage dependency of active current limits (ipmax(uWT)). It is used for the current limitation model, IEC 61400-27-1:2015, 5.6.5.8.
iqmax		Lookup table for voltage dependency of reactive current limits (iqmax(uWT)). It is used for the current limitation model, IEC 61400-27-1:2015, 5.6.5.8.
pwp		Power vs. frequency lookup table (pWPbias(f)). It is used for the wind power plant frequency and active power control model, IEC 61400-27-1:2015, Annex D.
tcwdu		Crowbar duration versus voltage variation look-up table (TCW(du)). It is a case-dependent parameter. It is used for the type 3B generator set model, IEC 61400-27-1:2015, 5.6.3.3.
tduwt		Lookup table to determine the duration of the power reduction after a voltage dip, depending on the size of the voltage dip (Td(uWT)). It is a type-dependent parameter. It is used for the pitch control power model, IEC 61400-27-1:2015, 5.6.5.1.
qmaxp		Lookup table for active power dependency of reactive power maximum limit (qmaxp(p)). It is used for the QP and QU limitation model, IEC 61400-27-1:2015, 5.6.5.10.
qminp		Lookup table for active power dependency of reactive power minimum limit (qminp(p)). It is used for the QP and QU limitation model, IEC 61400-27-1:2015, 5.6.5.10.
qmaxu		Lookup table for voltage dependency of reactive power maximum limit (qmaxu(p)). It is used for the QP and QU limitation model, IEC 61400-27-1:2015, 5.6.5.10.
qminu		Lookup table for voltage dependency of reactive power minimum limit (qminu(p)). It is used for the QP and QU limitation model, IEC 61400-27-1:2015, 5.6.5.10.
tuover		Disconnection time versus over-voltage lookup table (Tuover(uWT)). It is used for the grid protection model, IEC 61400-27-1:2015, 5.6.6.
tuunder		Disconnection time versus under-voltage lookup table (Tuunder(uWT)). It is used for the grid protection model, IEC 61400-27-1:2015, 5.6.6.
tfover		Disconnection time versus over-frequency lookup table (Tfover(fWT)). It is used for the grid protection model, IEC 61400-27-1:2015, 5.6.6.
tfunder		Disconnection time versus under-frequency lookup table (Tfunder(fWT)). It is used for the grid protection model, IEC 61400-27-1:2015, 5.6.6.
qwp		Look up table for the UQ static mode (qWP(uerr)). It is used for the voltage and reactive power control model, IEC 61400-27-1:2015, Annex D.

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5.3.18.41 WindPlantQcontrolModeKind enumeration

Reactive power/voltage controller mode.

Table 397 shows all literals of WindPlantQcontrolModeKind.

Table 397 – Literals of WindDynamics::WindPlantQcontrolModeKind

literal	value	description
reactivePower		Reactive power reference.
powerFactor		Power factor reference.
uqStatic		UQ static.
voltageControl		Voltage control.

5.3.19 Package LoadDynamics

5.3.19.1 General

Dynamic load models are used to represent the dynamic real and reactive load behaviour of a load from the static power flow model.

Dynamic load models can be defined as applying either to a single load (energy consumer) or to a group of energy consumers.

Large industrial motors or groups of similar motors can be represented by a synchronous machine model (SynchronousMachineDynamics) or an asynchronous machine model (AsynchronousMachineDynamics), which are usually represented as generators with negative active power output in the static (power flow) data.

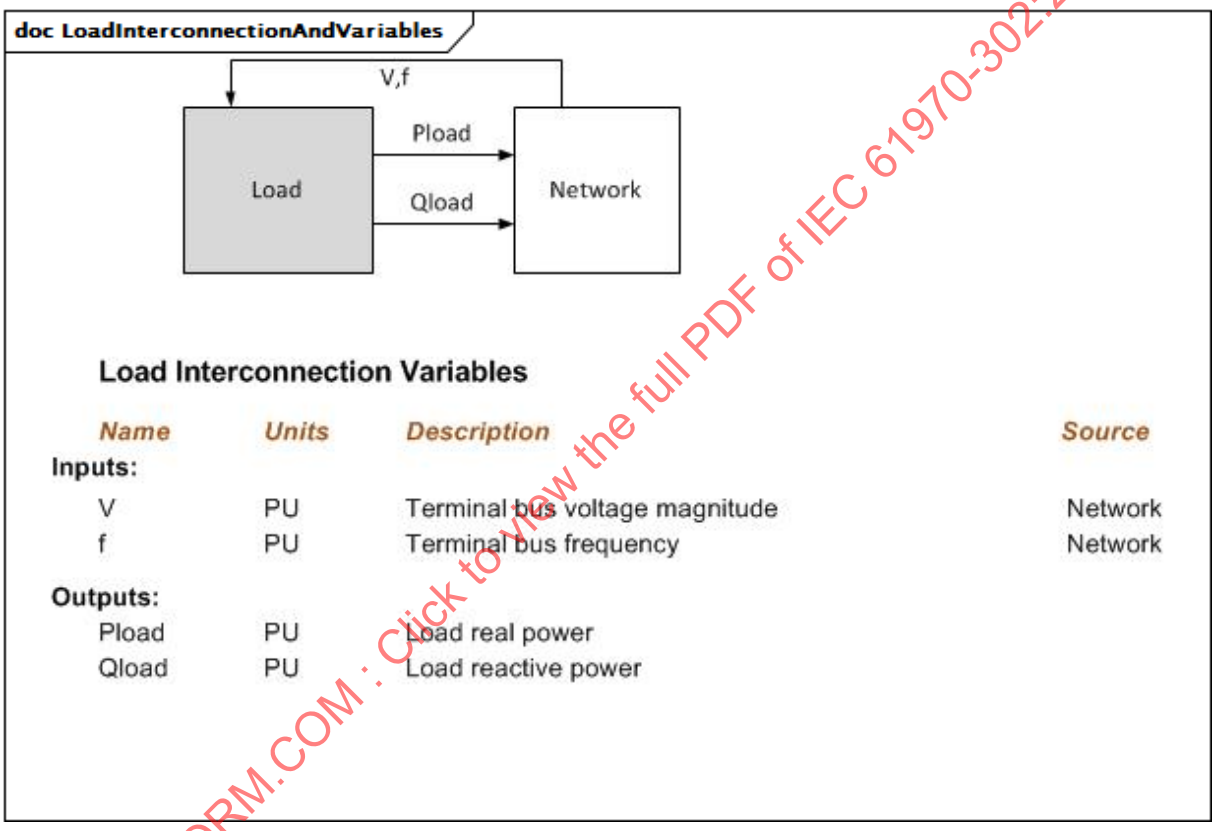

Figure 166 – LoadInterconnectionAndVariables

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Figure 166: This diagram illustrates the inputs and outputs for a load.

Diagram details:

1) The application program converts the P and Q of the load into a current injection at the bus.

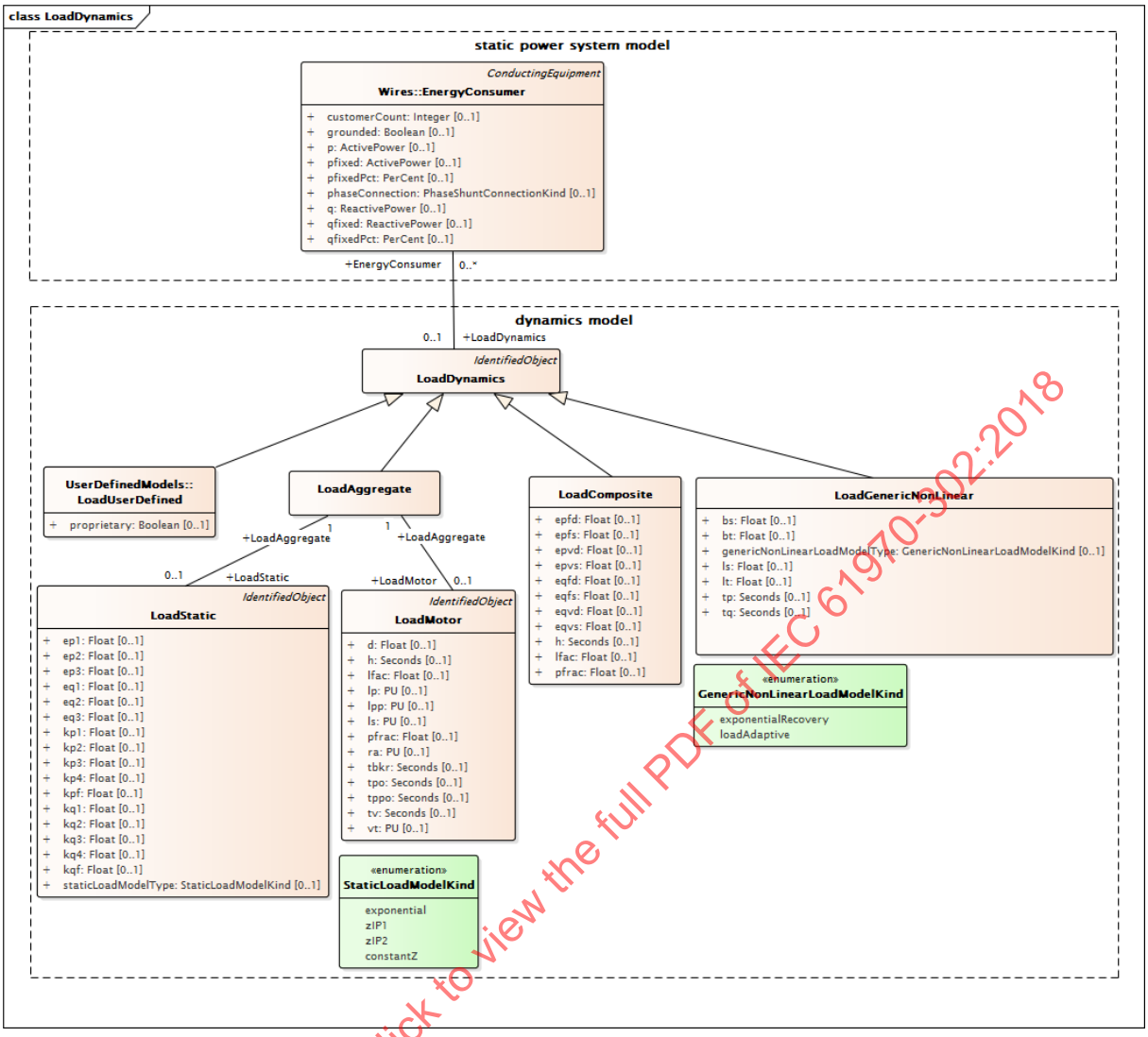

Figure 167 – Class diagram LoadDynamics::LoadDynamics

Figure 167: This diagram shows static power system model classes and dynamics model classes related to modelling of load for dynamics. An association between the EnergyConsumerDynamics class and the EnergyConsumer class provides a means for relating the dynamics model to the static model.

5.3.19.2 LoadComposite

Combined static load and induction motor load effects.

The dynamics of the motor are simplified by linearizing the induction machine equations.

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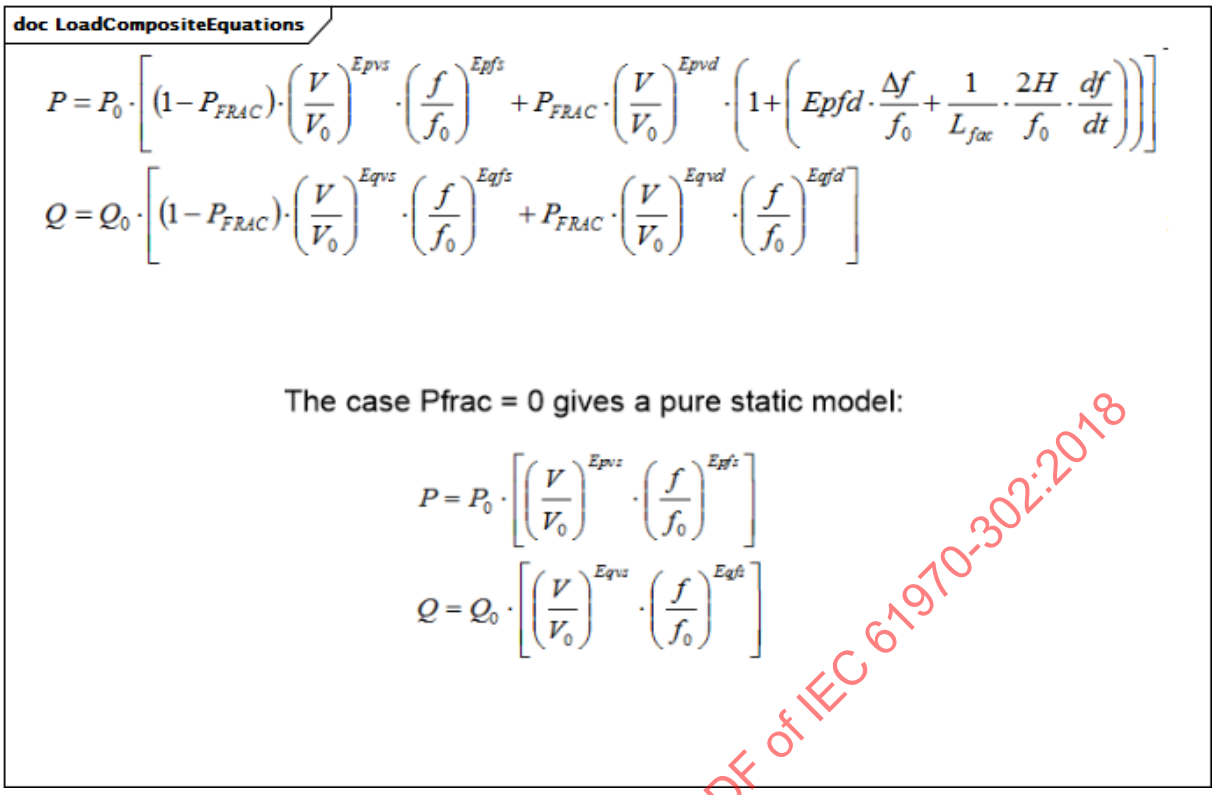

Figure 168 – LoadCompositeEquations

Figure 168: This diagram illustrates the equations of the model which combines static load and induction motor load effects.

Table 398 shows all attributes of LoadComposite.

Table 398 – Attributes of LoadDynamics::LoadComposite

name	mult	type	description
epvs	0..1	Float	Active load-voltage dependence index (static) (Epvs). Typical value = 0,7.
epfs	0..1	Float	Active load-frequency dependence index (static) (Epfs). Typical value = 1,5.
eqvs	0..1	Float	Reactive load-voltage dependence index (static) (Eqvs). Typical value = 2.
eqfs	0..1	Float	Reactive load-frequency dependence index (static) (Eqfs). Typical value = 0.
epvd	0..1	Float	Active load-voltage dependence index (dynamic) (Epvd). Typical value = 0,7.
epfd	0..1	Float	Active load-frequency dependence index (dynamic) (Epfd). Typical value = 1,5.
eqvd	0..1	Float	Reactive load-voltage dependence index (dynamic) (Eqvd). Typical value = 2.
eqfd	0..1	Float	Reactive load-frequency dependence index (dynamic) (Eqfd). Typical value = 0.
lfac	0..1	Float	Loading factor (Lfac). The ratio of initial P to motor MVA base. Typical value = 0,8.
h	0..1	Seconds	Inertia constant (H) (>= 0). Typical value = 2,5.
pfrac	0..1	Float	Fraction of constant-power load to be represented by this motor model (PFRAC) (>= 0,0 and <= 1,0). Typical value = 0,5.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 399 shows all association ends of LoadComposite with other classes.

Table 399 – Association ends of LoadDynamics::LoadComposite with other classes

mult from	name	mult to	type	description
0..1	EnergyConsumer	0..*	EnergyConsumer	inherited from: LoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.3 LoadGenericNonLinear

Generic non-linear dynamic (GNLD) load. This model can be used in mid-term and long-term voltage stability simulations (i.e., to study voltage collapse), as it can replace a more detailed representation of aggregate load, including induction motors, thermostatically controlled and static loads.

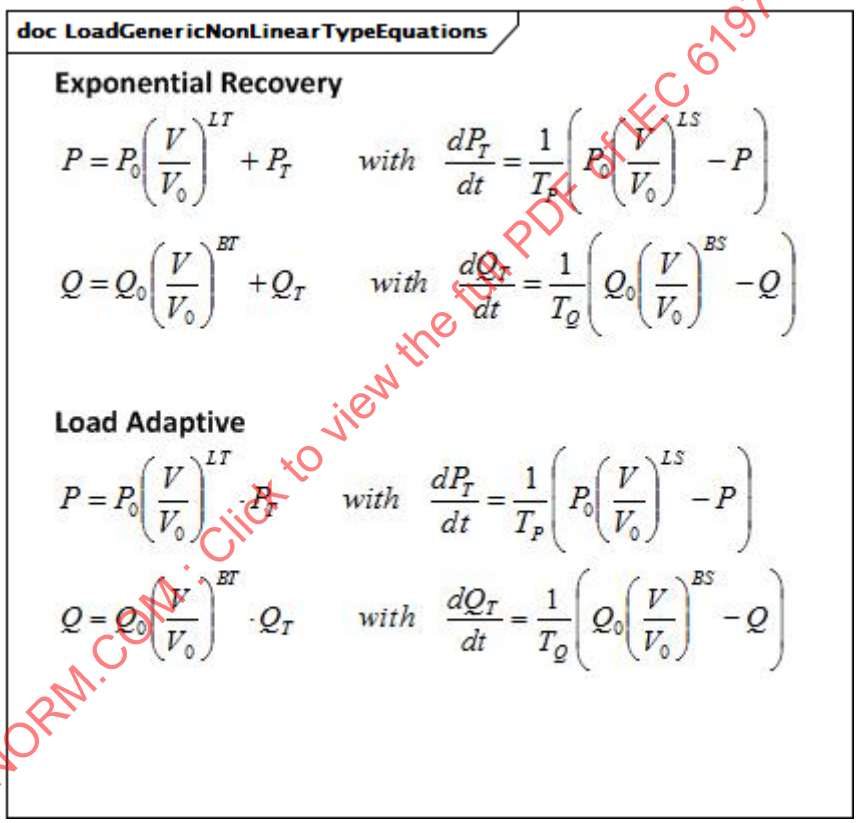

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Figure 169 – LoadGenericNonLinearTypeEquations

Figure 169: This diagram illustrates the generic non-linear type equations.

Diagram details:

1) P0 and Q0 are initial active and reactive power from the steady state solution (SvPowerFlow.p and SvPowerFlow.q).
2) V0 is the initial voltage from the steady state solution (SvPowerFlow.v).
3) V is the implied voltage signal from the bus to which the load is attached.

Table 400 shows all attributes of LoadGenericNonLinear.

Table 400 – Attributes of LoadDynamics::LoadGenericNonLinear

name	mult	type	description
genericNonLinearLoadModelType	0..1	GenericNonLinearLoadModelKind	Type of generic non-linear load model.
tp	0..1	Seconds	Time constant of lag function of active power (TP) (> 0).
tq	0..1	Seconds	Time constant of lag function of reactive power (TQ) (> 0).
ls	0..1	Float	Steady state voltage index for active power (LS).
lt	0..1	Float	Transient voltage index for active power (LT).
bs	0..1	Float	Steady state voltage index for reactive power (BS).
bt	0..1	Float	Transient voltage index for reactive power (BT).
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 401 shows all association ends of LoadGenericNonLinear with other classes.

Table 401 – Association ends of LoadDynamics::LoadGenericNonLinear with other classes

mult from	name	mult to	type	description
0..1	EnergyConsumer	0..*	EnergyConsumer	inherited from: LoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.4 LoadDynamics

Load whose behaviour is described by reference to a standard model or by definition of a user-defined model.

A standard feature of dynamic load behaviour modelling is the ability to associate the same behaviour to multiple energy consumers by means of a single load definition. The load model is always applied to individual bus loads (energy consumers).

Table 402 shows all attributes of LoadDynamics.

Table 402 – Attributes of LoadDynamics::LoadDynamics

name	mult	type	description
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 403 shows all association ends of LoadDynamics with other classes.

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Table 403 – Association ends of LoadDynamics::LoadDynamics with other classes

mult from	name	mult to	type	description
0..1	EnergyConsumer	0..*	EnergyConsumer	Energy consumer to which this dynamics load model applies.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.5 LoadAggregate

Aggregate loads are used to represent all or part of the real and reactive load from one or more loads in the static (power flow) data. This load is usually the aggregation of many individual load devices and the load model is an approximate representation of the aggregate response of the load devices to system disturbances.

Standard aggregate load model comprised of static and/or dynamic components. A static load model represents the sensitivity of the real and reactive power consumed by the load to the amplitude and frequency of the bus voltage. A dynamic load model can be used to represent the aggregate response of the motor components of the load.

Table 404 shows all attributes of LoadAggregate.

Table 404 – Attributes of LoadDynamics::LoadAggregate

name	mult	type	description
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 405 shows all association ends of LoadAggregate with other classes.

Table 405 – Association ends of LoadDynamics::LoadAggregate with other classes

mult from	name	mult to	type	description
1..1	LoadStatic	0..1	LoadStatic	Aggregate static load associated with this aggregate load.
1..1	LoadMotor	0..1	LoadMotor	Aggregate motor (dynamic) load associated with this aggregate load.
0..1	EnergyConsumer	0..*	EnergyConsumer	inherited from: LoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.6 LoadStatic

General static load. This model represents the sensitivity of the real and reactive power consumed by the load to the amplitude and frequency of the bus voltage.

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doc LoadStaticTypeEquations

Exponential

$$P = P_0\left[K_{p1}\left(\frac{V}{V_0}\right)^{Ep1} + K_{p2}\left(\frac{V}{V_0}\right)^{Ep2} + K_{p3}\left(\frac{V}{V_0}\right)^{Ep3}\right]\left(1. + K_{pf}\Delta f\right)$$

$$Q = Q_0\left[K_{q1}\left(\frac{V}{V_0}\right)^{Eq1} + K_{q2}\left(\frac{V}{V_0}\right)^{Eq2} + K_{q3}\left(\frac{V}{V_0}\right)^{Eq3}\right]\left(1. + K_{qf}\Delta f\right)$$

ZIP1

$$P = P_0\left[K_{p1}\left(\frac{V}{V_0}\right)^{2} + K_{p2}\left(\frac{V}{V_0}\right)^{1} + K_{p3}\right]\left(1. + K_{pf}\Delta f\right)$$

$$Q = Q_0\left[K_{q1}\left(\frac{V}{V_0}\right)^{2} + K_{q2}\left(\frac{V}{V_0}\right)^{1} + K_{q3}\right]\left(1. + K_{qf}\Delta f\right)$$

ZIP2

$$P = P_0\left[K_{p1}\left(\frac{V}{V_0}\right)^{2} + K_{p2}\left(\frac{V}{V_0}\right)^{1} + K_{p3}\right] + K_{p4}\left(1. + K_{pf}\Delta f\right)$$

$$Q = Q_0\left[K_{q1}\left(\frac{V}{V_0}\right)^{2} + K_{q2}\left(\frac{V}{V_0}\right)^{1} + K_{q3}\right] + K_{q4}\left(1. + K_{qf}\Delta f\right)$$

ConstantZ

$$P = P_0\left(\frac{V}{V_0}\right)^{2}$$

$$Q = Q_0\left(\frac{V}{V_0}\right)^{2}$$

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Figure 170 – LoadStaticTypeEquations

Figure 170: This diagram illustrates the variations of the static load model which can be specified by the staticLoadModelType attribute.

Table 406 shows all attributes of LoadStatic.

Table 406 – Attributes of LoadDynamics::LoadStatic

name	mult	type	description
staticLoadModelType	0..1	StaticLoadModelKind	Type of static load model. Typical value = constantZ.
kp1	0..1	Float	First term voltage coefficient for active power (Kp1). Not used when .staticLoadModelType = constantZ.
kp2	0..1	Float	Second term voltage coefficient for active power (Kp2). Not used when .staticLoadModelType = constantZ.
kp3	0..1	Float	Third term voltage coefficient for active power (Kp3). Not used when .staticLoadModelType = constantZ.
kp4	0..1	Float	Frequency coefficient for active power (Kp4) (not = 0 if .staticLoadModelType = zIP2). Used only when .staticLoadModelType = zIP2.
ep1	0..1	Float	First term voltage exponent for active power (Ep1). Used only when .staticLoadModelType = exponential.
ep2	0..1	Float	Second term voltage exponent for active power (Ep2). Used only when .staticLoadModelType = exponential.
ep3	0..1	Float	Third term voltage exponent for active power (Ep3). Used only when .staticLoadModelType = exponential.
kpf	0..1	Float	Frequency deviation coefficient for active power (Kpf). Not used when .staticLoadModelType = constantZ.
kq1	0..1	Float	First term voltage coefficient for reactive power (Kq1). Not used when .staticLoadModelType = constantZ.
kq2	0..1	Float	Second term voltage coefficient for reactive power (Kq2). Not used when .staticLoadModelType = constantZ.
kq3	0..1	Float	Third term voltage coefficient for reactive power (Kq3). Not used when .staticLoadModelType = constantZ.
kq4	0..1	Float	Frequency coefficient for reactive power (Kq4) (not = 0 when .staticLoadModelType = zIP2). Used only when .staticLoadModelType – zIP2.
eq1	0..1	Float	First term voltage exponent for reactive power (Eq1). Used only when .staticLoadModelType = exponential.
eq2	0..1	Float	Second term voltage exponent for reactive power (Eq2). Used only when .staticLoadModelType = exponential.
eq3	0..1	Float	Third term voltage exponent for reactive power (Eq3). Used only when .staticLoadModelType = exponential.
kqf	0..1	Float	Frequency deviation coefficient for reactive power (Kqf). Not used when .staticLoadModelType = constantZ.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 407 shows all association ends of LoadStatic with other classes.

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Table 407 – Association ends of LoadDynamics::LoadStatic with other classes

mult from	name	mult to	type	description
0..1	LoadAggregate	1..1	LoadAggregate	Aggregate load to which this aggregate static load belongs.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.7 LoadMotor

Aggregate induction motor load. This model is used to represent a fraction of an ordinary load as "induction motor load". It allows a load that is treated as an ordinary constant power in power flow analysis to be represented by an induction motor in dynamic simulation. This model is intended for representation of aggregations of many motors dispersed through a load represented at a high voltage bus but where there is no information on the characteristics of individual motors.

Either a "one-cage" or "two-cage" model of the induction machine can be modelled. Magnetic saturation is not modelled.

This model treats a fraction of the constant power part of a load as a motor. During initialisation, the initial power drawn by the motor is set equal to Pfrac times the constant P part of the static load. The remainder of the load is left as a static load.

The reactive power demand of the motor is calculated during initialisation as a function of voltage at the load bus. This reactive power demand can be less than or greater than the constant Q component of the load. If the motor's reactive demand is greater than the constant Q component of the load, the model inserts a shunt capacitor at the terminal of the motor to bring its reactive demand down to equal the constant Q reactive load.

If an induction motor load model and a static load model are both present for a load, the motor Pfrac is assumed to be subtracted from the power flow constant P load before the static load model is applied. The remainder of the load, if any, is then represented by the static load model.

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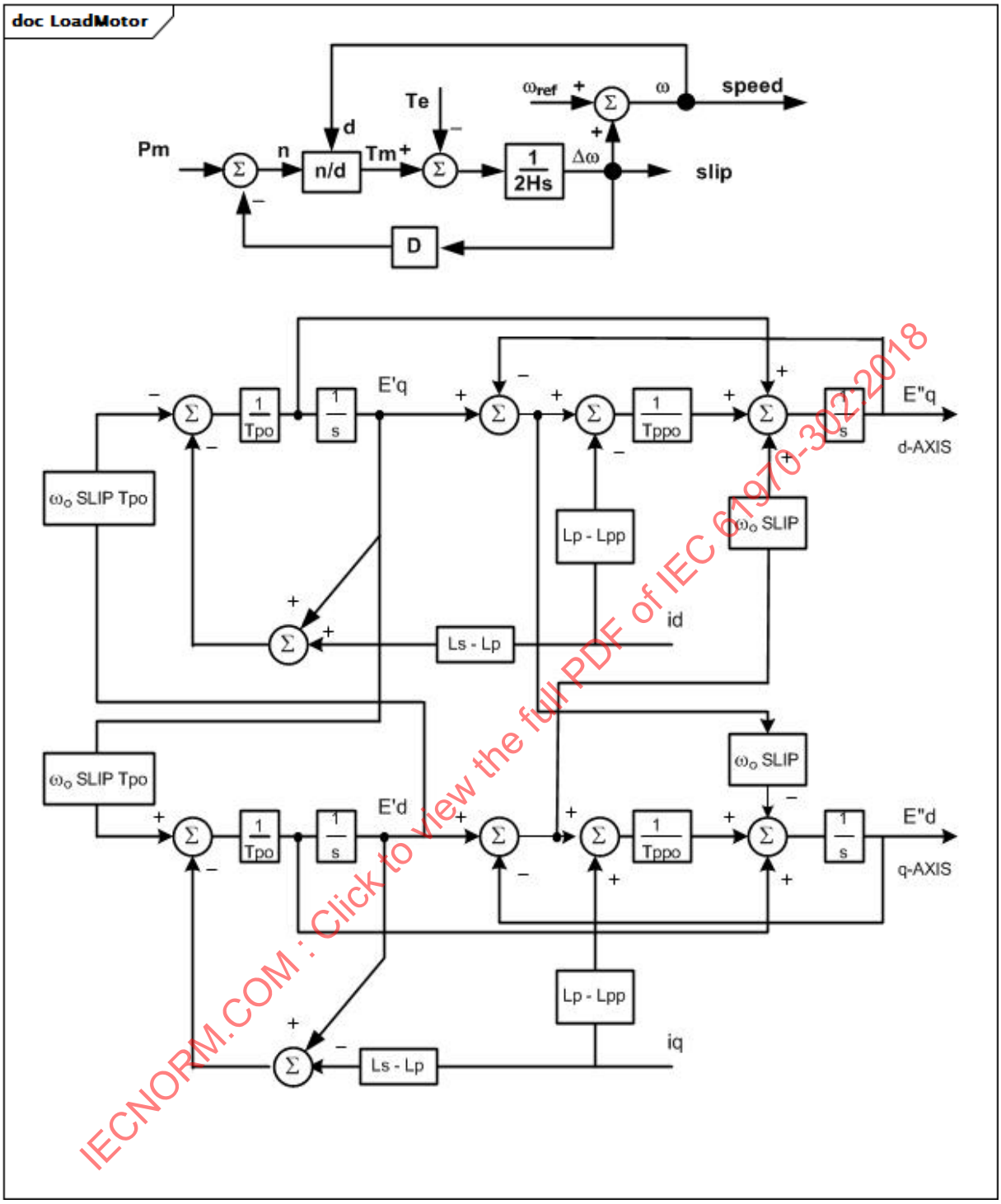

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Figure 171 – LoadMotor

Figure 171: These diagrams describe the aggregate induction motor load model. The upper diagram represents the mechanical load model. The lower is the 3-phase induction motor electrical model.

Parameter details:

1) Ls, Lp, Lpp shall all be specified.
2) If Lpp = 0 or Lpp = Lp, or Tppo = 0, only one cage is represented.

3) The initial value of Pm or the value coming from an separate mechanical load model, if used, is multiplied by speed raised to the power D to determine the effective mechanical load seen by the motor.

4) The parameters Vt and Tv define the under-voltage tripping logic. A timer is started if the terminal voltage falls below Vt PU and continues to run until the voltage rises above Vt. If voltage has not risen above Vt when the timer reaches Tv, the motor is tripped after a delay of circuit breaker operating time (Tbkr).

5) PU parameters are on the motor MVA base. The MVA base is calculated during initialisation as the initial motor P in MW divided by the loading factor (LoadMotor.lfac).

Table 408 shows all attributes of LoadMotor.

Table 408 – Attributes of LoadDynamics::LoadMotor

name	mult	type	description
pfrac	0..1	Float	Fraction of constant-power load to be represented by this motor model (Pfrac) (>= 0,0 and <= 1,0). Typical value = 0,3.
lfac	0..1	Float	Loading factor (Lfac). The ratio of initial P to motor MVA base. Typical value = 0,8.
ls	0..1	PU	Synchronous reactance (Ls). Typical value = 3,2.
lp	0..1	PU	Transient reactance (Lp). Typical value = 0,15.
lpp	0..1	PU	Subtransient reactance (Lpp). Typical value = 0,15.
ra	0..1	PU	Stator resistance (Ra). Typical value = 0.
tpo	0..1	Seconds	Transient rotor time constant (Tpo) (>= 0). Typical value = 1.
tppo	0..1	Seconds	Subtransient rotor time constant (Tppo) (>= 0). Typical value = 0,02.
h	0..1	Seconds	Inertia constant (H) (>= 0). Typical value = 0,4.
d	0..1	Float	Damping factor (D). Unit = delta P/delta speed. Typical value = 2.
vt	0..1	PU	Voltage threshold for tripping (Vt). Typical value = 0,7.
tv	0..1	Seconds	Voltage trip pickup time (Tv) (>= 0). Typical value = 0,1.
tbkr	0..1	Seconds	Circuit breaker operating time (Tbkr) (>= 0). Typical value = 0,08.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 409 shows all association ends of LoadMotor with other classes.

Table 409 – Association ends of LoadDynamics::LoadMotor with other classes

mult from	name	mult to	type	description
0..1	LoadAggregate	1..1	LoadAggregate	Aggregate load to which this aggregate motor (dynamic) load belongs.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.19.8 GenericNonLinearLoadModelKind enumeration

Type of generic non-linear load model.

Table 410 shows all literals of GenericNonLinearLoadModelKind.

Table 410 – Literals of LoadDynamics::GenericNonLinearLoadModelKind

literal	value	description
exponentialRecovery		Exponential recovery model.
loadAdaptive		Load adaptive model.

5.3.19.9 StaticLoadModelKind enumeration

Type of static load model.

Table 411 shows all literals of StaticLoadModelKind.

Table 411 – Literals of LoadDynamics::StaticLoadModelKind

literal	value	description
exponential		This model is an exponential representation of the load. Exponential equations for active and reactive power are used and the following attributes are required: kp1, kp2, kp3, kpf, ep1, ep2, ep3 kq1, kq2, kq3, kqf, eq1, eq2, eq3.
zIP1		This model integrates the frequency-dependent load (primarily motors). ZIP1 equations for active and reactive power are used and the following attributes are required: kp1, kp2, kp3, kpf kq1, kq2, kq3, kqf.
zIP2		This model separates the frequency-dependent load (primarily motors) from other load. ZIP2 equations for active and reactive power are used and the following attributes are required: kp1, kp2, kp3, kq4, kpf kq1, kq2, kq3, kq4, kqf.
constantZ		The load is represented as a constant impedance. ConstantZ equations are used for active and reactive power and no attributes are required.

5.3.20 Package HVDCDynamics

5.3.20.1 General

High voltage direct current (HVDC) models.

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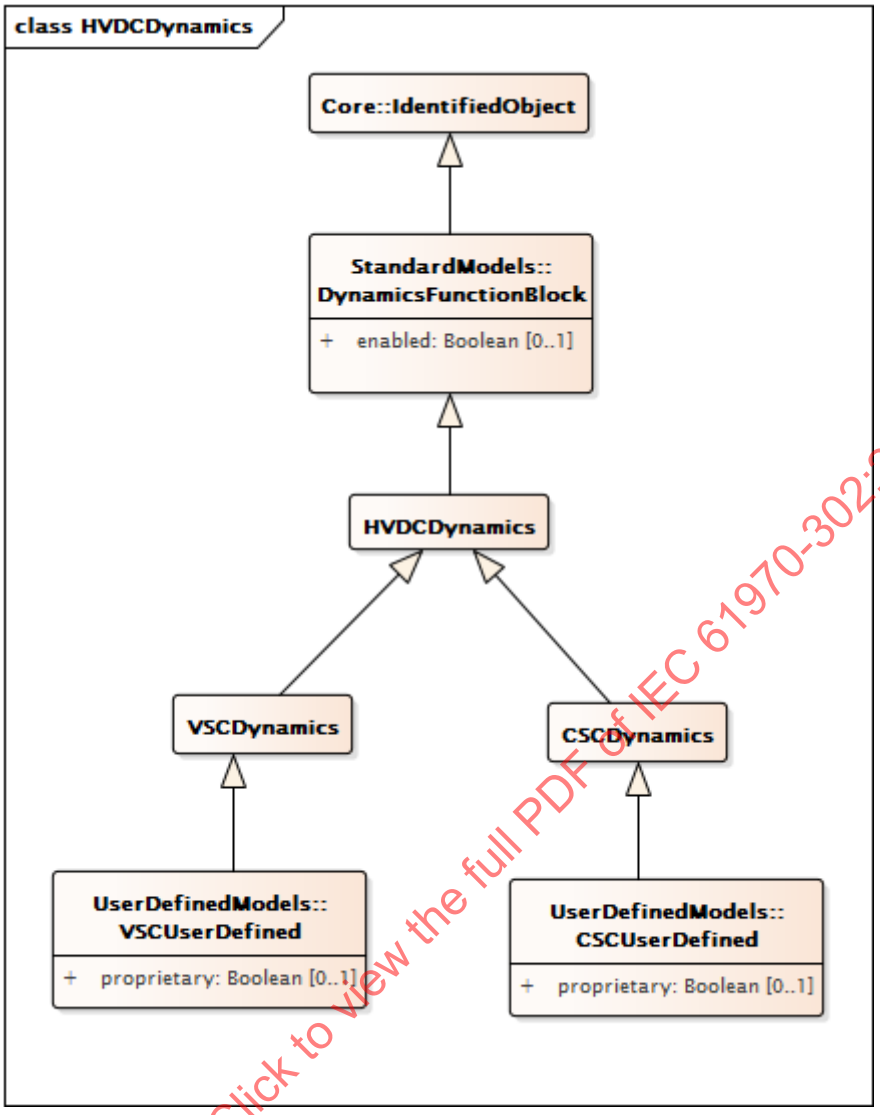

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Figure 172 – Class diagram HVDCDynamics::HVDCDynamics

Figure 172: This diagram shows the dynamics model classes related to modelling of the HVDC.

5.3.20.2 HVDCDynamics

HVDC whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 412 shows all attributes of HVDCDynamics.

Table 412 – Attributes of HVDCDynamics::HVDCDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 413 shows all association ends of HVDCDynamics with other classes.

Table 413 – Association ends of HVDCDynamics::HVDCDynamics with other classes

mult from	name	mult to	type	description
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.20.3 CSCDynamics

CSC function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 414 shows all attributes of CSCDynamics.

Table 414 – Attributes of HVDCDynamics::CSCDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 415 shows all association ends of CSCDynamics with other classes.

Table 415 – Association ends of HVDCDynamics::CSCDynamics with other classes

mult from	name	mult to	type	description
0..1	CSConverter	1..1	CsConverter	Current source converter to which current source converter dynamics model applies.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.20.4 VSCDynamics

VSC function block whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 416 shows all attributes of VSCDynamics.

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Table 416 – Attributes of HVDCDynamics::VSCDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 417 shows all association ends of VSCDynamics with other classes.

Table 417 – Association ends of HVDCDynamics::VSCDynamics with other classes

mult from	name	mult to	type	description
0..1	VsConverter	1..1	VsConverter	Voltage source converter to which voltage source converter dynamics model applies.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.3.21 Package StaticVarCompensatorDynamics

5.3.21.1 General

Static var compensator (SVC) models.

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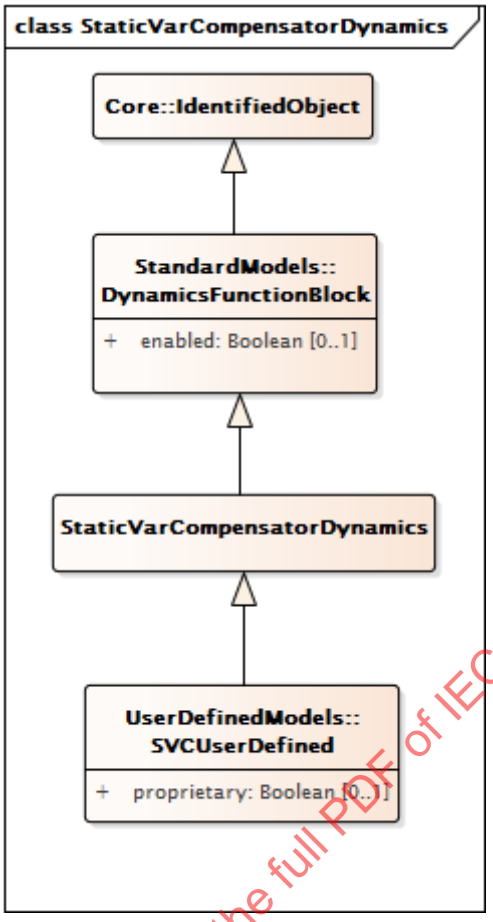

Figure 173 – Class diagram StaticVarCompensatorDynamics::StaticVarCompensatorDynamics

Figure 173: This diagram shows the dynamics model classes related to modelling of the static var compensator (SVC) models.

5.3.21.2 StaticVarCompensatorDynamics

Static var compensator whose behaviour is described by reference to a standard model or by definition of a user-defined model.

Table 418 shows all attributes of StaticVarCompensatorDynamics.

Table 418 – Attributes of StaticVarCompensatorDynamics::StaticVarCompensatorDynamics

name	mult	type	description
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 419 shows all association ends of StaticVarCompensatorDynamics with other classes.

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Table 419 – Association ends of StaticVarCompensatorDynamics::StaticVarCompensatorDynamics with other classes

mult from	name	mult to	type	description
0..1	StaticVarCompensator	1..1	StaticVarCompensator	Static Var Compensator to which Static Var Compensator dynamics model applies.
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4 Package UserDefinedModels

5.4.1 General

This subclause contains user-defined dynamic model classes to support the exchange of both proprietary and explicitly defined user-defined models.

Proprietary models represent behaviour which, while not defined by a standard model class, is mutually understood by the sending and receiving applications based on the name passed in the .name attribute of the appropriate xxxUserDefined class. Proprietary model parameters are passed as general attributes using as many instances of the ProprietaryParameterDynamics class as there are parameters.

Explicitly defined models describe dynamic behaviour in detail in terms of control blocks and their input and output signals. Note that the classes to support explicitly defined modelling are not currently defined – it is future work intended to also be supported by the family of xxxUserDefined classes.

Both types of user-defined models use the family of xxxUserDefined classes, which allow a user-defined model to be used:

- as the model for an individual standard function block (such as a turbine-governor or power system stabilizer) in a standard interconnection model whose other function blocks could be either standard or user-defined. For an illustration of this form of usage for a proprietary model, see the ExampleFunctionBlockProprietaryModel diagram in subclause 5.5.
- as the complete representation of a dynamic behaviour model (for an entire synchronous machine, for example) where standard function blocks and standard interconnections are not used at all. For an illustration of this form of usage for a proprietary model, see the ExampleCompleteProprietaryModel diagram in subclause 5.5.

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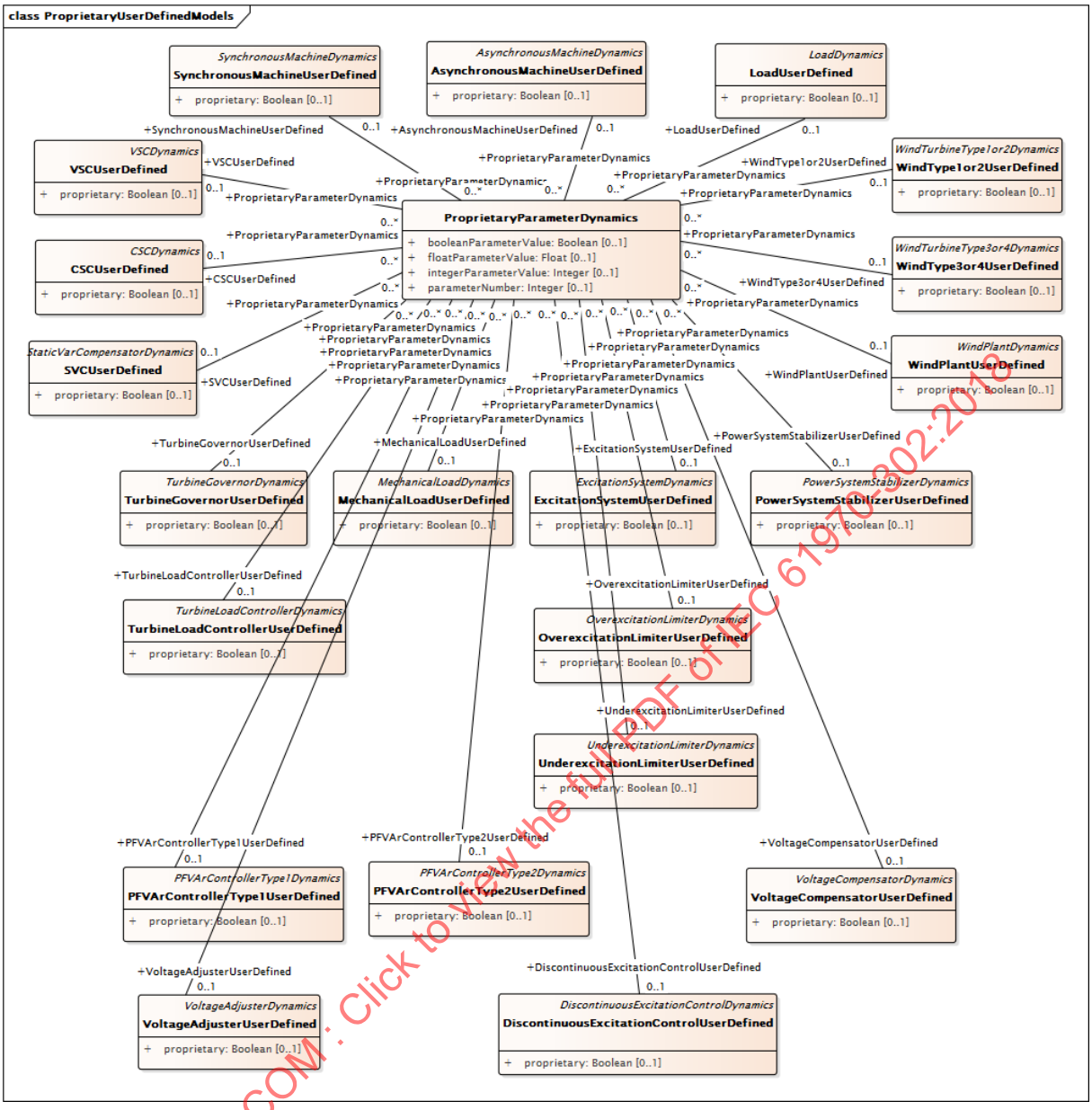

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Figure 174 – Class diagram UserDefinedModels::ProprietaryUserDefinedModels

Figure 174: This diagram shows the user-defined model classes and their relationship to the ProprietaryParameterDynamics class that supports the definition of multiple, appropriately data-typed attributes for each user-defined model.

5.4.2 SynchronousMachineUserDefined

Synchronous machine whose dynamic behaviour is described by a user-defined model.

Table 420 shows all attributes of SynchronousMachineUserDefined.

Table 420 – Attributes of UserDefinedModels::SynchronousMachineUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 421 shows all association ends of SynchronousMachineUserDefined with other classes.

Table 421 – Association ends of UserDefinedModels::SynchronousMachineUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	SynchronousMachine	1..1	SynchronousMachine	inherited from: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	inherited from: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	inherited from: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDyanmics	0..1	CrossCompoundTurbineGovernorDyanmics	inherited from: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.3 AsynchronousMachineUserDefined

Asynchronous machine whose dynamic behaviour is described by a user-defined model.

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Table 422 shows all attributes of AsynchronousMachineUserDefined.

Table 422 – Attributes of UserDefinedModels::AsynchronousMachineUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
damping	0..1	Float	inherited from: RotatingMachineDynamics
inertia	0..1	Seconds	inherited from: RotatingMachineDynamics
saturationFactor	0..1	Float	inherited from: RotatingMachineDynamics
saturationFactor120	0..1	Float	inherited from: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	inherited from: RotatingMachineDynamics
statorResistance	0..1	PU	inherited from: RotatingMachineDynamics
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 423 shows all association ends of AsynchronousMachineUserDefined with other classes.

Table 423 – Association ends of UserDefinedModels::AsynchronousMachineUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	AsynchronousMachine	1..1	AsynchronousMachine	inherited from: AsynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	inherited from: AsynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	inherited from: AsynchronousMachineDynamics
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	inherited from: AsynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.4.4 TurbineGovernorUserDefined

Turbine-governor function block whose dynamic behaviour is described by a user-defined model.

Table 424 shows all attributes of TurbineGovernorUserDefined.

Table 424 – Attributes of UserDefinedModels::TurbineGovernorUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 425 shows all association ends of TurbineGovernorUserDefined with other classes.

Table 425 – Association ends of UserDefinedModels::TurbineGovernorUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	inherited from: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.5 TurbineLoadControllerUserDefined

Turbine load controller function block whose dynamic behaviour is described by a user-defined model.

Table 426 shows all attributes of TurbineLoadControllerUserDefined.

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Table 426 – Attributes of UserDefinedModels::TurbineLoadControllerUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 427 shows all association ends of TurbineLoadControllerUserDefined with other classes.

Table 427 – Association ends of UserDefinedModels::TurbineLoadControllerUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	TurbineGovernorDynamics	1..1	TurbineGovernorDynamics	inherited from: TurbineLoadControllerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.6 MechanicalLoadUserDefined

Mechanical load function block whose dynamic behaviour is described by a user-defined model.

Table 428 shows all attributes of MechanicalLoadUserDefined.

Table 428 – Attributes of UserDefinedModels::MechanicalLoadUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 429 shows all association ends of MechanicalLoadUserDefined with other classes.

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Table 429 – Association ends of UserDefinedModels::MechanicalLoadUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	inherited from: MechanicalLoadDynamics
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	inherited from: MechanicalLoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.7 ExcitationSystemUserDefined

Excitation system function block whose dynamic behaviour is described by a user-defined model.

Table 430 shows all attributes of ExcitationSystemUserDefined.

Table 430 – Attributes of UserDefinedModels::ExcitationSystemUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 431 shows all association ends of ExcitationSystemUserDefined with other classes.

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Table 431 – Association ends of UserDefinedModels::ExcitationSystemUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	inherited from: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	inherited from: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	inherited from: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	inherited from: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	inherited from: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	inherited from: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.8 OverexcitationLimiterUserDefined

Overexcitation limiter system function block whose dynamic behaviour is described by a user-defined model.

Table 432 shows all attributes of OverexcitationLimiterUserDefined.

Table 432 – Attributes of UserDefinedModels::OverexcitationLimiterUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 433 shows all association ends of OverexcitationLimiterUserDefined with other classes.

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Table 433 – Association ends of UserDefinedModels::OverexcitationLimiterUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: OverexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.9 UnderexcitationLimiterUserDefined

Underexcitation limiter function block whose dynamic behaviour is described by a user-defined model.

Table 434 shows all attributes of UnderexcitationLimiterUserDefined.

Table 434 – Attributes of UserDefinedModels::UnderexcitationLimiterUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 435 shows all association ends of UnderexcitationLimiterUserDefined with other classes.

Table 435 – Association ends of UserDefinedModels::UnderexcitationLimiterUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: UnderexcitationLimiterDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: UnderexcitationLimiterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.4.10 PowerSystemStabilizerUserDefined

Power system stabilizer function block whose dynamic behaviour is described by a user-defined model.

Table 436 shows all attributes of PowerSystemStabilizerUserDefined.

Table 436 – Attributes of UserDefinedModels::PowerSystemStabilizerUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 437 shows all association ends of PowerSystemStabilizerUserDefined with other classes.

Table 437 – Association ends of UserDefinedModels::PowerSystemStabilizerUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..*	RemoteInputSignal	inherited from: PowerSystemStabilizerDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PowerSystemStabilizerDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.4.11 DiscontinuousExcitationControlUserDefined

Discontinuous excitation control function block whose dynamic behaviour is described by a user-defined model.

Table 438 shows all attributes of DiscontinuousExcitationControlUserDefined.

Table 438 – Attributes of UserDefinedModels::DiscontinuousExcitationControlUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 439 shows all association ends of DiscontinuousExcitationControlUserDefined with other classes.

Table 439 – Association ends of UserDefinedModels::DiscontinuousExcitationControlUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: DiscontinuousExcitationControlDynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: DiscontinuousExcitationControlDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.12 PFVArControllerType1UserDefined

Power factor or VAr controller type 1 function block whose dynamic behaviour is described by a user-defined model.

Table 440 shows all attributes of PFVArControllerType1UserDefined.

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Table 440 – Attributes of UserDefinedModels::PFVArControllerType1UserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 441 shows all association ends of PFVArControllerType1UserDefined with other classes.

Table 441 – Association ends of UserDefinedModels::PFVArControllerType1UserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: PFVArControllerType1Dynamics
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType1Dynamics
1..1	VoltageAdjusterDynamics	0..1	VoltageAdjusterDynamics	inherited from: PFVArControllerType1Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.13 VoltageAdjusterUserDefined

Voltage adjuster function block whose dynamic behaviour is described by a user-defined model.

Table 442 shows all attributes of VoltageAdjusterUserDefined.

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Table 442 – Attributes of UserDefinedModels::VoltageAdjusterUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 443 shows all association ends of VoltageAdjusterUserDefined with other classes.

Table 443 – Association ends of UserDefinedModels::VoltageAdjusterUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	PFVArControllerType1DynamicsType1Dynamics	1..1	PFVArControllerType1DynamicsType1Dynamics	inherited from: VoltageAdjusterDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.14 PFVArControllerType2UserDefined

Power factor or VAr controller type 2 function block whose dynamic behaviour is described by a user-defined model.

Table 444 shows all attributes of PFVArControllerType2UserDefined.

Table 444 – Attributes of UserDefinedModels::PFVArControllerType2UserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 445 shows all association ends of PFVArControllerType2UserDefined with other classes.

Table 445 – Association ends of UserDefinedModels::PFVArControllerType2UserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: PFVArControllerType2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.15 VoltageCompensatorUserDefined

Voltage compensator function block whose dynamic behaviour is described by a user-defined model.

Table 446 shows all attributes of VoltageCompensatorUserDefined.

Table 446 – Attributes of UserDefinedModels::VoltageCompensatorUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 447 shows all association ends of VoltageCompensatorUserDefined with other classes.

Table 447 – Association ends of UserDefinedModels::VoltageCompensatorUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: VoltageCompensatorDynamics
1..1	ExcitationSystemDynamics	1..1	ExcitationSystemDynamics	inherited from: VoltageCompensatorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

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5.4.16 LoadUserDefined

Load whose dynamic behaviour is described by a user-defined model.

Table 448 shows all attributes of LoadUserDefined.

Table 448 – Attributes of UserDefinedModels::LoadUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 449 shows all association ends of LoadUserDefined with other classes.

Table 449 – Association ends of UserDefinedModels::LoadUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	EnergyConsumer	0..*	EnergyConsumer	inherited from: LoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.17 WindType1or2UserDefined

Wind type 1 or type 2 function block whose dynamic behaviour is described by a user-defined model.

Table 450 shows all attributes of WindType1or2UserDefined.

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Table 450 – Attributes of UserDefinedModels::WindType1or2UserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 451 shows all association ends of WindType1or2UserDefined with other classes.

Table 451 – Association ends of UserDefinedModels::WindType1or2UserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType1or2Dynamics
0..1	AsynchronousMachineDynamics	1..1	AsynchronousMachineDynamics	inherited from: WindTurbineType1or2Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.18 WindType3or4UserDefined

Wind type 3 or type 4 function block whose dynamic behaviour is described by a user-defined model.

Table 452 shows all attributes of WindType3or4UserDefined.

Table 452 – Attributes of UserDefinedModels::WindType3or4UserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 453 shows all association ends of WindType3or4UserDefined with other classes.

Table 453 – Association ends of UserDefinedModels::WindType3or4UserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	PowerElectronicsConnection	1..1	PowerElectronicsConnection	inherited from: WindTurbineType3or4Dynamics
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindTurbineType3or4Dynamics
1..*	WindPlantDynamics	0..1	WindPlantDynamics	inherited from: WindTurbineType3or4Dynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.19 WindPlantUserDefined

Wind plant function block whose dynamic behaviour is described by a user-defined model.

Table 454 shows all attributes of WindPlantUserDefined.

Table 454 – Attributes of UserDefinedModels::WindPlantUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 455 shows all association ends of WindPlantUserDefined with other classes.

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Table 455 – Association ends of UserDefinedModels::WindPlantUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	RemoteInputSignal	0..1	RemoteInputSignal	inherited from: WindPlantDynamics
0..1	WindTurbineType3or4Dynamics	1..*	WindTurbineType3or4Dynamics	inherited from: WindPlantDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.20 CSCUserDefined

Current source converter (CSC) function block whose dynamic behaviour is described by a user-defined model.

Table 456 shows all attributes of CSCUserDefined.

Table 456 – Attributes of UserDefinedModels::CSCUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 457 shows all association ends of CSCUserDefined with other classes.

Table 457 – Association ends of UserDefinedModels::CSCUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	CSConverter	1..1	CsConverter	inherited from: CSCDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.21 VSCUserDefined

Voltage source converter (VSC) function block whose dynamic behaviour is described by a user-defined model.

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Table 458 shows all attributes of VSCUserDefined.

Table 458 – Attributes of UserDefinedModels::VSCUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 459 shows all association ends of VSCUserDefined with other classes.

Table 459 – Association ends of UserDefinedModels::VSCUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	VsConverter	1..1	VsConverter	inherited from: VSCDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.22 SVCUserDefined

Static var compensator (SVC) function block whose dynamic behaviour is described by a user-defined model.

Table 460 shows all attributes of SVCUserDefined.

Table 460 – Attributes of UserDefinedModels::SVCUserDefined

name	mult	type	description
proprietary	0..1	Boolean	Behaviour is based on a proprietary model as opposed to a detailed model. true = user-defined model is proprietary with behaviour mutually understood by sending and receiving applications and parameters passed as general attributes false = user-defined model is explicitly defined in terms of control blocks and their input and output signals.
enabled	0..1	Boolean	inherited from: DynamicsFunctionBlock
aliasName	0..1	String	inherited from: IdentifiedObject
description	0..1	String	inherited from: IdentifiedObject
mRID	0..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

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Table 461 shows all association ends of SVCUserDefined with other classes.

Table 461 – Association ends of UserDefinedModels::SVCUserDefined with other classes

mult from	name	mult to	type	description
0..1	ProprietaryParameterDynamics	0..*	ProprietaryParameterDynamics	Parameter of this proprietary user-defined model.
0..1	StaticVarCompensator	1..1	StaticVarCompensator	inherited from: StaticVarCompensatorDynamics
0..1	DiagramObjects	0..*	DiagramObject	inherited from: IdentifiedObject
1..1	Names	0..*	Name	inherited from: IdentifiedObject

5.4.23 ProprietaryParameterDynamics root class

Supports definition of one or more parameters of several different datatypes for use by proprietary user-defined models.

This class does not inherit from IdentifiedObject since it is not intended that a single instance of it be referenced by more than one proprietary user-defined model instance.

Table 462 shows all attributes of ProprietaryParameterDynamics.

Table 462 – Attributes of UserDefinedModels::ProprietaryParameterDynamics

name	mult	type	description
parameterNumber	0..1	Integer	Sequence number of the parameter among the set of parameters associated with the related proprietary user-defined model.
booleanParameterValue	0..1	Boolean	Boolean parameter value. If this attribute is populated, integerParameterValue and floatParameterValue will not be.
integerParameterValue	0..1	Integer	Integer parameter value. If this attribute is populated, booleanParameterValue and floatParameterValue will not be.
floatParameterValue	0..1	Float	Floating point parameter value. If this attribute is populated, booleanParameterValue and integerParameterValue will not be.

Table 463 shows all association ends of ProprietaryParameterDynamics with other classes.

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Table 463 – Association ends of UserDefinedModels::ProprietaryParameterDynamics with other classes

mult from	name	mult to	type	description
0..*	SynchronousMachineUserDefined	0..1	SynchronousMachineUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	AsynchronousMachineUserDefined	0..1	AsynchronousMachineUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	TurbineGovernorUserDefined	0..1	TurbineGovernorUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	TurbineLoadControllerUserDefined	0..1	TurbineLoadControllerUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	MechanicalLoadUserDefined	0..1	MechanicalLoadUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	ExcitationSystemUserDefined	0..1	ExcitationSystemUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	OverexcitationLimiterUserDefined	0..1	OverexcitationLimiterUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	UnderexcitationLimiterUserDefined	0..1	UnderexcitationLimiterUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	PowerSystemStabilizerUserDefined	0..1	PowerSystemStabilizerUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	DiscontinuousExcitationControlUserDefined	0..1	DiscontinuousExcitationControlUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	PFVArControllerType1UserDefined	0..1	PFVArControllerType1UserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	VoltageAdjusterUserDefined	0..1	VoltageAdjusterUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	PFVArControllerType2UserDefined	0..1	PFVArControllerType2UserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	VoltageCompensatorUserDefined	0..1	VoltageCompensatorUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	LoadUserDefined	0..1	LoadUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	WindType1or2UserDefined	0..1	WindType1or2UserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	WindType3or4UserDefined	0..1	WindType3or4UserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	WindPlantUserDefined	0..1	WindPlantUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	CSCUserDefined	0..1	CSCUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	VSCUserDefined	0..1	VSCUserDefined	Proprietary user-defined model with which this parameter is associated.
0..*	SVCUserDefined	0..1	SVCUserDefined	Proprietary user-defined model with which this parameter is associated.

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5.5 Package Examples

Examples illustrating the use of dynamic behaviour models are given in the following diagrams.

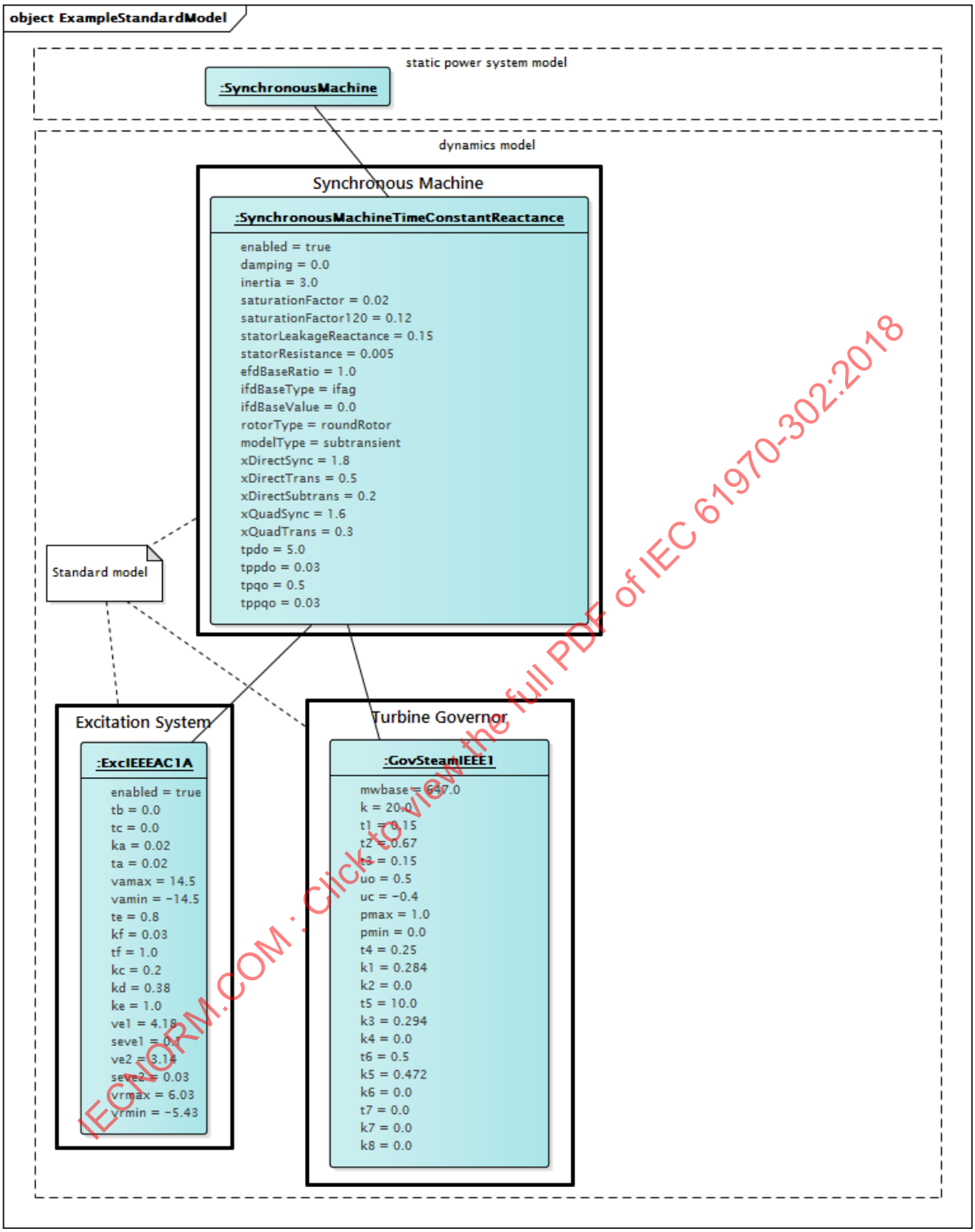

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Figure 175 – Object diagram Examples::ExampleStandardModel

Figure 175: This diagram shows a dynamic behaviour model for a synchronous generator using a standard round rotor subtransient generator model, a standard ExcIEEEAC1A excitation system model and a standard GovSteamIEEE1 turbine-governor model.

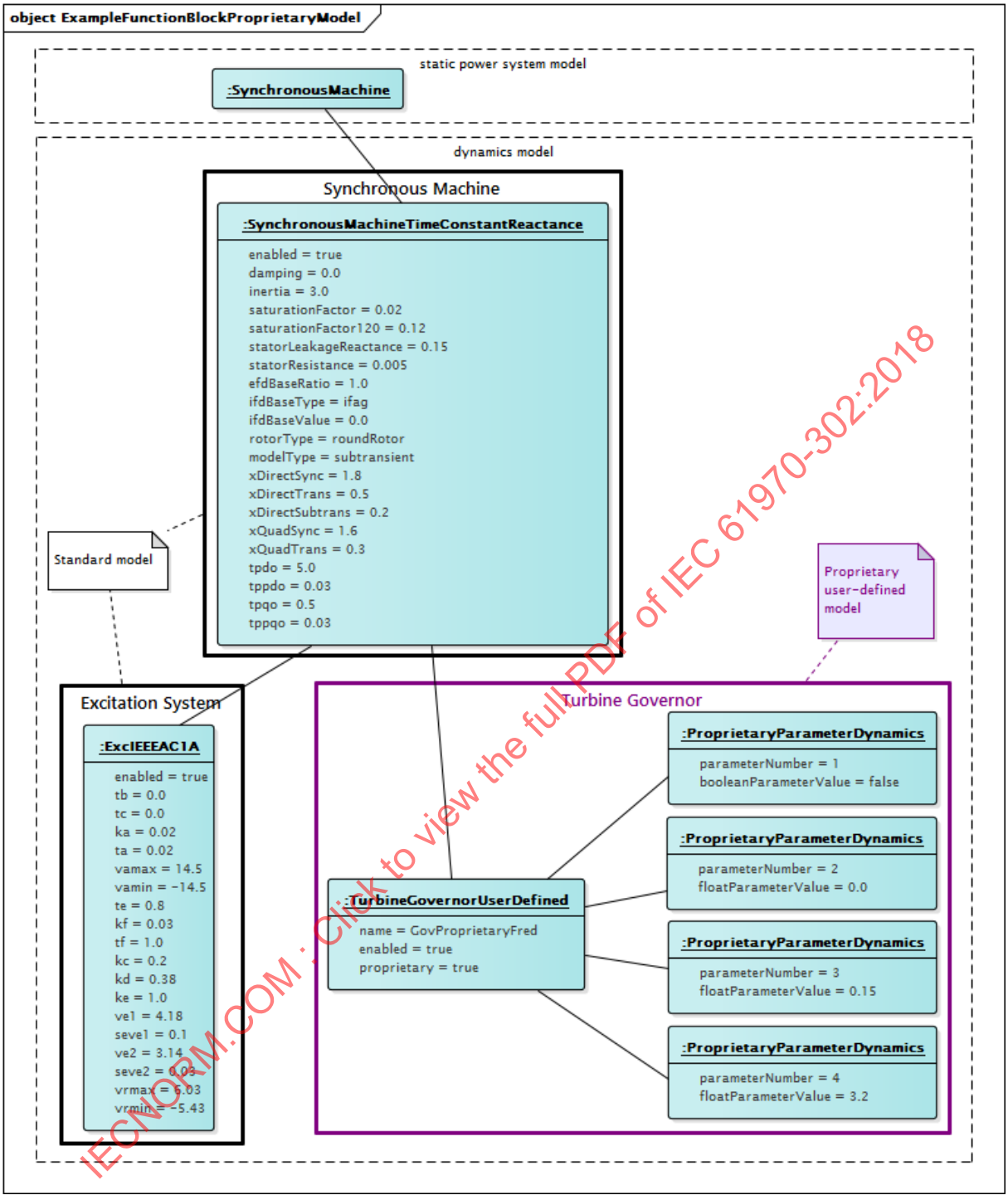

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Figure 176 – Object diagram Examples::ExampleFunctionBlockProprietaryModel

Figure 176: This diagram shows a dynamic behaviour model for a synchronous generator using a standard round rotor subtransient generator model, a standard ExcIEEEAC1A excitation system model and a proprietary turbine-governor model. The behaviour model for the turbine-governor is assumed to be understood by the sending and receiving applications and the needed parameter values are exchanged by means of the ProprietaryParameterDynamics instances.

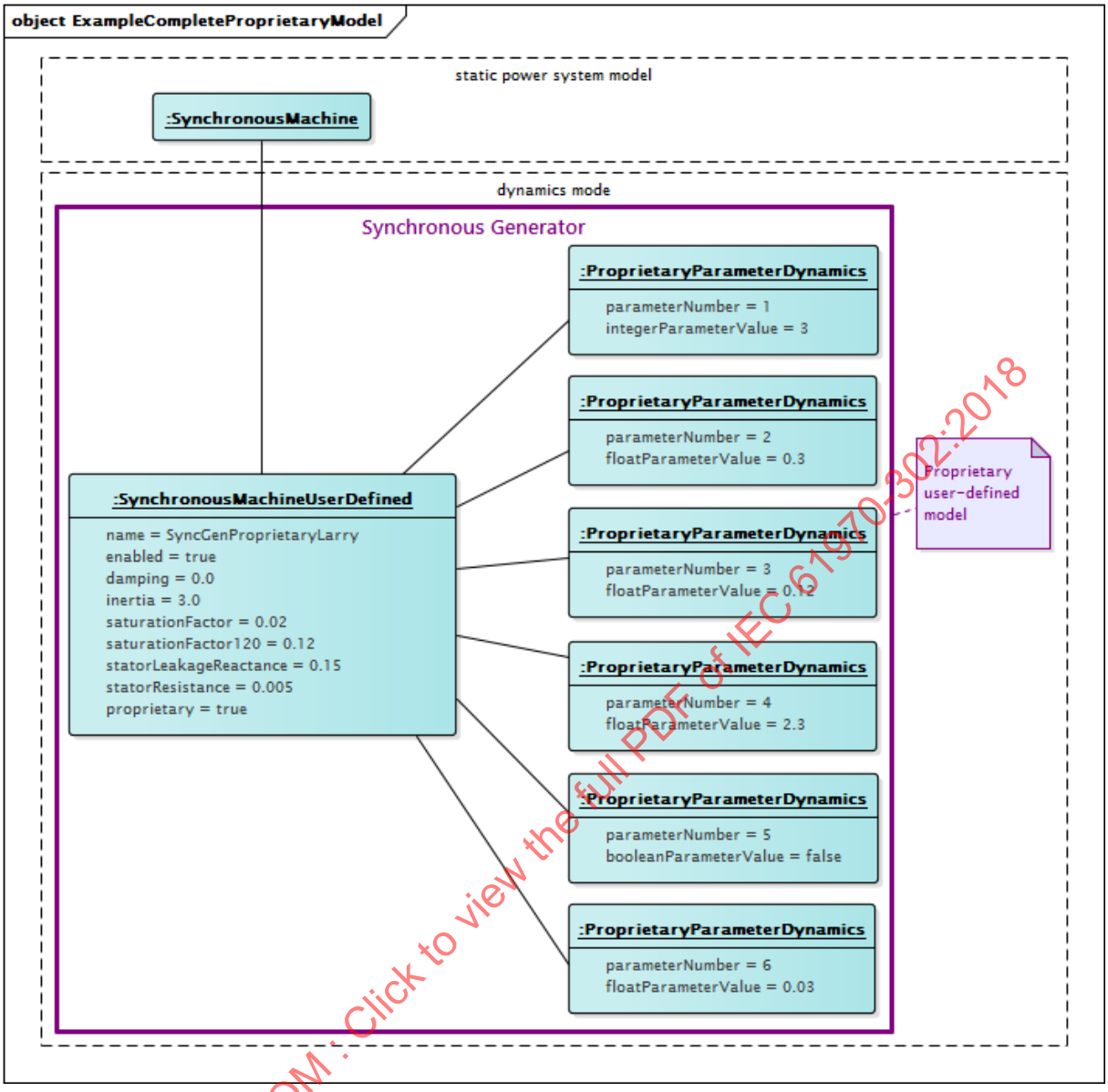

Figure 177 – Object diagram Examples::ExampleCompleteProprietaryModel

Figure 177: This diagram shows a completely proprietary dynamic behaviour model for a synchronous generator. All components of behaviour are proprietary and no standard interconnections are used. The behaviour model is assumed to be understood by the sending and receiving applications. The needed parameter values are exchanged by means of the ProprietaryParameterDynamics instances.

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Annex A
(informative)

Dynamics package symbol representation conventions

This clause describes conventions used in the auto-generated portions of this standard that accommodate for the symbol-handling limitations of the tools used in auto-generation.

Support for symbols by the auto-generation tools is limited to the alpha-numeric characters on a common QUERTY keyboard. The following alternate representations are employed:

- Greek letters are spelled out in all cases. Greek letters appear frequently in the description of wind dynamic models and the following table describes the naming of attributes for parameters represented by Greek symbols.

IEC 61400-27-1		IEC 61970-302: WindDynamics package	
Section reference	**Parameter**	**Class**	**Attribute**
5.6.1.2	Θ_{w0}	WindAeroOneDimIEC	thetaomega
5.6.1.3	dp_{ω}	WindAeroTwoDimIEC	dpomega
5.6.1.3	dp_{Θ}	WindAeroTwoDimIEC	dptheta
5.6.1.3	ω_0	WindAeroTwoDimIEC	omegazero
5.6.1.3	Θ_0	WindAeroTwoDimIEC	thetazero
5.6.1.3	Θ_{v2}	WindAeroTwoDimIEC	thetav2
5.6.5.2	$K_{P\omega}$	WindContPitchAngleIEC	kpomega
5.6.5.2	$K_{I\omega}$	WindContPitchAngleIEC	kiomega
5.6.5.2	Θ_{max}	WindContPitchAngleIEC	thetamax
5.6.5.2	Θ_{min}	WindContPitchAngleIEC	thetamin
5.6.5.2	$d\Theta_{min}$	WindContPitchAngleIEC	dthetamin
5.6.5.2	$d\Theta_{max}$	WindContPitchAngleIEC	dthetamax
5.6.5.2	T_{Θ}	WindContPitchAngleIEC	ttheta
5.6.5.3	$K_{\omega filt}$	WindContRotorRIEC	komegafilt
5.6.5.3	$T_{\omega filtrr}$	WindContRotorRIEC	tomegafiltrr
5.6.5.4	ω_{offset}	WindContPType3IEC	omegaoffset
5.6.5.4	$T_{\omega filtp3}$	WindContPType3IEC	tomegafiltp3
5.6.5.4	$T_{\omega ref}$	WindContPType3IEC	tomegaref
5.6.5.4	ζ	WindContPType3IEC	zeta
5.6.5.4	ω_{DTD}	WindContPType3IEC	omegadtd
5.6.5.4	$d\tau_{max}$	WindContPType3IEC	dthetamax
5.6.5.4	τ_{emin}	WindContPType3IEC	thetaemin
5.6.5.4	τ_{uscale}	WindContPType3IEC	thetauscale
5.6.5.4	$d\tau_{maxUVRT}$	WindContPType3IEC	dthetamaxuvrt
5.6.6	$d\Phi_{max}$	WindProtectionIEC	dfimax
5.6.5.4	$\omega(p)$	WindLookupTableFunction Kind	omegap

- The following characters are used to express mathematical operations:
  - * for multiplication
  - / for division

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- + for addition
- – for subtraction
- ** for exponentation
- = for equal to
- >= for greater-than or equal-to
- <= for less-than or equal-to

For clarity, mathematical symbols have spaces on either side unless preceded by a “(“ or followed by a “,” or “.”.

Italicization and subscripting are not preserved by the auto-generation process. In the source Enterprise Architect file, variable names are correctly italicized and subscripts are used as appropriate but those text features do not appear in this standard.

There is limited support for bulleted lists in the auto-generation process. Items in first level bulleted lists have their text preceded by “– “ and items in second level bulleted lists have their text preceded by “ + “.

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Annex B
(informative)

Use of per unit

Based on IEC agreements, the CIM standards (IEC 61968, IEC 61970, IEC 62325) are currently required to use engineering units (SI units), not per unit (PU), in their data types. While this approach has been made to work thus far, engineering units are not a natural fit for expressing information related to power system simulation. Already, the forced use of engineering units has caused some IEC national committees to not support CIM draft standard proposals, which has led to confusion in the industry and delays in the adoption of CIM standards.

Use of the CIM standards is increasing worldwide. European users, due to ENTSO-E adoption of a CIM-based data exchange, are currently defining additional requirements to IEC CIM standards to allow correct realization of data exchanges among all parties such as transmission system operators, distribution system operators, etc. North American and Chinese users are also actively involved through various projects or new work item proposals. Requirements are expanding because of the need to exchange more data or higher quality data or to have more frequent exchanges to ensure security of supply when operating or planning the electrical system to accommodate high penetration of renewable energy sources or to meet political goals or to comply with specific legislation.

As the use of the CIM standards increases, the need to exchange more and more detailed power system information means that the CIM standards will be called on to model, for data exchange purposes, information that is defined by other, pre-existing power system standards, such as those related to short-circuit and dynamics analysis.

Future IEC CIM standards will rely, more and more, on other IEC and IEEE standards, ENTSO-E European wide network codes (due to EU legislation) and standards defined by United States reliability entities. All of these standards or network codes express information in per unit form, since per unit is the method commonly used by both industry and academia for power system modelling. For instance, many parameters defined in IEEE 421.5-2005 (a standard defining dynamic behaviour that forms a basis for much of the Dynamics package in CIM) and in IEC 60909 (a standard used as the basis for short-circuit analysis-related parameters in CIM) and in IEC 61400-27-1 (a standard forming the basis for wind turbines/control related attributes in CIM package on dynamics) are defined in PU. In addition to this, information related to generators, transformers and their associated equipment is typically defined in PU in manufacturers' data or commissioning reports and is based on either specified standards or on well established industry practice.

Attempting to convert PU parameters to engineering units for data exchange in the domains of short-circuit analysis and dynamics is problematic at best: in most of the cases conversion is not possible as the base of the PU system is implicitly defined and unknown to the utility user who would be obliged to configure the conversion in a software product. This is especially valid for parameters in PU which are obtained under field test or commissioning test conditions that are different than nominal operating conditions of the equipment in order to not destroy the equipment. The inability to accurately convert between PU and engineering units will lead to inadequate results when power system analysis applications are run.

In addition, a major advantage of using PU for parameters, and one of the reasons that PU is employed in standards and by manufacturers, is that the range of typical values of a particular parameter is similar from one generator (or other device) to another no matter what the MVA rating or terminal voltage level of the generator (or device) is. For instance, it is well known that the sub-transient reactance of a generator should be about 0,2 PU. If parameters are expressed in SI units, there is no way of determining whether a value is reasonable or not because it could vary widely for different machines, making the use of data-checking logic nearly impossible.

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IEC CIM standards should be understood as the standards that define a conceptual model and enable data exchange related to power system equipment, where equipment behaviour is often defined in other standards. To effectively accomplish its goals in this domain, use of the per unit data type by the CIM standards is essential.

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Annex C
(informative)

Updates to CIM dynamics standard models

IEC 61970-302 and IEC 61970-457 common information model (CIM) standards specify, respectively, the information model and profile which support the exchange of dynamic behaviour models used by software applications that perform analysis of the steady-state stability (small-signal stability) or transient stability of a power system as described and classified in the the report “Definition and classification of power system stability IEEE/CIGRE joint task force on stability terms and definitions” published in IEEE Transactions on Power Systems. Volume: 19, Issue: 3, Aug. 2004.

The standards support several mechanisms for describing dynamic behaviour:

- **standard models**: a simplified approach to exchange, where models are contained in packages in predefined libraries of classes that represent dynamic behaviours of elements of the power system interconnected in a standard manner.
- **explicit user-defined models**: a more flexible approach that allows users to exchange the definitions of a model by defining elementary control blocks and interconnections between these blocks in an explicit manner.
- **proprietary user-defined models**: an exchange that provides users with the ability to exchange the parameters of a model representing a vendor-proprietary device where an explicit public description of the model is not desired.

The change request process outlined in this annex applies only to **standard models**.

Updates to dynamics standard models

There are numerous possible drivers that could result in the need for updates to the dynamics standard models, including:

- interoperability testing identifies issues on which resolutions are found following an interactive process between users, vendors and IEC;
- users acquire new equipment which should be adequately represented in dynamics models;
- industry organizations develop new or improved standard models;
- new modelling functionalities are required by business processes.

Requests for updates could come from a variety of sources, including utilities, generator owners, manufacturers, standards organizations (such as the IEEE or IEC) or industry groups.

Updates could take the form of existing model corrections or new model additions.

Dynamics standard models are typically described using both graphics and text. Because of this complexity, a reliable, organized approach is necessary to capture and maintain the information needed for each standard model. The following process is intended to provide that structure as update requests to standard models are processed.

1) An update request is received by the CIM model manager responsible for the Dynamics package of the CIM UML, by means of a filled out dynamics standard model change request form (including attachments).
2) The proposed update is evaluated, in consultation with the requesting entity, for accuracy, completeness, usefulness and consistency with the overall CIM dynamics modelling approach. The relationship of the proposed update to various existing or developing standard models will also be considered. Other industry experts will be consulted if additional perspectives or input are needed.

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3) Once an update is agreed upon:

- the update is entered into the current UML model;
- the dynamics standard model change request form and attachments, which describe the update, are stored in a central change request location managed by the appropriate CIM model manager;
- any new or updated Microsoft Visio diagrams are stored in the central diagram storage location managed by CIM model manager.

Role of proprietary user-defined models in the extension process

Since field implementations and interoperability testing activities will expose dynamics standard model requirements that result in update requests, there will clearly be cases where standards updates lag behind real-world needs. There will be periods of time in which users will need to rely on adapted modelling in order to accomplish their goals. The use of proprietary user-defined models is a strategy that will temporarily meet the needs of users in such situations and will also facilitate the necessary refinement of standard model documentation needed to prepare a dynamics standard model change request form and attachments for submission.

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CIM dynamics standard model change request form

The aim of this template is to provide sufficient information to allow the requested dynamic standard model addition/change to be reviewed and incorporated into the CIM.

I. Information about the requestor

1) Name of the requestor: .....

.....

2) Requestor company name:.....

.....

3) Requestor contact information:

a) Address

.....

.....

.....

b) Phone:.....

c) Fax:.....

d) E-mail:.....

II. Type of change (please circle)

a) Existing CIM dynamics standard model update/correction

CIM model name:.....

b) New standard model addition

III. Existing standard model update/correction

a) Please describe the requested update or correction (use fields in Section IV New standard model addition below if applicable to assist in describing request):.....

.....

.....

.....

.....

.....

IV. New standard model addition – equipment information

1) Type (please circle)

a) Excitation system

b) Automatic Voltage Regulator (AVR)

c) Exciter

d) Power system stabilizer (PSS)

e) Governor

f) Turbine

g) FACTS device

h) Other, please specify

.....

2) Description, use of model

a) Name of model (what requestor calls model): .....

b) Is the model included in other international

or national publicly available standards? **Yes / No**

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If Yes, please specify the standard and the model reference here:

.....

c) Is it a simplified model? **Yes / No**

d) Is it a detailed model? **Yes / No**

e) Does the model represent the equipment adequately for assessment of overall power system behaviour (system stability studies)?: **Yes / No**

f) Does the model represent the equipment adequately for assessment of power plant behaviour? **Yes / No**

g) The model is for general use **Yes / No**

h) Please describe the recommended usage of the model: .....

.....

.....

.....

.....

.....

3) Block diagrams (*needed if model is not described by a diagram in a publicly available standard*)

a) Main block diagram – Attach a hardcopy or electronic copy (PowerPoint, Word, Visio, .jpg) diagram of the equipment.

b) Block diagram for initialization – Attach a block diagram (hardcopy or electronic copy) describing initialization.

c) Interface description (information on inputs/outputs)

Inputs			
Name	*Units*	*Description*	*Source*
Outputs			
Name	*Units*	*Description*	*Source*

d) Equations – Attach hardcopy or electronic copy of any specific equations needed to fully describe model functionality

4) Parameters (*typical value and typical range needed if not described in a publicly available standard*)

Please use the table below to describe all parameters used in the main block diagram:

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Parameter Name	Units[2]	Typical Value	Typical Range	Description

5) Step response at typical values (*needed if not described in a publicly available standard*)

In an attachment, please provide step response at typical values as supplementary documentation.

6) Relation between parameters in the model and real parameters of the equipment

In an attachment, please provide information regarding the relationship (direct – 1:1 or indirect – using equations) for all parameters that can be an object of change (parameters of control equipment, etc.) as supplementary documentation

Attachments

1) Main block diagram (*only if not public standard model*)
2) Block diagram for initialization (*only if not public standard model*)
3) Equations (*only if not public standard model and if necessary*)
4) Step response at typical values (*only if not public standard model*)
5) Relation between parameters in the model and real parameters of the equipment

Other attachments, please specify here:

6) .....
7) .....
8) .....
9) .....
10) .....

Signature: .....

Date (mm/dd/yyyy): .....

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2 Unit should be either ISO SI units or PU (per unit).

Bibliography

IEC 61400-27-1:2015, *Wind turbines – Part 27-1: Electrical simulation models – Wind turbines*

IEC 61970-501:2006, *Energy management system application program interface (EMS-API) – Part 501: Common Information Model Resource Description Framework (CIM RDF) schema*

IEEE 1110-1991, *IEEE Guide for synchronous generator modeling practices and applications in stability analysis*

IEEE 421.2-1990, *IEEE Guide for identification, testing, and evaluation of the dynamic performance of excitation control systems*

IEEE 421.5-2005, *IEEE recommended practice for excitation system models for power system stability studies*

IEEE Task Force on Overall Plant Response, "*Dynamic models for steam and hydro turbines in power system studies*", IEEE Trans. PAS-92, Dec. 1973, pp. 1904-1915

IEEE Working Group on Prime Mover and Energy Supply Models, "*Hydraulic turbine and turbine control models for system dynamic studies*", IEEE Trans. on Power Systems, Vol. 7, No. 1, Feb. 1992, pp. 167-179

IEEE Special Publication, *Dynamic models for turbine-governors in power system studies*, December 2012

IEEE/CIGRE, *Stability terms and definitions*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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INTERFACE DE PROGRAMMATION D'APPLICATION POUR SYSTÈME DE GESTION D'ÉNERGIE (EMS-API) –

Partie 302: Régimes dynamiques de modèle d'information commun (CIM)

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Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
57/1954/FDIS	57/1977/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

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Une liste de toutes les parties de la série IEC 61970, publiées sous le titre général: *Interface de programmation d'application pour système de gestion d'énergie (EMS-API)*, peut être consultée sur le site web de l'IEC.

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INTRODUCTION

La présente Norme internationale est l'une des parties de la série de normes IEC 61970 qui définit une interface de programmation d'application (API – application program interface) pour un système de gestion d'énergie (EMS – energy management system).

La série de normes IEC 61970 a pour principal objet de produire les normes destinées à faciliter l'intégration d'applications EMS développées de façon indépendante par différents fournisseurs, entre des EMS complets développés de façon indépendante ou entre un EMS et d'autres systèmes concernés par différents aspects de l'exploitation d'un système de puissance, tels que les systèmes de gestion de la distribution (DMS – distribution management systems) ou de la production. Cela s'effectue par la définition d'interfaces de programmation d'application pour permettre à ces applications ou systèmes d'accéder aux données publiques et d'échanger des informations indépendamment de la représentation interne de ces informations.

Le modèle d'information commun (CIM – common information model) spécifie la sémantique de cette API. Les spécifications d'interface de composants (CIS – component interface specifications), qui sont contenues dans d'autres parties de la série de normes IEC 61970, spécifient le contenu des messages échangés.

Le CIM est un modèle abstrait qui représente tous les objets principaux d'une entreprise de distribution d'électricité habituellement nécessaires pour modéliser les opérations d'une entreprise d'électricité. Ce modèle inclut les classes et les attributs publics de ces objets, ainsi que les relations entre eux.

L'IEC 61970-301 définit la base du CIM constituée d'un ensemble de paquetages qui offrent une vue logique des aspects fonctionnels d'un EMS.

La présente partie de la norme (l'IEC 61970-302) s'appuie sur l'IEC 61970-301 et fournit les spécifications pour les modèles d'échange représentant le comportement dynamique de la majeure partie des composants de systèmes de puissance couramment utilisés aujourd'hui par les entreprises d'électricité pour procéder à des simulations de systèmes dans le cadre de l'évaluation dynamique et de la planification des systèmes.

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INTERFACE DE PROGRAMMATION D'APPLICATION POUR SYSTÈME DE GESTION D'ÉNERGIE (EMS-API) –

Partie 302: Régimes dynamiques de modèle d'information commun (CIM)

1 Domaine d'application

Le modèle d'information commun (CIM) est un modèle abstrait qui représente tous les objets principaux d'une entreprise de distribution d'électricité habituellement nécessaires aux opérations d'une entreprise d'électricité. En fournissant une méthode normalisée de représentation des ressources de systèmes de puissance sous la forme de classes et d'attributs d'objets, ainsi que leurs relations, le CIM facilite l'intégration des applications de l'EMS développées de façon indépendante par différents fournisseurs, entre des EMS complets développés de façon indépendante ou entre un EMS et d'autres systèmes concernés par différents aspects de l'exploitation d'un système de puissance, tels que la gestion de la production ou de la distribution. Le système SCADA est modélisé dans toute la mesure nécessaire pour prendre en charge la simulation des systèmes de puissance et la communication entre des centres de commande. Le CIM facilite l'intégration en définissant un langage commun (c'est-à-dire une sémantique) fondé sur le modèle CIM pour permettre à ces applications ou systèmes d'accéder aux données publiques et d'échanger des informations indépendamment de la représentation interne de ces informations.

Compte tenu de la taille du CIM complet, les classes d'objets qui le composent sont regroupées en un certain nombre de paquetages logiques, qui représentent chacun une certaine partie de l'ensemble du système de puissance modélisé. Les collections de ces paquetages sont en cours d'élaboration sous forme de Normes internationales distinctes.

Le présent document particulier spécifie un paquetage dynamique (Dynamics) contenant des extensions du CIM. Il s'agit d'assurer l'échange des modèles entre les applications logicielles qui procèdent à l'analyse de la stabilité en régime établi (stabilité en petits signaux) ou de la stabilité transitoire d'un système de puissance tel que défini dans le document *Definition and classification of power system stability* (Définition et classification de la stabilité des réseaux d'énergie électrique) du joint task force (groupe de travail commun) IEEE/CIGRE on stability terms and definitions.

Les descriptions de modèles indiquées dans la présente norme donnent des spécifications pour chaque type de modèle dynamique, ainsi que des informations nécessaires à inclure dans les échanges de cas dynamiques entre les applications de planification/d'étude.

Le domaine d'application des extensions CIM spécifiées dans la présente norme inclut:

- les modèles de normes: une approche simplifiée visant à décrire des modèles dynamiques, les modèles représentant le comportement dynamique des éléments du système de puissance étant contenus dans des bibliothèques prédéfinies de classes interconnectées de manière normalisée. Seuls les noms des éléments sélectionnés des modèles, accompagnés de leurs attributs, sont nécessaires à la description du comportement dynamique.
- modèles définis par l'utilisateur propriétaires: approche offrant la possibilité à l'utilisateur de définir les paramètres d'un modèle de comportement dynamique représentant le dispositif propriétaire d'un fournisseur ou d'un utilisateur lorsque la norme ne donne pas de description explicite du modèle. Les mêmes bibliothèques et interconnexions normalisées sont utilisées tant pour les modèles définis par l'utilisateur propriétaires que pour les modèles normalisés. Les détails comportementaux du modèle ne sont pas documentés dans la norme, seuls les paramètres du modèle l'étant.

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2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050 (toutes les parties), *Vocabulaire Électrotechnique International*

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary* (disponible en anglais seulement)

IEC 61970-301, *Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 301: Base de modèle d'information commun (CIM)*

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 60050 (pour le glossaire général) et de l'IEC 61970-2 (pour les définitions du glossaire EMS-API), ainsi que les suivants, s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1
interface de programmation d'application
API
ensemble des fonctions publiques qu'offre un composant exécutable d'application pour être utilisées par d'autres composants exécutables d'application

Note 1 à l'article: L'abréviation «API» est dérivée du terme anglais développé correspondant «application program interface».

3.2
modèle d'information commun
CIM
modèle abstrait représentant tous les principaux objets dans une entreprise de service public de distribution d'électricité généralement contenus dans un modèle d'information EMS

Note 1 à l'article: En fournissant une façon normalisée de représenter des ressources de système de puissance comme des classes et des attributs d'objets ainsi que leurs relations, le CIM facilite l'intégration des applications EMS développées de façon indépendante par différents fournisseurs, entre des EMS complets développés de façon indépendante ou entre un EMS et d'autres systèmes concernés par différents aspects de l'exploitation d'un système de puissance tels que la gestion de la production ou de la distribution.

Note 2 à l'article: L'abréviation «CIM» est dérivée du terme anglais développé correspondant «common information model».

3.3
CIMXML
format de sérialisation pour l'échange de données XML comme défini dans le présent document

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3.4
modèle objet de document
DOM
interface de plate-forme et de langage neutre définie par le World Wide Web Consortium (W3C) permettant aux programmes et aux scripts d'accéder dynamiquement au contenu, à la structure et au style des documents et de les échanger

Note 1 à l'article: L'abréviation «DOM» est dérivée du terme anglais développé correspondant «document object model».

3.5
définition de type de document
DTD
document spécifique à la description du vocabulaire et de la syntaxe associés à un document XML

Note 1 à l'article: Les Schémas XML et RDF sont d'autres formes pouvant être utilisées.

Note 2 à l'article: L'abréviation «DTD» est dérivée du terme anglais développé correspondant «document type definition».

3.6
système de gestion d'énergie
EMS
système informatique comprenant une plate-forme logicielle offrant les services de support de base et un ensemble d'applications offrant les fonctionnalités nécessaires au bon fonctionnement des installations de production et de transmission d'électricité afin d'assurer la sécurité adéquate d'approvisionnement énergétique à un coût minimal

Note 1 à l'article: L'abréviation «EMS» est dérivée du terme anglais développé correspondant «energy management system».

3.7
langage de balisage hypertexte
HTML
langage de balisage utilisé pour mettre en forme et présenter les informations sur le Web

Note 1 à l'article: L'abréviation «HTML» est dérivée du terme anglais développé correspondant «hypertext markup language».

3.8
modèle
ensemble de données décrivant les objets ou les entités réel(le)s ou calculé(e)s, dont la sémantique est définie par des *profils* (3.9) dans le contexte du CIM

Note 1 à l'article: Dans une analyse des systèmes de puissance, un modèle désigne un ensemble de données statiques décrivant le système de puissance. Des exemples de modèles incluent le modèle de réseau statique, la solution de topologie et la solution de réseau produits par une application de calcul de répartition ou d'estimateur d'état.

3.9
profil
schéma qui définit la structure et la sémantique d'un modèle pouvant être échangé et qui est un sous-ensemble restreint du CIM plus général

3.10
document de profil
ensemble de profils destinés à être utilisés ensemble dans un but commercial particulier

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3.11
cadre de description des ressources
RDF
langage recommandé par le W3C pour exprimer des métadonnées que les ordinateurs peuvent traiter simplement

Note 1 à l'article: RDF utilise XML comme syntaxe d'encodage.

Note 2 à l'article: L'abréviation «RDF» est dérivée du terme anglais développé correspondant «Resource Description Framework».

3.12
schéma RDF
langage de spécification de schéma exprimé à l'aide de RDF pour décrire les ressources et leurs propriétés, y compris la manière dont les ressources sont liées les unes aux autres, utilisé pour spécifier un schéma spécifique à l'application

3.13
objets réels
objets appartenant au domaine du problème du monde réel différents des objets d'interface et des objets de contrôleur au sein de la mise en œuvre

Note 1 à l'article: Les objets réels pour le domaine de l'EMS sont définis comme des classes dans l'IEC 61970-301.

Note 2 à l'article: Les classes et les objets modélisent ce qui se trouve dans un système de puissance et qui nécessite d'être représenté de la même façon que pour les applications EMS. Une classe est une description d'un objet réel, telle que PowerTransformer, GeneratingUnit ou Load, qui nécessite d'être représentée comme faisant partie du modèle intégral de système de puissance dans un EMS. Parmi les autres types d'objets figurent des éléments tels que les programmes et les mesurages que des applications EMS nécessitent également de traiter, d'analyser et de stocker. De tels objets nécessitent une représentation commune pour atteindre les objectifs de compatibilité de connexion et d'interopérabilité de la norme EMS-API. Un objet particulier dans un système de puissance ayant une identité unique est modélisé comme une instance de la classe à laquelle il appartient.

3.14
langage normalisé de balisage généralisé
SGML
norme internationale pour la définition de méthodes indépendantes de l'appareil et du système pour représenter les textes au format électronique

Note 1 à l'article: HTML et XML sont issus de SGML.

Note 2 à l'article: L'abréviation «SGML» est dérivée du terme anglais développé correspondant «Standard Generalized Markup Language».

3.15
Unified Modeling Language
UML
langage de modélisation orienté objet et méthodologie pour spécifier, visualiser, élaborer et documenter les artefacts d'un processus intensif du système

Note 1 à l'article: L'abréviation «UML» est dérivée du terme anglais développé correspondant «unified modeling language».

3.16
identificateur de ressource uniforme
URI
syntaxe et sémantique normalisées de Web pour identifier (référencer) les ressources telles que des fichiers, des documents, et des images

Note 1 à l'article: L'abréviation «URI» est dérivée du terme anglais développé correspondant «uniform resource identifier».

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3.17
langage de balisage extensible
XML
sous-ensemble du langage normalisé de balisage généralisé (SGML), ISO 8879, pour insérer des données structurées dans un fichier texte

Note 1 à l'article: Il s'agit d'une recommandation approuvée du W3C. Elle est gratuite, indépendante de la plate-forme et adaptée à de nombreux outils logiciels facilement disponibles.

Note 2 à l'article: L'abréviation «XML» est dérivée du terme anglais développé correspondant «extensible markup language».

3.18
langage extensible de feuille de style
XSL
langage pour exprimer les feuilles de style des documents XML

Note 1 à l'article: L'abréviation «XSL» est dérivée du terme anglais développé correspondant «extensible stylesheet language».

4 Organisation du document

Le Paragraphe 5.1 donne des informations générales relatives au domaine d'application et à l'utilisation des modèles dynamiques CIM.

Le Paragraphe 5.2 décrit l'interconnexion normalisée des modèles pour différents types d'équipements.

Le Paragraphe 5.3 contient les spécifications de modèle normalisé regroupées par type d'équipement modélisé.

Le Paragraphe 5.4 contient les classes de modèle définies par l'utilisateur.

Le Paragraphe 5.5 présente l'utilisation d'un modèle dynamique CIM classique à l'aide de diagrammes d'instance.

L'Annexe A décrit les conventions de représentation de symboles du paquetage Dynamics.

L'Annexe B justifie l'utilisation du type de données par unité.

L'Annexe C décrit le processus par lequel les mises à jour des modèles normalisés Dynamics peuvent être demandées et fournit un formulaire de demande.

5 Paquetage Dynamics

5.1 Généralités

Les définitions du modèle dynamique CIM reflètent les représentations des modèles les plus courants de l'IEEE ou, dans le cas des modèles d'éoliennes, de l'IEC, ainsi que les modèles inclus dans certains logiciels de stabilité transitoire largement utilisés par les entreprises d'électricité.

Ces modèles dynamiques visent à assurer l'interopérabilité entre les produits logiciels de différents fournisseurs utilisés par les entreprises d'électricité, les compagnies d'énergie, les gestionnaires de réseaux de transport et les organismes de transport régionaux/gestionnaires de réseau indépendants. Il est important de noter que chaque fournisseur est libre de choisir la mise en œuvre interne de ces modèles. Les différences entre les résultats des fournisseurs, pour autant qu'elles soient acceptées par les principes techniques, par suite de représentations internes différentes, sont acceptables.

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Sauf indication explicite contraire, les conventions suivantes de modélisation sont suivies:

- les intégrateurs limités sont de type sans enroulement;
- il doit être possible de saisir une constante de temps nulle (lorsque cela est indiqué).

5.2 Paquetage StandardInterconnections

5.2.1 Généralités

Le présent paragraphe décrit les interconnexions normalisées pour différents types d'équipements. Ces interconnexions sont comprises par les programmes d'application et peuvent être identifiées en fonction de la présence de l'une des classes essentielles en relation avec le modèle de flux de puissance statique: SynchronousMachineDynamics, AsynchronousMachineDynamics, EnergyConsumerDynamics ou WindTurbineType3or4Dynamics.

Les relations entre les classes exprimées dans les diagrammes d'interconnexion sont destinées à prendre en charge le comportement dynamique décrit par les modèles normalisés ou les modèles définis par l'utilisateur.

Dans les diagrammes d'interconnexion, les cases noires représentent les blocs fonctionnels dont la fonctionnalité peut être assurée par l'un des nombreux modèles normalisés ou par un modèle défini par l'utilisateur. Les cases bleues représentent les modèles normalisés spécifiques. Une case en pointillés indique que le bloc fonctionnel ou le modèle normalisé spécifique est facultatif.

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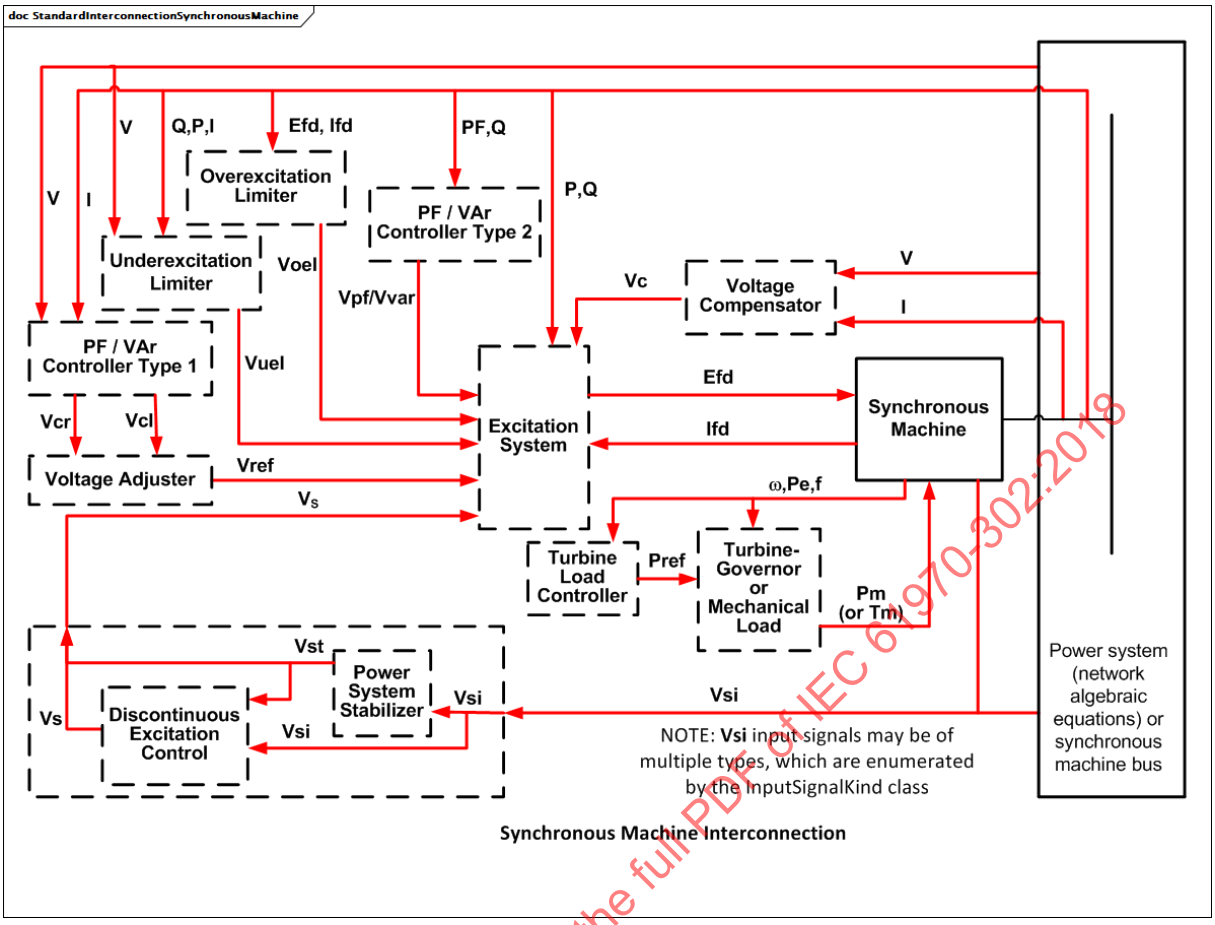

Anglais	Français
Overexcitation Limiter	Limiteur de surexcitation
PF/Var Controller Type 2	Régulateur de facteur de puissance ou régulateur VAr de Type 2
Underexcitation Limiter	Limiteur de sous-excitation
Voltage Compensator	Compensateur de variation de tension
PF/Var Controller Type 1	Régulateur de facteur de puissance ou régulateur VAr de Type 1
Excitation System	Système d'excitation
Voltage Adjuster	Dispositif d'ajustage de tension
Synchronous Machine	Machine synchrone
Turbine Load Controller	Régulateur de puissance de turbine
Turbine Governor or Mechanical Load	Régulateur de turbine ou charge mécanique
Power System (network algebraic equations) or synchronous machine bus	Système de puissance (équations algébriques du réseau) ou bus de machine synchrone
Discontinuous Excitation Control	Commande d'excitation discontinue
Power System Stabilizer	Stabilisateur de système de puissance
Vsi input signal may be of multiple types, which are enumerated by the InputSignalKind class	Le signal d'entrée Vsi peut être de plusieurs types qui sont énumérés par la classe InputSignalKind
Synchronous Machine Interconnection	Interconnexion de machine synchrone

Figure 1 – StandardInterconnectionSynchronousMachine

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Figure 1: Un modèle dynamique comprenant une seule machine synchrone (un générateur, un moteur ou un condensateur) et ses modèles d'équipements connexes (blocs fonctionnels) est associé à une machine synchrone du modèle (de flux de puissance) statique, dont l'interconnexion normalisée est présentée ci-dessus.

L'interface entre la machine synchrone dynamique et les équations algébriques du réseau dépend de l'application. Il n’est pas nécessaire d'identifier les variables utilisées pour cette interface, étant donné qu'elles sont internes au programme d'application, qu'elles sont bien définies et qu'il n'est pas nécessaire de les échanger entre les applications.

Les interfaces entre les différents blocs de la figure ci-dessus sont indicatives de la variété de signaux d'entrée et de sortie définis par les modèles normalisés individuels. La figure donne des informations relatives à la plupart des interfaces alternatives, par exemple, le régulateur de turbine (pour les générateurs) ou la charge mécanique (pour les moteurs), et la machine synchrone dynamique peut être le couple mécanique (Tm) ou la puissance mécanique (Pm).

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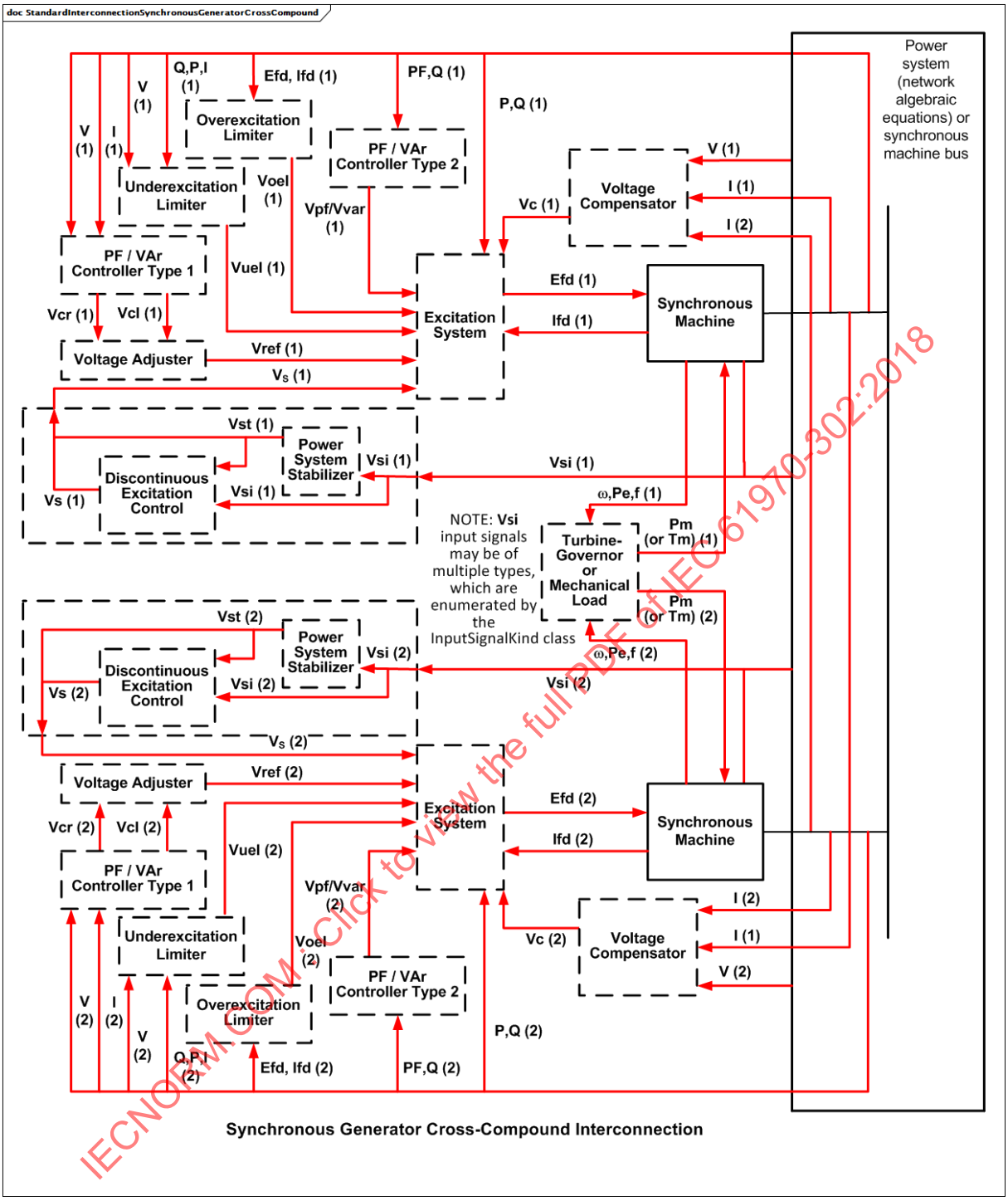

Synchronous Generator Cross-Compound Interconnection

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Anglais	Français
Overexcitation Limiter	Limiteur de surexcitation
PF/Var Controller Type 2	Régulateur de facteur de puissance ou régulateur VAr de Type 2
Underexcitation Limiter	Limiteur de sous-excitation
Voltage Compensator	Compensateur de variation de tension
Power System (network algebraic equations) or synchronous machine bus	Système de puissance (équations algébriques du réseau) ou bus de machine synchrone
PF/Var Controller Type 1	Régulateur de facteur de puissance ou régulateur VAr de Type 1

Anglais	Français
Excitation System	Système d'excitation
Synchronous Machine	Machine synchrone
Voltage Adjuster	Dispositif d'ajustage de tension
Discontinuous Excitation Control	Commande d'excitation discontinue
Power System Stabilizer	Stabilisateur de système de puissance
Vsi input signal may be of multiple types, which are enumerated by the InputSignalKind class	Le signal d'entrée Vsi peut être de plusieurs types qui sont énumérés par la classe InputSignalKind
Turbine Governor or Mechanical Load	Régulateur de turbine ou charge mécanique
Overexcitation Limiter	Limiteur de surexcitation
Synchronous Generator Cross-Coumpound Interconnection	Interconnexion transversale de générateur synchrone

Figure 2 – StandardInterconnectionSynchronousGeneratorCrossCompound

Figure 2: Un modèle dynamique cross-compound comprenant plusieurs générateurs synchrones et leurs modèles d'équipements connexes (blocs fonctionnels) est associé à plusieurs machines synchrones du modèle (de flux de puissance) statique, dont l'interconnexion normalisée est présentée ci-dessus.

Le générateur 2 est la deuxième unité d'une paire cross-compound de générateurs. Il est en général connecté au même bus aux bornes. Un seul modèle de régulateur de turbine détermine la puissance mécanique des deux unités.

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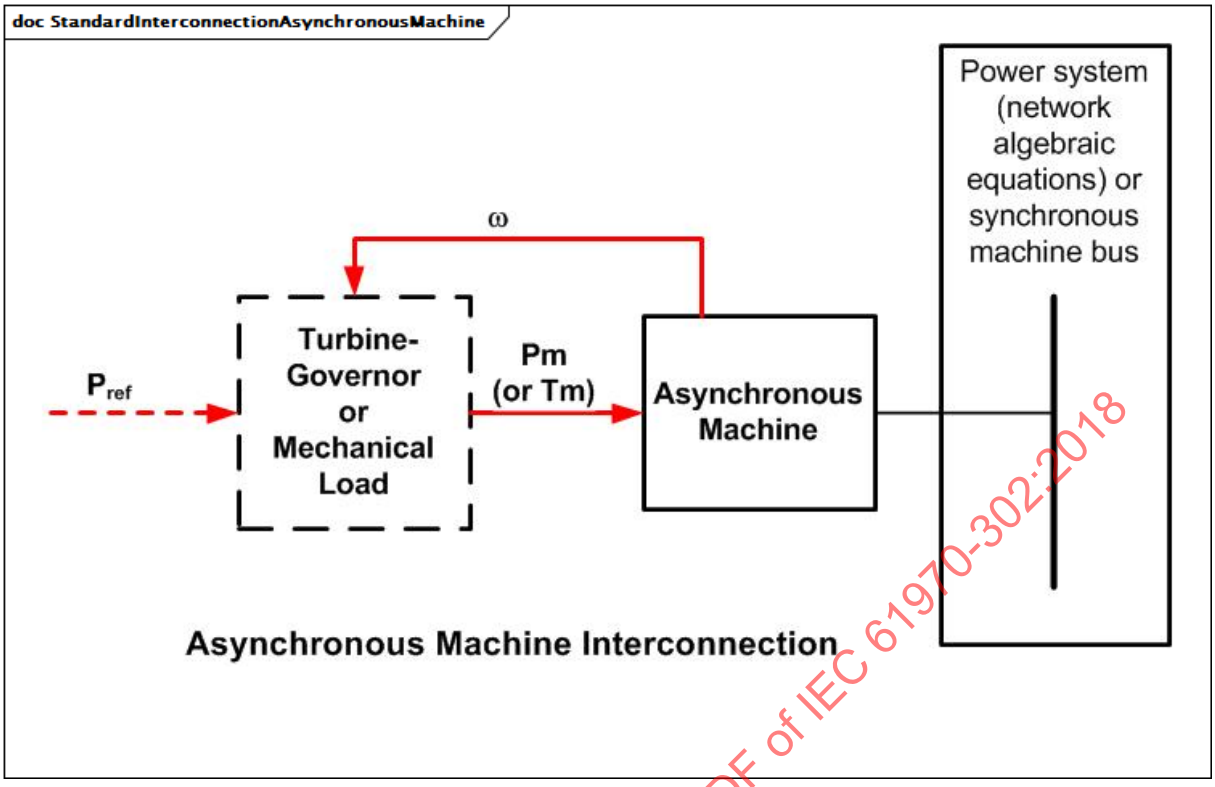

Anglais	Français
Turbine Governor or Mechanical Load	Régulateur de turbine ou charge mécanique
Asynchronous Machine	Machine asynchrone
Power System (network algebraic equations) or synchronous machine bus	Système de puissance (équations algébriques du réseau) ou bus de machine synchrone
Pm (or Tm)	Pm (ou Tm)
Asynchronous machine interconnection	Interconnexion de machine asynchrone

Figure 3 – StandardInterconnectionAsynchronousMachine

Figure 3: Un modèle dynamique comprenant une machine asynchrone (un générateur ou un moteur) et ses modèles d'équipements connexes (blocs fonctionnels) est associé à une machine asynchrone du modèle (de flux de puissance) statique, dont l'interconnexion normalisée est présentée ci-dessus.

Cette interconnexion concerne une machine à induction "à cage d'écureuil" ou une machine à induction à rotor bobiné avec enroulements de champ court-circuités. D'autres modèles et une interconnexion différente sont exigés pour une machine à rotor bobiné avec connexions externes aux enroulements de champ.

L'interface entre la machine asynchrone dynamique et les équations algébriques du réseau dépend de l'application.

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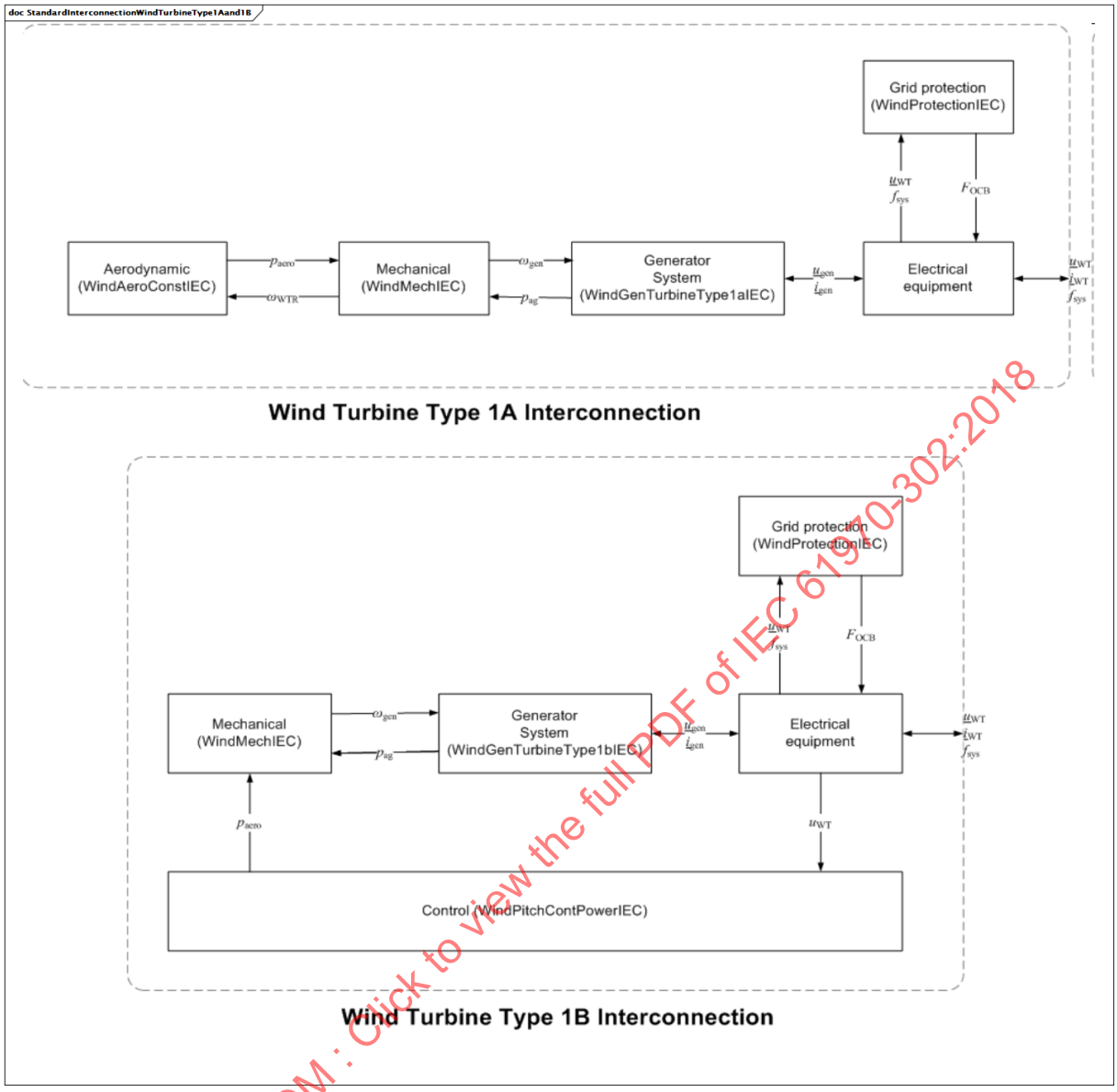

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Anglais	Français
Grid protection	Protection du réseau
Aerodynamic	Aérodynamique
Mechanical	Mécanique
Generator system	Système de générateur
Electrical equipment	Équipement électrique
Wind Turbine Type 1A Interconnection	Interconnexion d'éolienne de Type 1A
Wind Turbine Type 1B Interconnection	Interconnexion d'éolienne de Type 1B

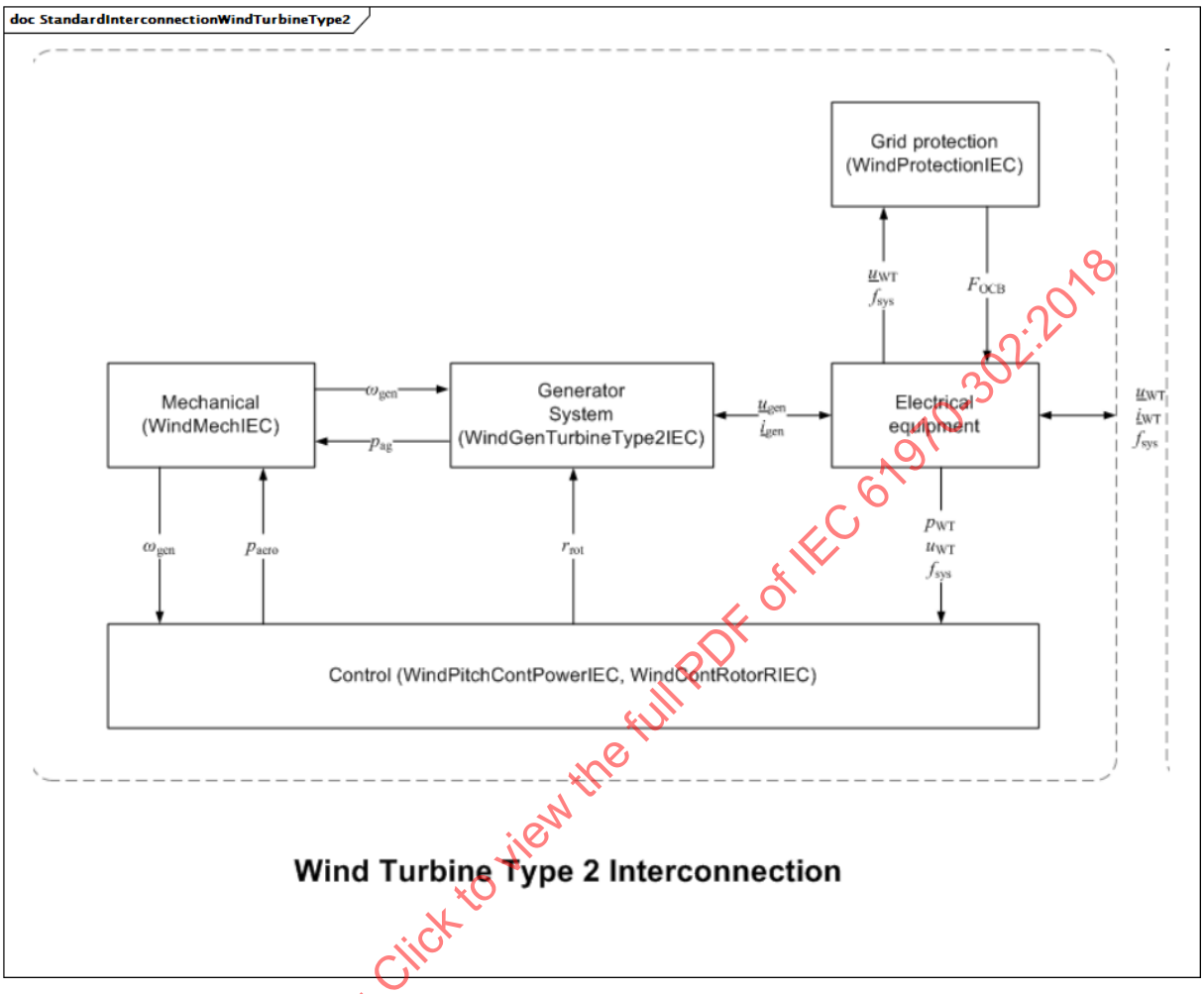
Figure 4 – StandardInterconnectionWindTurbineType1Aand1B

Figure 4: Un modèle dynamique représentant un modèle d'éolienne de type 1 utilise des générateurs asynchrones directement raccordés au réseau, c'est-à-dire sans convertisseur de puissance. La plupart des éoliennes de type 1 disposent d'un système de démarrage progressif, qui n'est actif qu'au moment du démarrage. Il existe deux modèles de type 1:

- type 1A: éoliennes avec angle de pas fixe;
- type 1B: éoliennes avec commande d'angle de pas d'alimentation continue sous tension.

Les deux interconnexions normalisées sont représentées dans la Figure.

Référence: IEC 61400-27-1:2015, 5.5.2.



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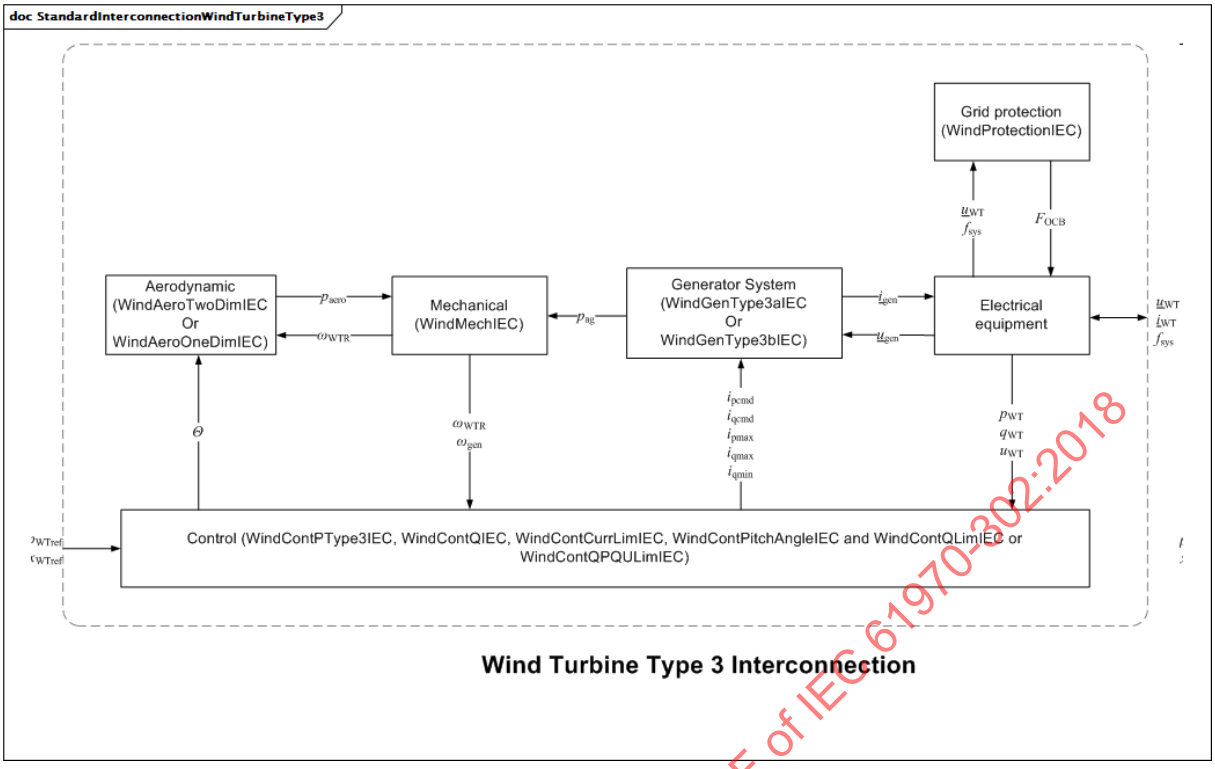
Anglais	Français
Grid protection	Protection du réseau
Mechanical	Mécanique
Generator system	Système de générateur
Electrical equipment	Équipement électrique
Control	Commande
Wind Turbine Type 2 Interconnection	Interconnexion d'éolienne de Type 2

Figure 5 – StandardInterconnectionWindTurbineType2

Figure 5: Un modèle dynamique représentant un aérogénérateur de type 2 et ses modèles d'équipements normalisés connexes est associé à une machine asynchrone du modèle (de flux de puissance) statique, dont l'interconnexion normalisée est représentée ci-dessus.

La turbine de type 2 est équipée d'une résistance rotorique variable (VRR – variable rotor resistance) et utilise donc un générateur asynchrone à résistance rotorique variable (VRRAG – variable rotor resistance asynchronous generator). Les éoliennes de type 2 sont également souvent équipées d'une commande d'inclinaison des pales.

Référence: IEC 61400-27-1:2015, 5.5.3.



Wind Turbine Type 3 Interconnection

Anglais	Français
Grid protection	Protection du réseau
Aerodynamic	Aérodynamique
Or	Ou
Mechanical	Mécanique
Generator system	Système de générateur
Electrical equipment	Équipement électrique
Control	Commande
Wind Turbine Type 3 Interconnection	Interconnexion d'éolienne de type 3
and	et
or	ou

Figure 6 – StandardInterconnectionWindTurbineType3

Figure 6: Un modèle dynamique représentant une éolienne de type 3 qui utilise un générateur asynchrone à double alimentation (DFAG – doubly fed asynchronous generator), dont le stator est directement raccordé au réseau et dont le rotor est raccordé par l'intermédiaire d'un convertisseur de puissance dos à dos. Son interconnexion normalisée est représentée dans la figure.

Référence: IEC 61400-27-1:2015, 5.5.4.

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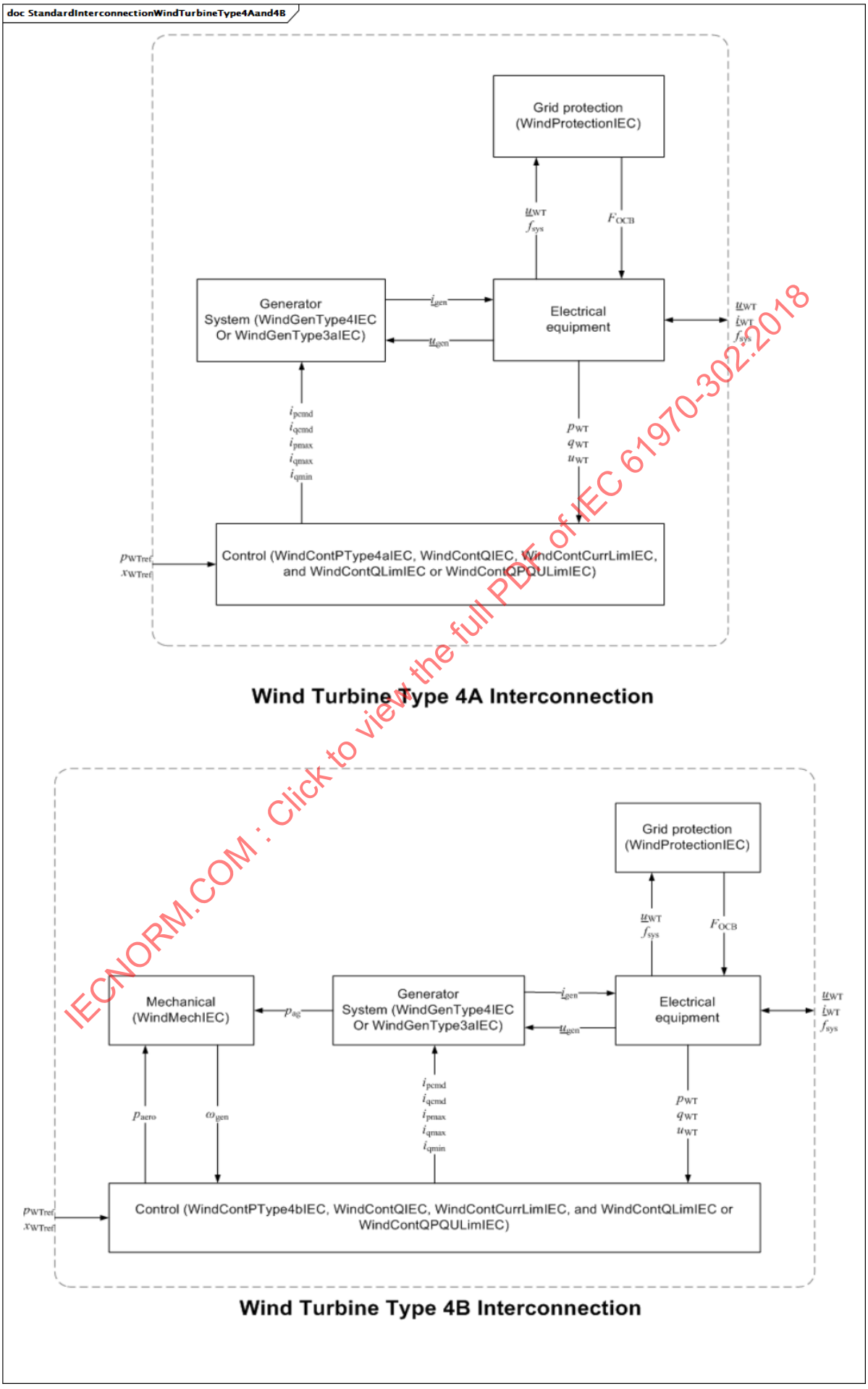

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Anglais	Français
Grid protection	Protection du réseau
Generator system	Système de générateur
Or	Ou
Electrical equipment	Équipement électrique
Mechanical	Mécanique
Control	Commande
and	et
or	ou
Wind Turbine Type 4A Interconnection	Interconnexion d'éolienne de type 4A
Wind Turbine Type 4B Interconnection	Interconnexion d'éolienne de type 4B

Figure 7 – StandardInterconnectionWindTurbineType4Aand4B

Figure 7: Un modèle dynamique représentant une éolienne de type 4 qui utilise des générateurs synchrones (SG – synchronous generator) ou des générateurs asynchrones (AG – asynchronous generator). Certaines éoliennes de type 4 utilisent des générateurs synchrones à entraînement direct et sont donc dépourvues de boîte de vitesses.

Il existe deux modèles de type 4:

- type 4A: modèle négligeant les composantes aérodynamiques et mécaniques et, par conséquent, ne simulant pas les variations de puissance;
- type 4B: modèle composé d'un modèle mécanique à 2 masses pour répliquer les variations de puissance, mais en partant d'un couple aérodynamique constant.

Les interconnexions normalisées pour les deux modèles sont représentées dans la figure.

Référence: IEC 61400-27-1:2015, 5.5.5.

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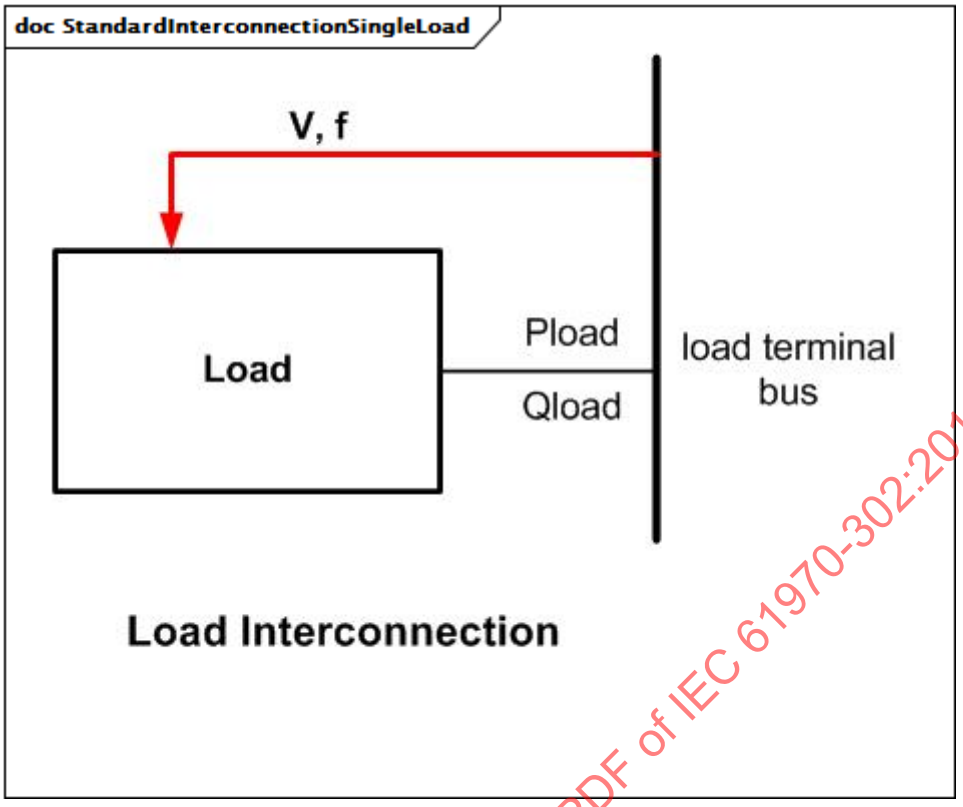

Anglais	Français
Load	Charge
load terminal bus	bus aux bornes de charge
Load Interconnection	Interconnexion de charge

Figure 8 – StandardInterconnectionSingleLoad

Figure 8: Un modèle de charge est associé à un consommateur d'énergie dans les données de flux de puissance et ne comporte aucune interconnexion normalisée avec d'autres modèles.

Les consommations P et Q de la charge sont déterminées en fonction de l'amplitude et de la fréquence de la tension au bus aux bornes (comme représenté ci-dessus).

L'interface entre le modèle et les équations algébriques du réseau dépend de l'application. En règle générale, les modèles de charge (du moteur) dynamique interfacent avec les équations du réseau d'une manière similaire aux modèles de moteur.

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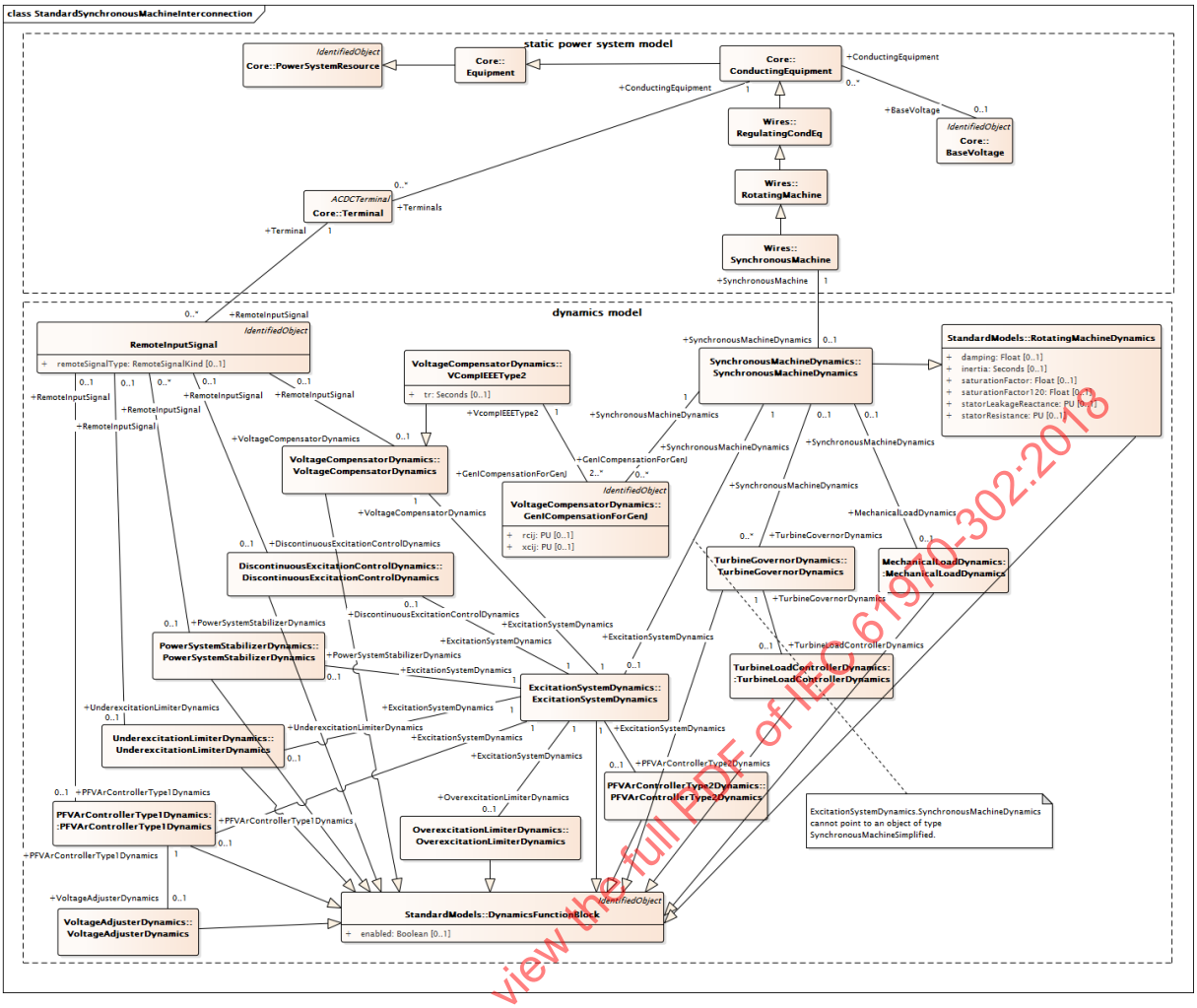

Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 9 – Diagramme de classe StandardInterconnections::StandardSynchronousMachineInterconnection

Figure 9: Ce diagramme présente les classes nécessaires aux deux types de modèles d'interconnexion de machine synchrone: machine synchrone normalisée et générateur synchrone normalisé cross-compound.

Une interconnexion de machine synchrone normalisée a une seule instance de classe enfant SynchronousMachineDynamics, alors qu'une connexion transversale de générateur a plusieurs instances des classes enfants SynchronousMachineDynamics liées par une seule instance d'une classe enfant TurbineGovernorDynamics.

Un modèle d'interconnexion de machine synchrone normalisée valide respecte les règles suivantes.

- Il peut avoir:
  - une instance de la classe enfant TurbineGovernorDynamics, mais uniquement si SynchronousMachine.operatingMode = generator;

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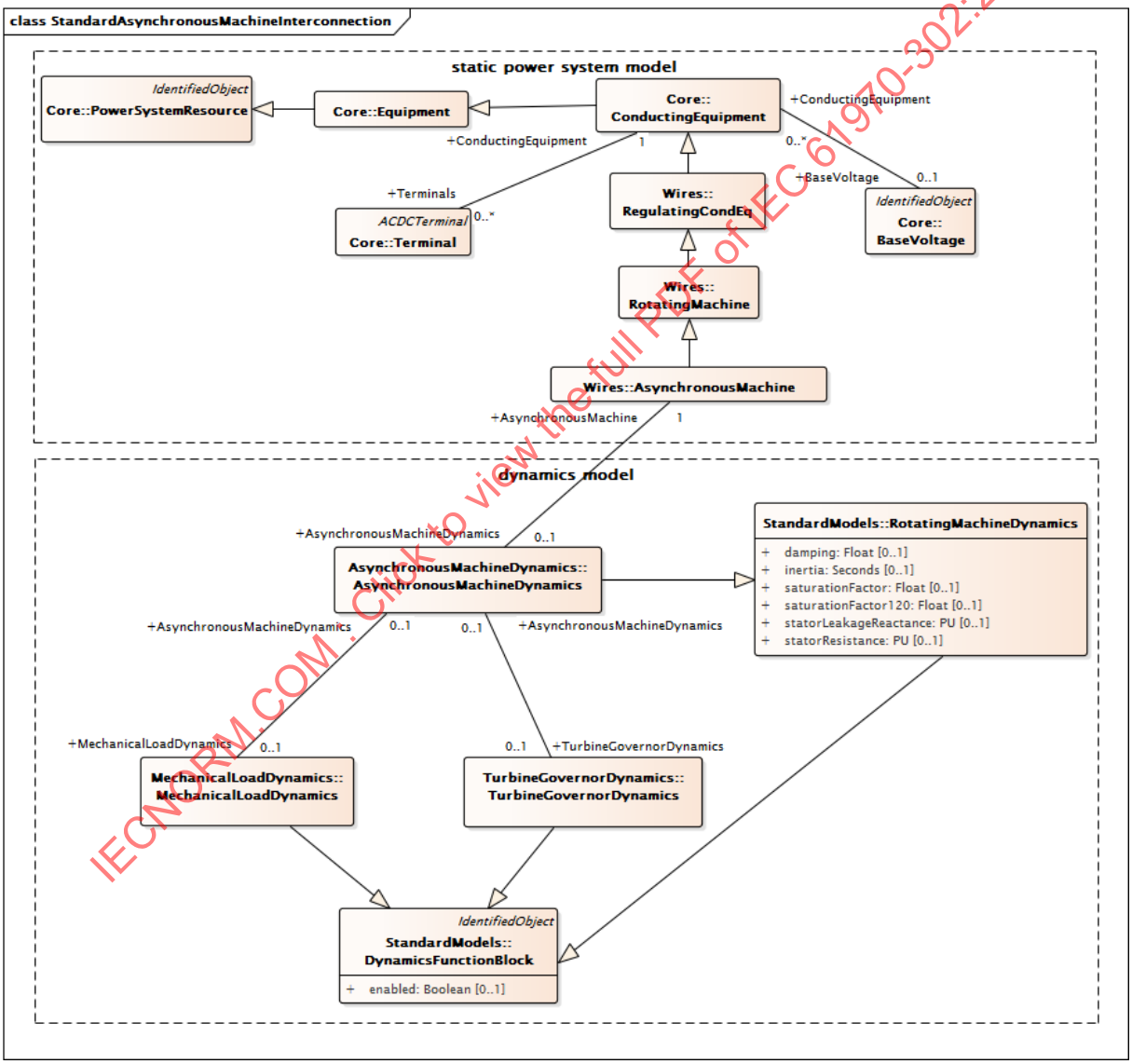
  - une instance de la classe enfant MechanicalLoadDynamics, mais uniquement si SynchronousMachine.operatingMode = motor ou si SynchronousMachine.operatingMode = condenser.
- Il ne peut avoir d'instance de GenICompensationForGenJ.

Un modèle d'interconnexion transversale de générateur respecte les règles suivantes.

- Il peut avoir:
  + plusieurs instances des classes enfants SynchronousMachineDynamics, comportant chacune son SynchronousMachine.operatingMode = generator connexe;
  + une instance de la classe enfant TurbineGovernorDynamics.
- Il doit avoir au moins deux instances de GenICompensationForGenJ associées à chaque instance d'une classe enfant SynchronousMachineDynamics.



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Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 10 – Diagramme de classe StandardInterconnections::StandardAsynchronousMachineInterconnection

Figure 10: Ce diagramme représente les classes nécessaires au modèle d'interconnexion de machine asynchrone.

Une interconnexion de machine asynchrone normalisée a une seule instance de la classe enfant AsynchronousMachineDynamics.

Un modèle d'interconnexion de machine asynchrone normalisée valide respecte également les règles suivantes. Il peut avoir:

- une instance de la classe enfant TurbineGovernorDynamics, mais uniquement si AsynchronousMachine.asynchronousMachineType = generator;
- une instance de la classe enfant MechanicalLoadDynamics, mais uniquement si AsynchronousMachine.asynchronousMachineType = motor.

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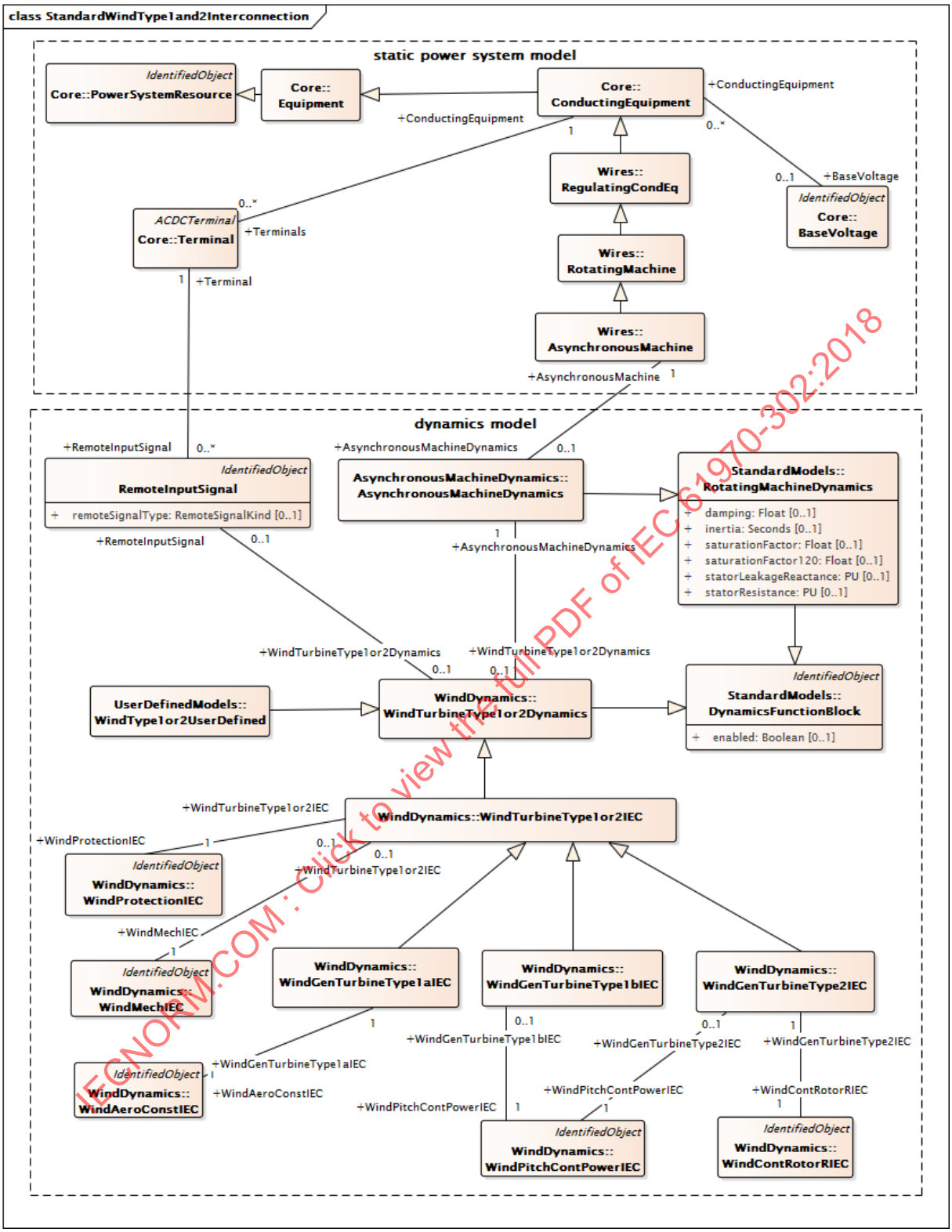

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Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 11 – Diagramme de classe StandardInterconnections::StandardWindType1and2Interconnection

Figure 11: Ce diagramme représente les classes nécessaires aux modèles d'interconnexion d'éoliennes de type 1 et de type 2.

Tous les modèles d'interconnexion IEC normalisés d'éoliennes de type 1 et de type 2 ont une seule instance de la classe enfant AsynchronousMachineDynamics et une seule instance de la classe WindGenTurbineType1aIEC, de la classe WindGenTurbineType1bIEC ou de la classe WindGenTurbineType2IEC, selon le cas.

Un modèle d'interconnexion IEC valide d'éolienne de Type 1A doit également avoir une instance de chacune des classes suivantes (et aucune autre):

- WindMechIEC;
- WindAeroConstIEC;
- WindProtectionIEC.

Un modèle d'interconnexion IEC valide d'éolienne de Type 1B doit également avoir une instance de chacune des classes suivantes (et aucune autre):

- WindMechIEC;
- WindProtectionIEC;
- WindPitchContPowerIEC.

Un modèle d'interconnexion IEC valide d'éolienne de Type 2 doit également avoir une instance de chacune des classes suivantes (et aucune autre):

- WindMechIEC;
- WindContRotorRIEC;
- WindProtectionIEC;
- WindPitchContPowerIEC.

La classe WindProtectionIEC et la classe WindContRotorRIEC utilisent la classe WindDynamicsLookupTable.

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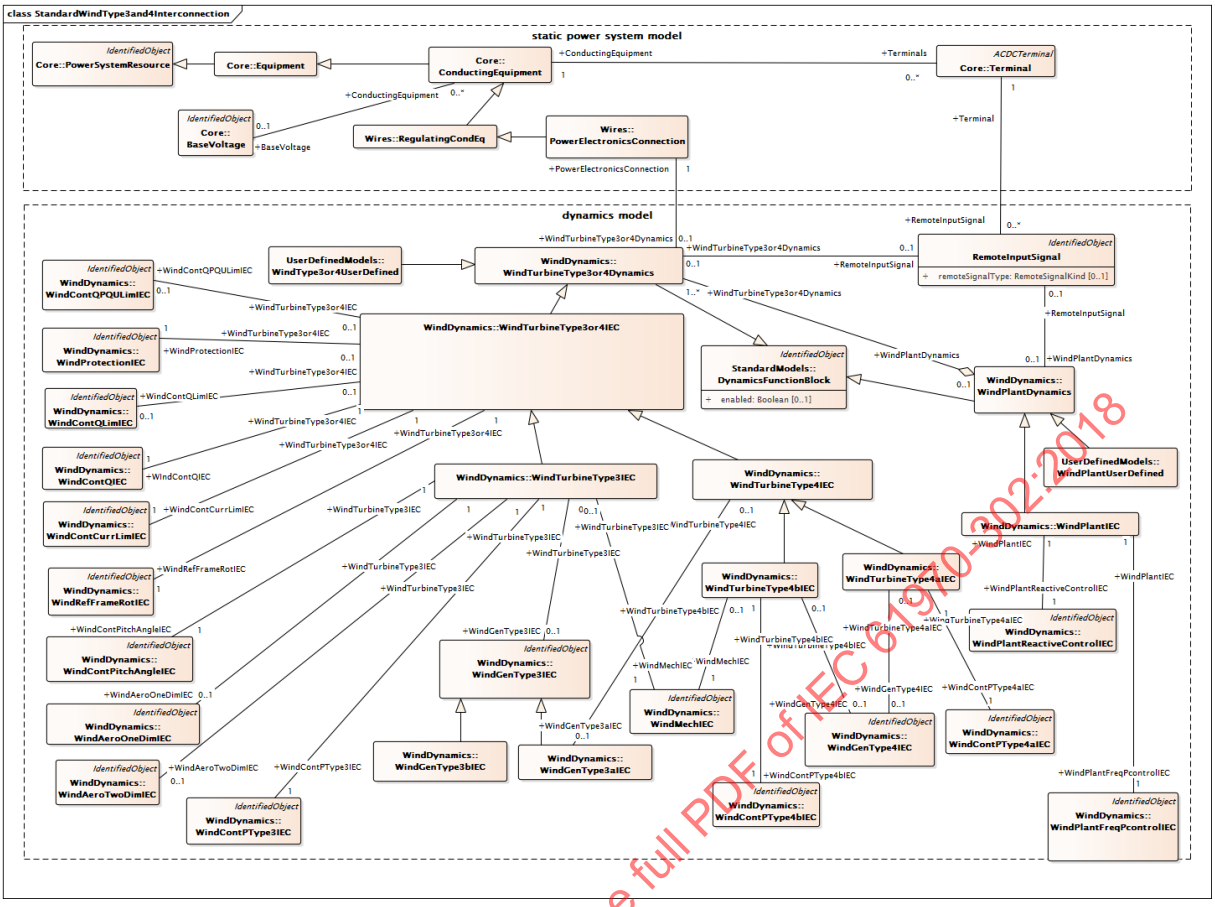

Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 12 – Diagramme de classe StandardInterconnections::StandardWindType3and4Interconnection

Figure 12: Ce diagramme représente les classes nécessaires aux modèles d'interconnexion d'éoliennes de type 3 et de type 4, y compris le modèle de centrale éolienne.

Le modèle IEC normalisé d'éoliennes de type 3, de type 4A et de type 4B, ainsi que le modèle d'interconnexion de centrale éolienne, ont les instances uniques suivantes:

Éolienne IEC de type 3:

- WindTurbineType3IEC;
- WindAeroOneDimIEC ou WindAeroTwoDimIEC;
- WindMechIEC;
- WindGenType3aIEC ou WindGenType3bIEC;
- WindContPType3IEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC ou WindContQPQULimIEC;
- WindContPitchAngleIEC;
- WindProtectionIEC.

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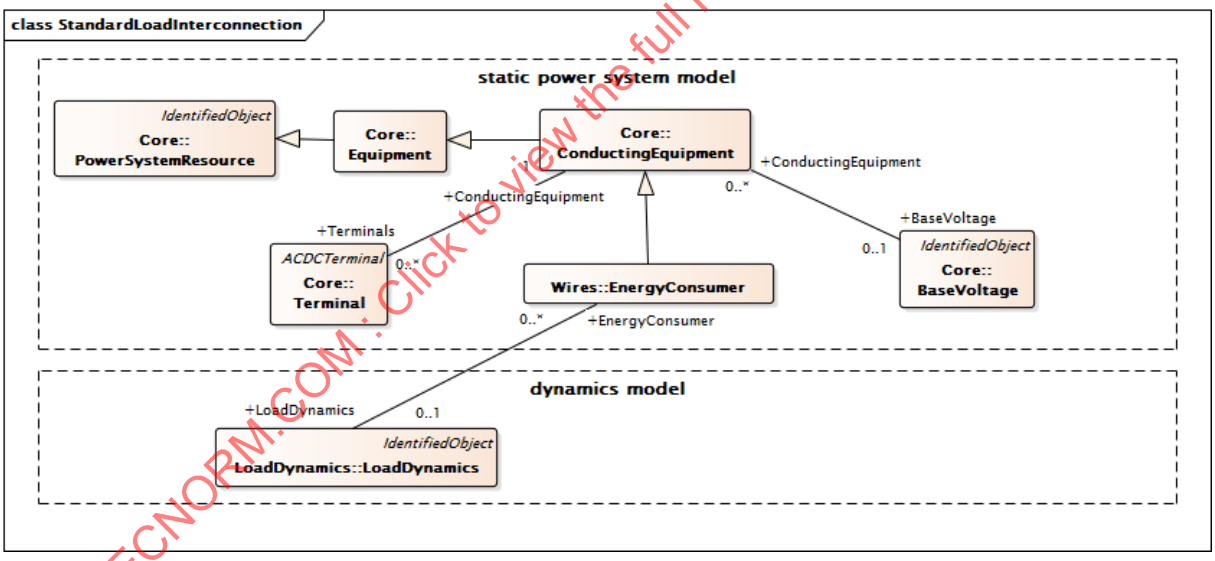
Éolienne IEC de type 4A:

- WindTurbineType4aIEC;
- WindGenType4IEC ou WindGenType3aIEC;
- WindContPType4aIEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC ou WindContQPQULimIEC;
- WindProtectionIEC.

Éolienne IEC de type 4B:

- WindTurbineType4bIEC;
- WindMechIEC;
- WindGenType4IEC ou WindGenType3aIEC;
- WindContPType4bIEC;
- WindContQIEC;
- WindContCurrLimIEC;
- WindContQLimIEC ou WindContQPQULimIEC;
- WindProtectionIEC.



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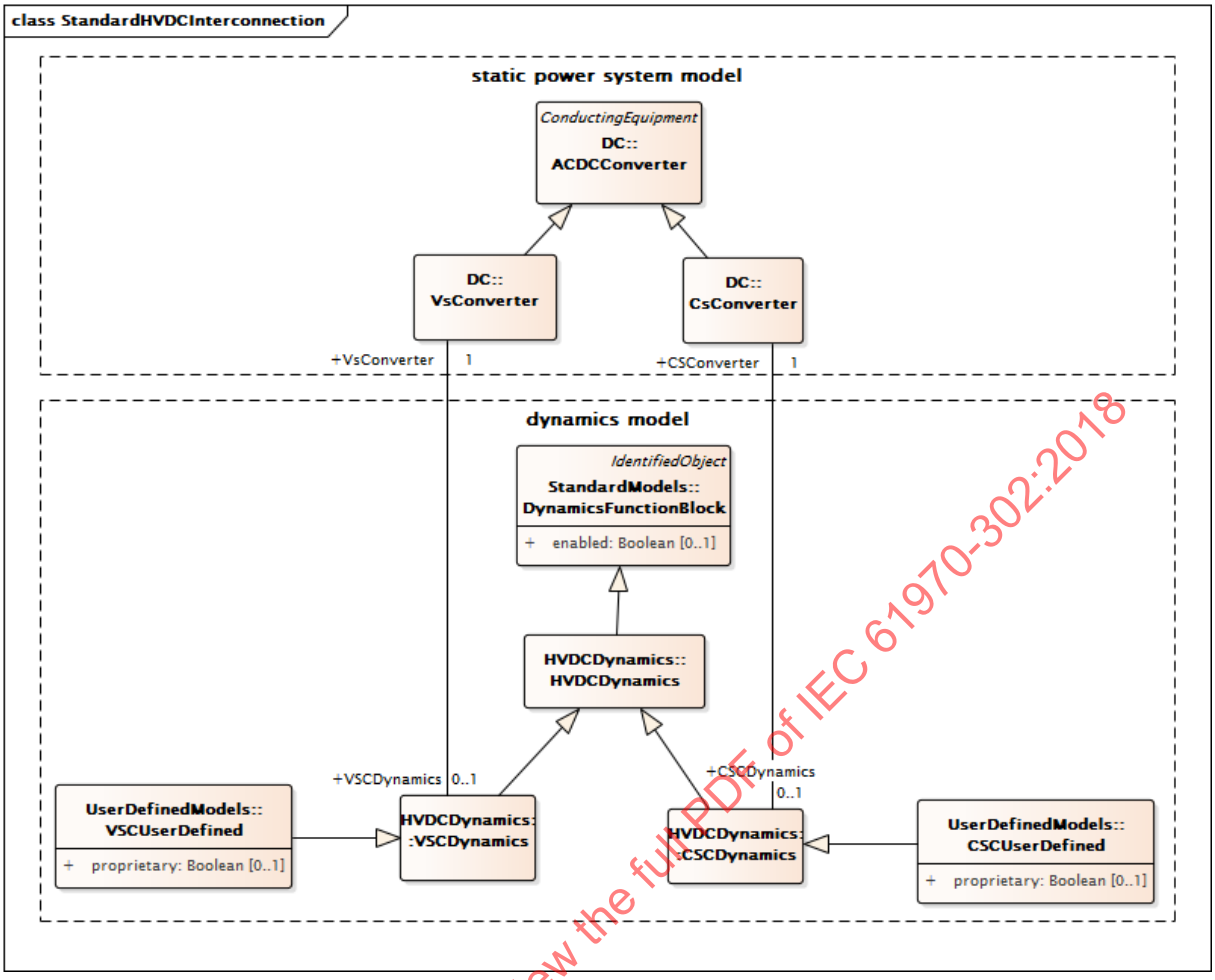
Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 13 – Diagramme de classe StandardInterconnections::StandardLoadInterconnection

Figure 13: Ce diagramme représente les classes nécessaires au modèle d'interconnexion de charge.

Un modèle normalisé d'interconnexion de charge a une seule instance de la classe enfant EnergyConsumerDynamics et une instance associée de la classe enfant LoadDynamics.



Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 14 – Diagramme de classe StandardInterconnections::StandardHVDCInterconnection

Figure 14: Ce diagramme représente les classes nécessaires au modèle d'interconnexion CCHT.

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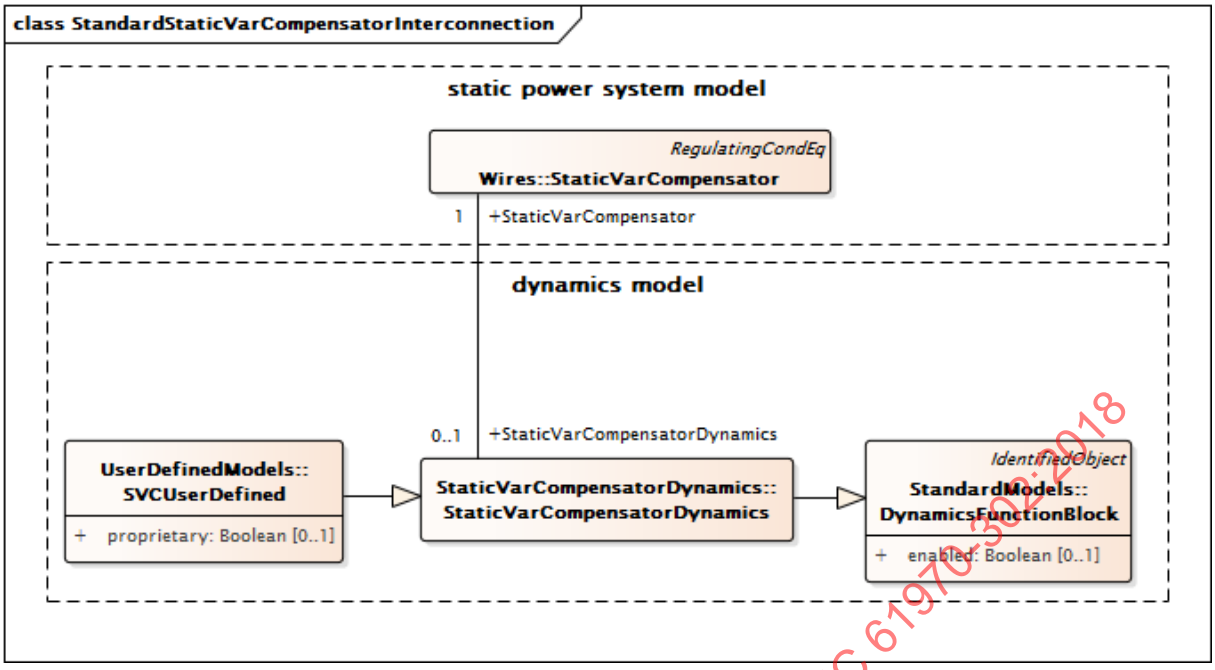

Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 15 – Diagramme de classe StandardInterconnections::StandardStaticVarCompensatorInterconnection

Figure 15: Ce diagramme représente les classes nécessaires au modèle d'interconnexion d'un compensateur statique (SVC – static var compensator).

5.2.2 RemoteInputSignal

Prend en charge la connexion à un terminal associé à un bus distant à partir duquel provient un signal d'entrée d'un type particulier.

Le Tableau 1 présente tous les attributs de RemoteInputSignal.

Tableau 1 – Attributs de StandardInterconnections::RemoteInputSignal

nom	mult	type	description
remoteSignalType	0..1	RemoteSignalKind	Type de signal d'entrée.
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 2 présente toutes les extrémités d'association de RemoteInputSignal avec d'autres classes.

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Tableau 2 – Extrémités d'association de StandardInterconnections:: RemoteInputSignal avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..*	Terminal	1..1	Terminal	Terminal distant auquel ce signal d'entrée est associé.
0..1	VoltageCompensatorDynamics	0..1	VoltageCompensatorDynamics	Modèle de compensateur de variation de tension utilisant ce signal d'entrée distant.
0..1	WindPlantDynamics	0..1	WindPlantDynamics	Centrale éolienne utilisant le signal distant.
0..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	Modèle de limiteur de sous-excitation utilisant ce signal d'entrée distant.
0..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	Modèle de commande d'excitation discontinue utilisant ce signal d'entrée distant.
0..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	Modèle d'aérogénérateur de type 1 ou de type 2 utilisant ce signal d'entrée distant.
0..1	WindTurbineType3or4Dynamics	0..1	WindTurbineType3or4Dynamics	Modèle d'éolienne de type 3 ou de type 4 utilisant ce signal d'entrée distant.
0..*	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	Modèle de stabilisateur de système de puissance utilisant ce signal d'entrée distant.
0..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	Facteur de puissance ou modèle de contrôleur VAr de type 1 utilisant ce signal d'entrée distant.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.2.3 Énumération RemoteSignalKind

Type de signal d'entrée provenant du bus éloigné.

Le Tableau 3 présente tous les libellés de RemoteSignalKind.

Tableau 3 – Libellés de StandardInterconnections::RemoteSignalKind

libellé	valeur	description
remoteBusVoltageFrequency		L'entrée est la fréquence de tension provenant du bus éloigné du terminal.
remoteBusVoltageFrequencyDeviation		L'entrée est l'écart de fréquence de tension provenant du bus éloigné du terminal.
remoteBusFrequency		L'entrée est la fréquence du bus éloigné du terminal.
remoteBusFrequencyDeviation		L'entrée est l'écart de fréquence provenant du bus éloigné du terminal.
remoteBusVoltageAmplitude		L'entrée est l'amplitude de fréquence provenant du bus éloigné du terminal.
remoteBusVoltage		L'entrée est la tension provenant du bus éloigné du terminal.
remoteBranchCurrentAmplitude		L'entrée est l'amplitude de courant de branche provenant du bus éloigné du terminal.
remoteBusVoltageAmplitudeDerivative		L'entrée est la dérivée d'amplitude de courant de branche provenant du bus éloigné du terminal.
remotePuBusVoltageDerivative		L'entrée est la dérivée de tension en PU provenant du bus éloigné du terminal.

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5.3 Paquetage StandardModels

5.3.1 Généralités

Le présent paragraphe contient les spécifications de modèle dynamique normalisé regroupées en paquetages par bloc fonctionnel normalisé (type d'équipement en cours de modélisation).

Dans le CIM, les modèles dynamiques normalisés sont exprimés au moyen d'une classe portant le nom du modèle normalisé, et d'attributs reflétant chacun des paramètres nécessaires à la description du comportement d'une instance du modèle normalisé.

5.3.2 DynamicsFunctionBlock

Classe parente abstraite pour tous les blocs fonctionnels dynamiques.

Le Tableau 4 présente tous les attributs de DynamicsFunctionBlock.

Tableau 4 – Attributs de StandardModels::DynamicsFunctionBlock

nom	mult	type	description
enabled	0..1	Boolean	Indicateur utilisé par le bloc fonctionnel. true = utilisation activée du bloc fonctionnel false = utilisation désactivée du bloc fonctionnel
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 5 présente toutes les extrémités d'association de DynamicsFunctionBlock avec d'autres classes.

Tableau 5 – Extrémités d'association de StandardModels:: DynamicsFunctionBlock avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.3 RotatingMachineDynamics

Classe parente abstraite pour tous les modèles normalisés de machine asynchrone et synchrone.

Le Tableau 6 présente tous les attributs de RotatingMachineDynamics.

Tableau 6 – Attributs de StandardModels::RotatingMachineDynamics

nom	mult	type	description
damping	0..1	Float	Coefficient du couple d'amortissement (D) (>= 0). Constante proportionnelle qui, lorsqu'elle est multipliée par la vitesse angulaire des pôles du rotor par rapport au champ magnétique (fréquence), se traduit par le couple d'amortissement. Cette valeur est souvent nulle quand les sources de couple d'amortissement (enroulements amortisseurs de générateur, effets amortisseurs de charge, etc.) sont modélisées en détail. Valeur classique = 0.
inertia	0..1	Seconds	Constante d'inertie du générateur ou du moteur et charge mécanique (H) (> 0). Cela représente la spécification pour l'énergie emmagasinée dans la masse à mouvement tournant quand le fonctionnement a lieu à la vitesse assignée. Pour un générateur, sont compris le générateur et tous les autres éléments (turbine, excitatrice) qui se trouvent sur le même arbre et qui ont des unités de MW x s. Pour un moteur, sont compris à la fois le moteur et sa charge mécanique. Les unités conventionnelles sont les PU sur la base du MVA du générateur, habituellement exprimées en MW*s/MVA ou juste en s. Cette valeur est utilisée dans le référentiel électrique d'accélération pour les solutions de simulateur de formation des opérateurs. Valeur classique = 3.
saturationFactor	0..1	Float	Facteur de saturation à la tension assignée aux bornes (S1) (>= 0). Non utilisé par le modèle simplifié. Défini par S(E1) dans le diagramme SynchronousMachineSaturationParameters. Valeur classique = 0,02.
saturationFactor120	0..1	Float	Facteur de saturation à 120 % de la tension assignée aux bornes (S12) (>= RotatingMachineDynamics.saturationFactor). Non utilisé par le modèle simplifié, défini par S(E2) dans le diagramme SynchronousMachineSaturationParameters. Valeur classique = 0,12.
statorLeakageReactance	0..1	PU	Réactance de fuite du stator (Xl) (>= 0). Valeur classique = 0,15.
statorResistance	0..1	PU	Résistance du stator (armature) (Rs) (>= 0). Valeur classique = 0,005.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 7 présente toutes les extrémités d'association de RotatingMachineDynamics avec d'autres classes.

Tableau 7 – Extrémités d'association de StandardModels:: RotatingMachineDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.4 Package SynchronousMachineDynamics

5.3.4.1 Généralités

Pour les unités conventionnelles de production d'énergie (turbine thermique, turbine hydraulique, turbine à combustion, par exemple), un modèle de machine synchrone représente les caractéristiques électriques du générateur et les caractéristiques mécaniques de l'inertie rotative du turboalternateur. Les moteurs industriels ou groupes de moteurs similaires volumineux peuvent être représentés par des modèles de moteur individuel, sous la forme de générateurs avec puissance active négative dans les données (de flux de puissance) statiques.

L'interconnexion avec les équations du réseau électrique peut différer selon les outils de simulation. L'outil a simplement besoin de connaître la machine synchrone pour établir l'interconnexion correcte. L'interconnexion avec l'équipement du moteur peut également différer en raison des signaux d'entrée et de sortie exigés par les modèles normalisés.

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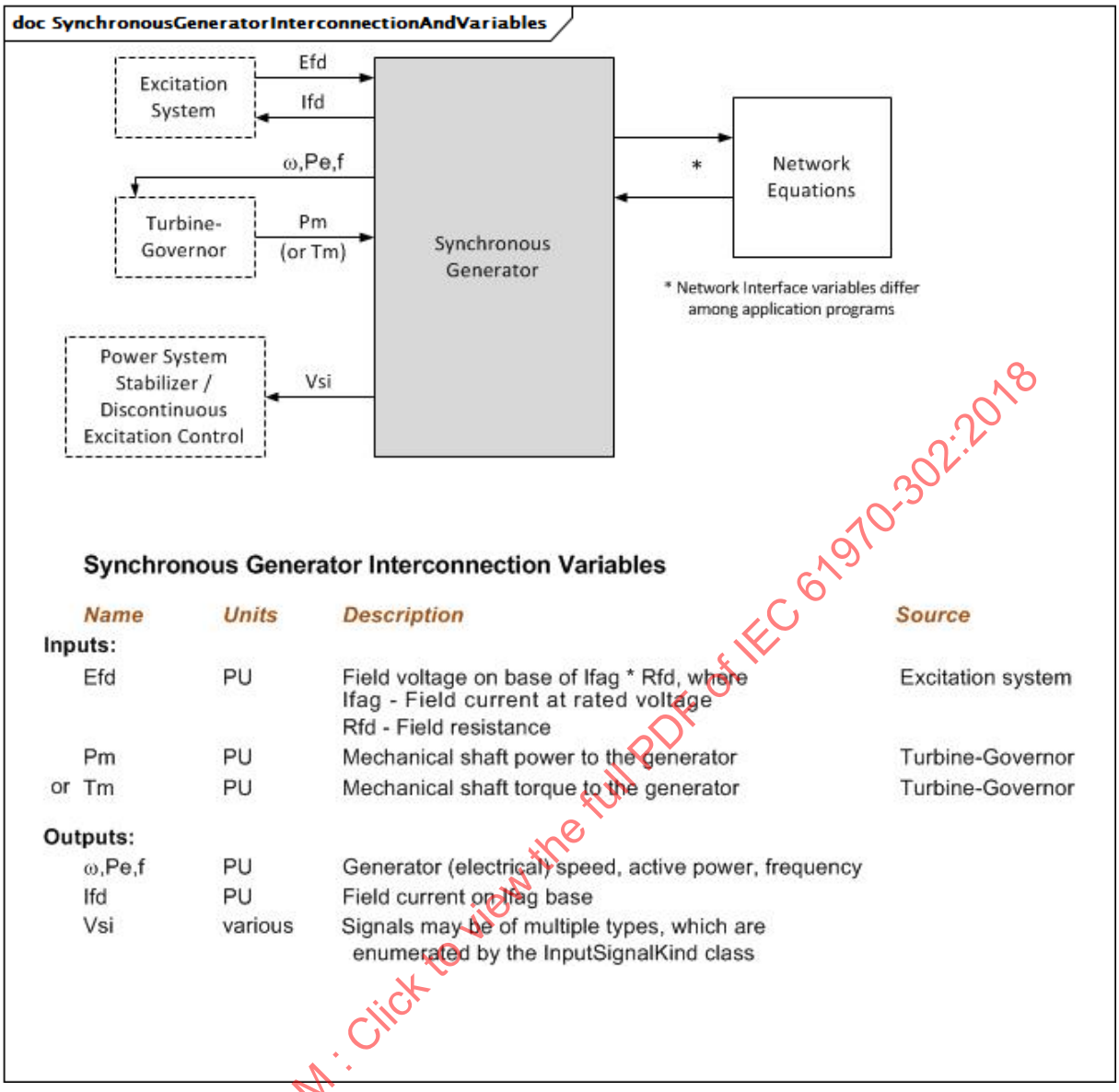

Synchronous Generator Interconnection Variables

	Name	Units	Description	Source
Inputs:				
	Efd	PU	Field voltage on base of Ifag * Rfd, where Ifag - Field current at rated voltage Rfd - Field resistance	Excitation system
	Pm	PU	Mechanical shaft power to the generator	Turbine-Governor
or	Tm	PU	Mechanical shaft torque to the generator	Turbine-Governor
Outputs:				
	ω,Pe,f	PU	Generator (electrical) speed, active power, frequency	
	Ifd	PU	Field current on Ifag base	
	Vsi	various	Signals may be of multiple types, which are enumerated by the InputSignalKind class	

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Anglais	Français
Excitation System	Système d'excitation
Turbine-Governor	Régulateur de turbine
Power system stabilizer/Discontinuous Excitation Control	Stabilisateur de système de puissance/Commande d'excitation discontinue
Synchronous generator	Générateur synchrone
Network Equations	Équations du réseau
*Network interface variables differ among application programs	*Les variables d'interface de réseau diffèrent selon les programmes d'application
Synchronous Generator Interconnection variables	Variables d'interconnexion de générateur synchrone
Name	Nom
Units	Unités
Inputs	Entrées
Pm or Tm	Pm ou Tm
Outputs	Sorties

Anglais	Français
Field voltage on base of Ifag * Rfd, where Ifag – Field current at rated voltage	Tension de champ sur la base d'Ifag * Rfd, où Ifag – Courant de champ à la tension assignée
Rfd – Field resistance	Rfd – Résistance de champ
Mechanical shaft power to the generator	Puissance à l'arbre mécanique vers le générateur
Mechanical shaft torque to the generator	Couple de l'arbre mécanique vers le générateur
Generator (electrical) speed, active power, frequency	Vitesse (électrique), puissance active, fréquence du générateur
Field current on Ifag base	Courant de champ sur la base d'Ifag
Signals may be of multiple types, which are enumerated by InputSugnalKind class	Les signaux peuvent être de plusieurs types, qui sont énumérés par la classe InputSugnalKind
various	diverses

Figure 16 – SynchronousGeneratorInterconnectionAndVariables

Figure 16: Ce diagramme représente les entrées et sorties d'un générateur synchrone.

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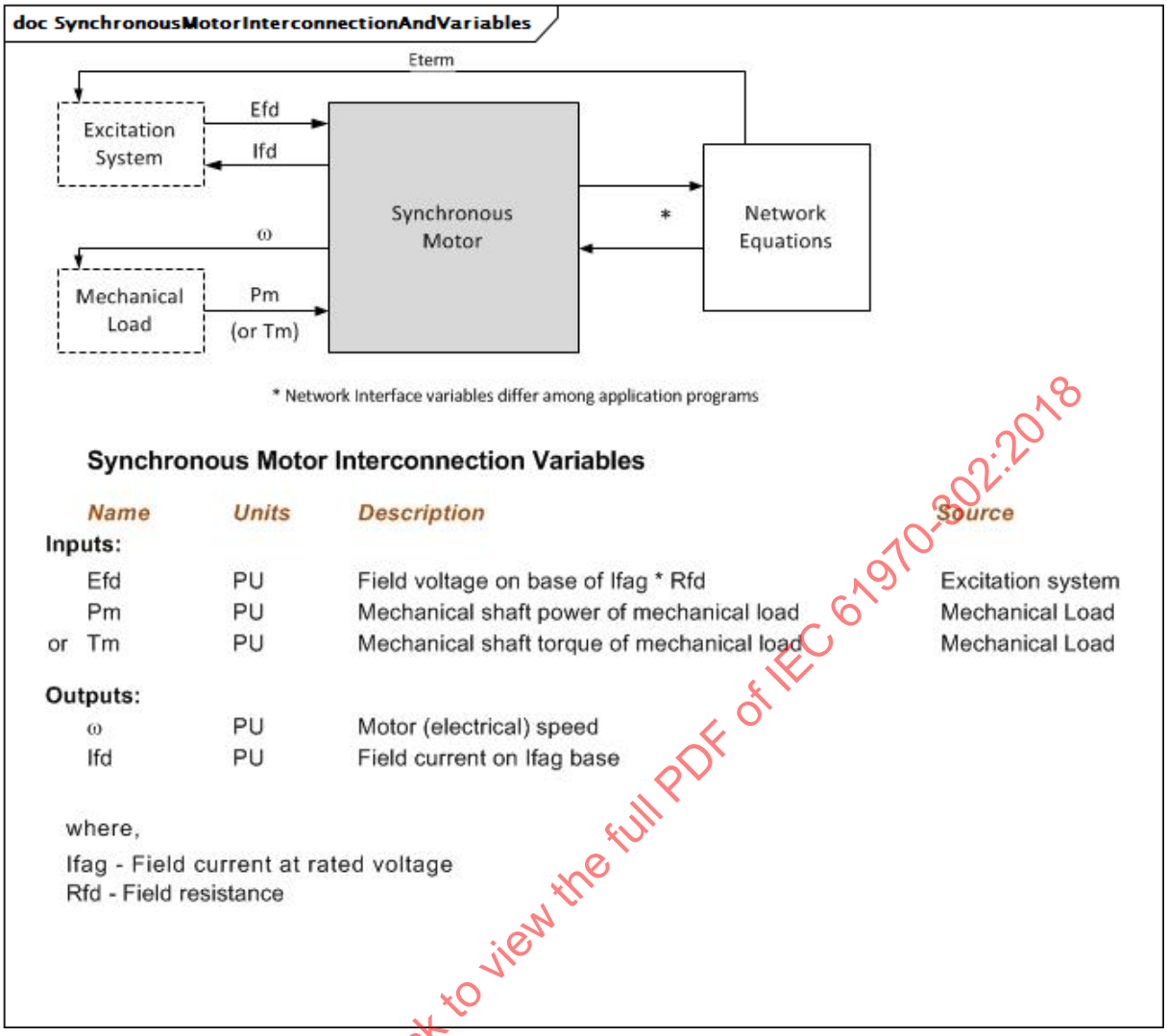

Synchronous Motor Interconnection Variables

	Name	Units	Description	Source
Inputs:				
	Efd	PU	Field voltage on base of Ifag * Rfd	Excitation system
	Pm	PU	Mechanical shaft power of mechanical load	Mechanical Load
or	Tm	PU	Mechanical shaft torque of mechanical load	Mechanical Load
Outputs:				
	ω	PU	Motor (electrical) speed	
	Ifd	PU	Field current on Ifag base	

where,

Ifag - Field current at rated voltage
Rfd - Field resistance

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Anglais	Français
Excitation System	Système d'excitation
Mechanical load	Charge mécanique
Synchronous motor	Moteur synchrone
Network Equations	Équations du réseau
*Network interface variables differ among application programs	*Les variables d'interface de réseau diffèrent selon les programmes d'application
Synchronous Motor Interconnection variables	Variables d'interconnexion de moteur synchrone
Name	Nom
Units	Unités
Inputs	Entrées
Outputs	Sorties
Pm or Tm	Pm ou Tm
Field voltage on base of Ifag * Rfd	Tension de champ sur la base d'Ifag * Rfd
Rfd – Field resistance	Rfd – Résistance de champ
Mechanical shaft power of mechanical load	Puissance à l'arbre mécanique de la charge mécanique
Mechanical shaft torque of mechanical load	Couple de l'arbre mécanique de la charge mécanique

Anglais	Français
Motor (electrical) speed	Vitesse (électrique) du moteur
Field current on Ifag base	Courant de champ sur la base d'Ifag
where, Ifag – Field current at rated voltage	où, Ifag – Courant de champ à la tension assignée
Rfd – Field resistance	Rfd – Résistance de champ

Figure 17 – SynchronousMotorInterconnectionAndVariables

Figure 17: Ce diagramme représente les entrées et sorties d'un moteur synchrone.

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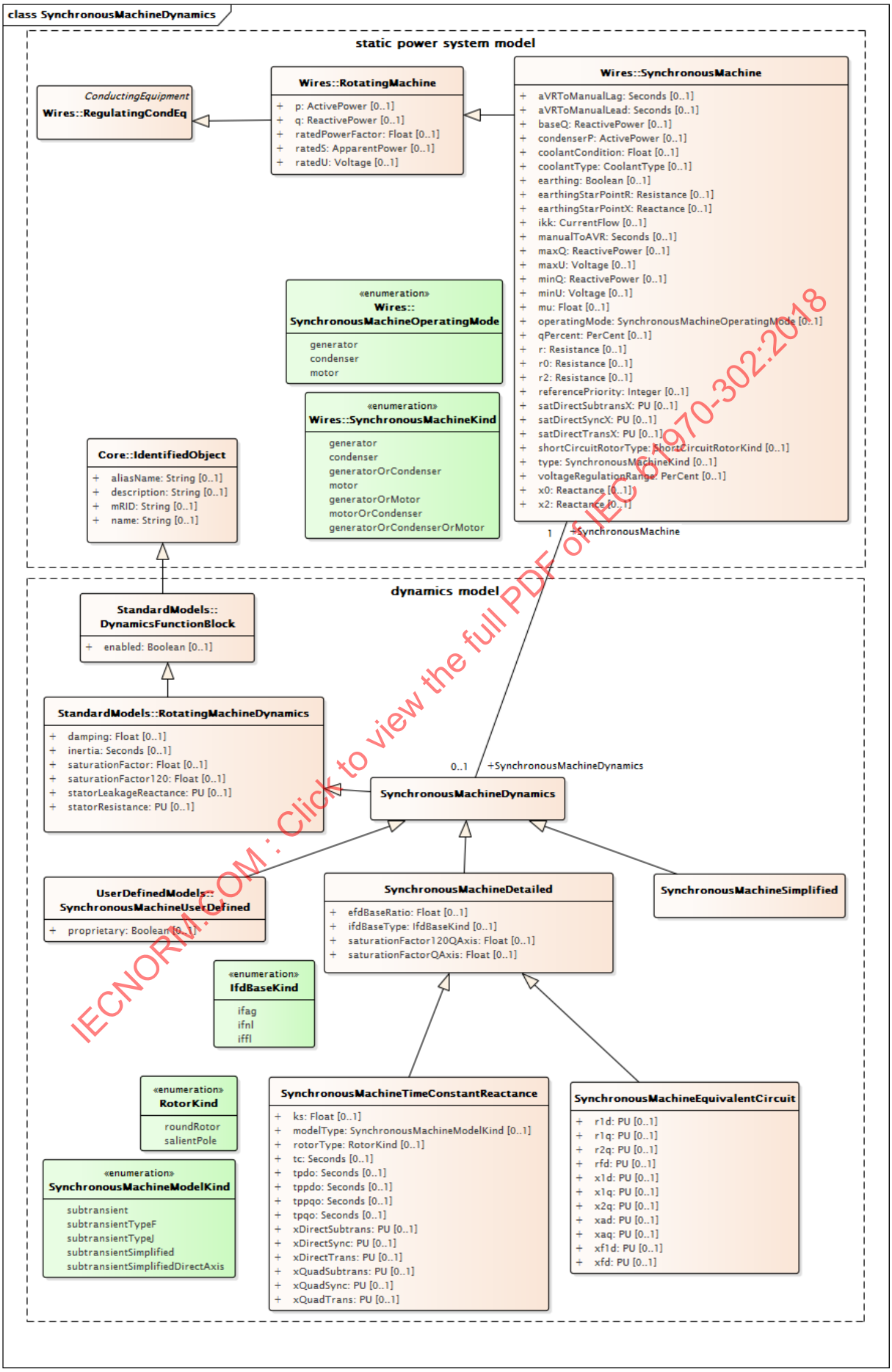

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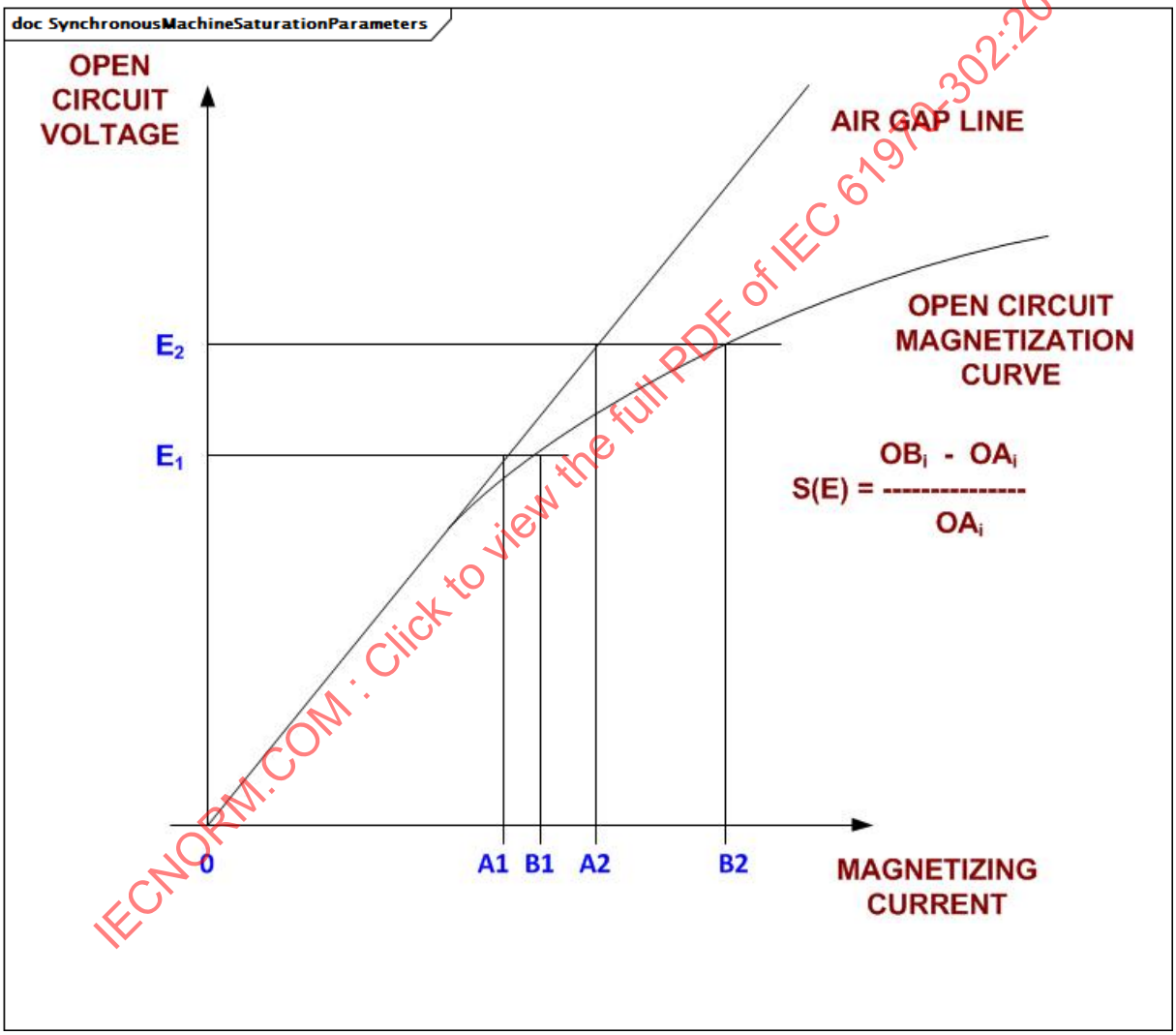
Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 18 – Diagramme de classe SynchronousMachineDynamics::SynchronousMachineDynamics

Figure 18: Ce diagramme représente les classes de modèle de système de puissance statique et les classes de modèle dynamique liées au modèle dynamique de machine synchrone. Une association entre la classe SynchronousMachineDynamics et la classe SynchronousMachine offre un moyen de relier le modèle dynamique au modèle statique.



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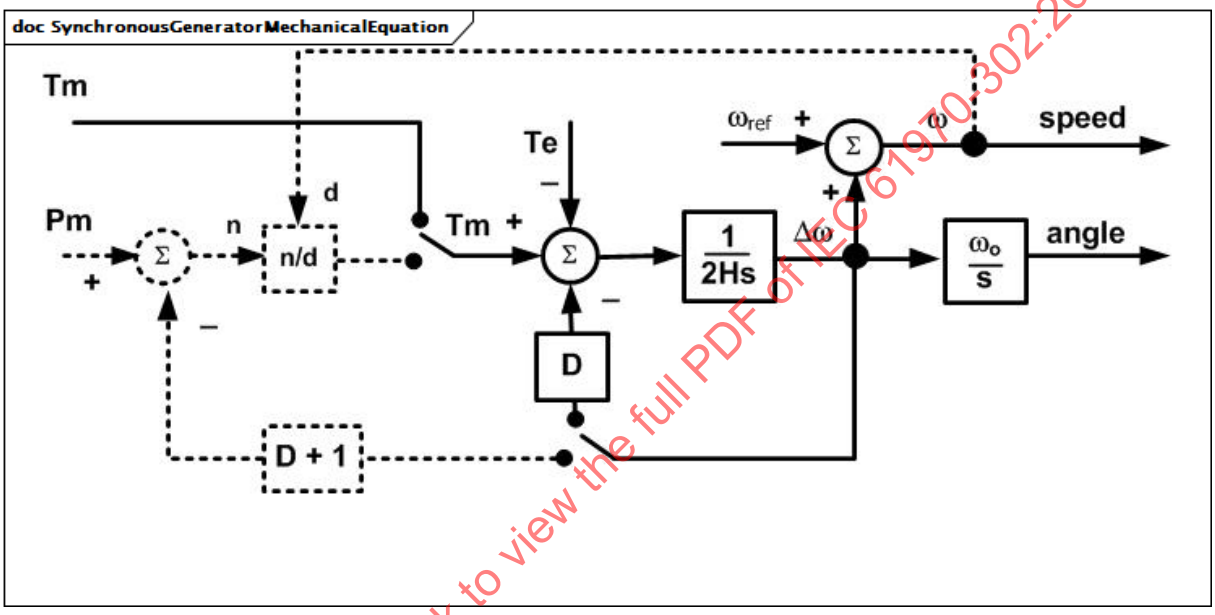
Anglais	Français
OPEN CIRCUIT VOLTAGE	TENSION EN CIRCUIT OUVERT
AIR GAP LINE	LIGNE D'ENTREFER
OPEN CIRCUIT MAGNETIZATION CURVE	COURBE D'AIMANTATION EN CIRCUIT OUVERT
MAGNETIZING CURRENT	COURANT MAGNÉTISANT

Figure 19 – SynchronousMachineSaturationParameters

Figure 19: Ce diagramme représente les paramètres de saturation de la machine synchrone.

Détails sur ces paramètres:

1) La grandeur OAi en ampères est souvent appelée Ifag (ce qui signifie: courant moyen de champ à la tension assignée, circuit ouvert sur la ligne d'entrefer (pas de saturation)). OBi en ampères souvent appelée Ifnl (ce qui signifie: courant moyen de champ à la tension assignée sans charge sur la machine).
2) Les facteurs de saturation des générateurs sont donnés par RotatingMachineDynamics.saturationFactor et RotatingMachineDynamics.saturationFactor120.
3) Pour les excitatrices, les valeurs sont données dans les attributs pour chaque modèle normalisé de système d'excitation.



Anglais	Français
speed	vitesse

Figure 20 – SynchronousGeneratorMechanicalEquation

Figure 20: Les équations mécaniques pour toutes les variations du modèle de générateur synchrone sont les mêmes. Elles peuvent être représentées par le diagramme de bloc SynchronousGeneratorMechanicalEquation.

Détails sur les paramètres:

1) Toutes les variables sont des PU sur la base du MVA du générateur, sauf l'angle, qui est exprimé en radians.
2) omega0 est la fréquence synchrone du système en radians par s. omegaref est la fréquence du système en PU (ou fréquence de zone isolée), qui peut être constante à la fréquence initiale ou varier lors d'une simulation en fonction du programme d'application.
3) L'entrée des équations mécaniques peut être Pm ou Tm, selon le programme d'application. Il est nécessaire que les programmes d'application utilisant Pm en entrée avec la rétroaction d'amortissement soustraite de Pm augmentent D de 1 comme indiqué. Dans ce cas, la rétroaction d'amortissement au point de sommation du couple n'est pas utilisée.

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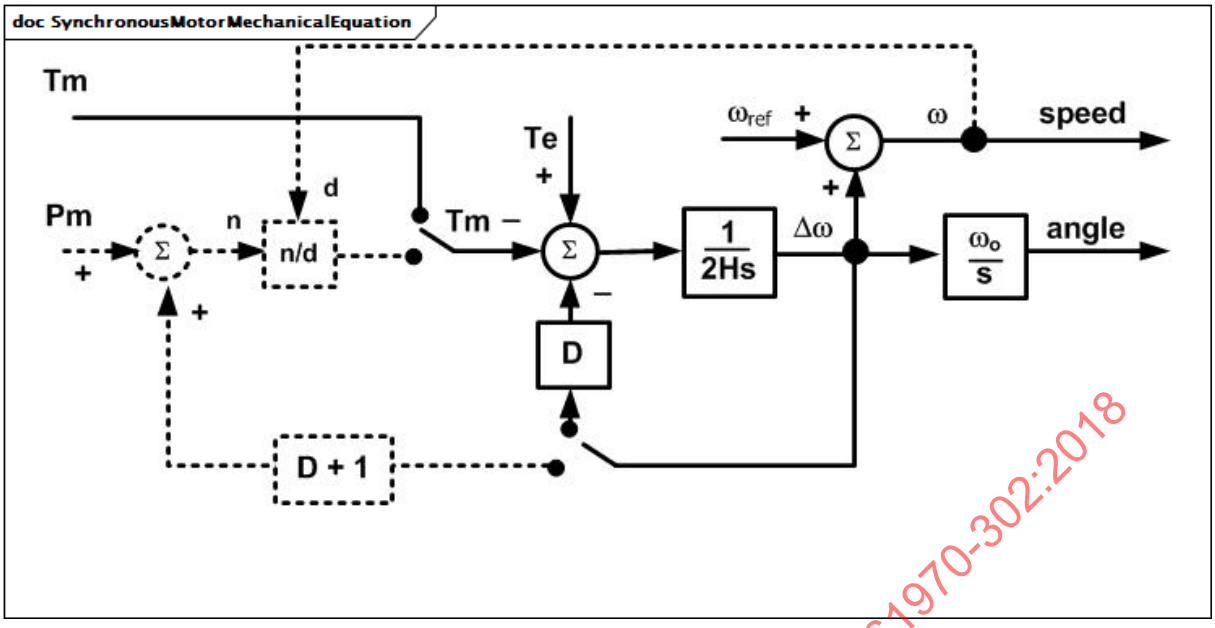

Anglais	Français
speed	vitesse

Figure 21 – SynchronousMotorMechanicalEquation

Figure 21: Les équations mécaniques pour toutes les variations du modèle de moteur synchrone sont les mêmes. Elles peuvent être représentées par le diagramme SynchronousMotorMechanicalEquation.

Détails sur les paramètres:

1) Toutes les variables sont des PU sur la base du MVA du moteur, sauf l'angle, qui est exprimé en radians.
2) omega0 est la fréquence synchrone du système en radians par s. omegaref est la fréquence du système en PU (ou fréquence de zone isolée), qui peut être constante à la fréquence initiale ou varier lors d'une simulation en fonction du programme d'application.

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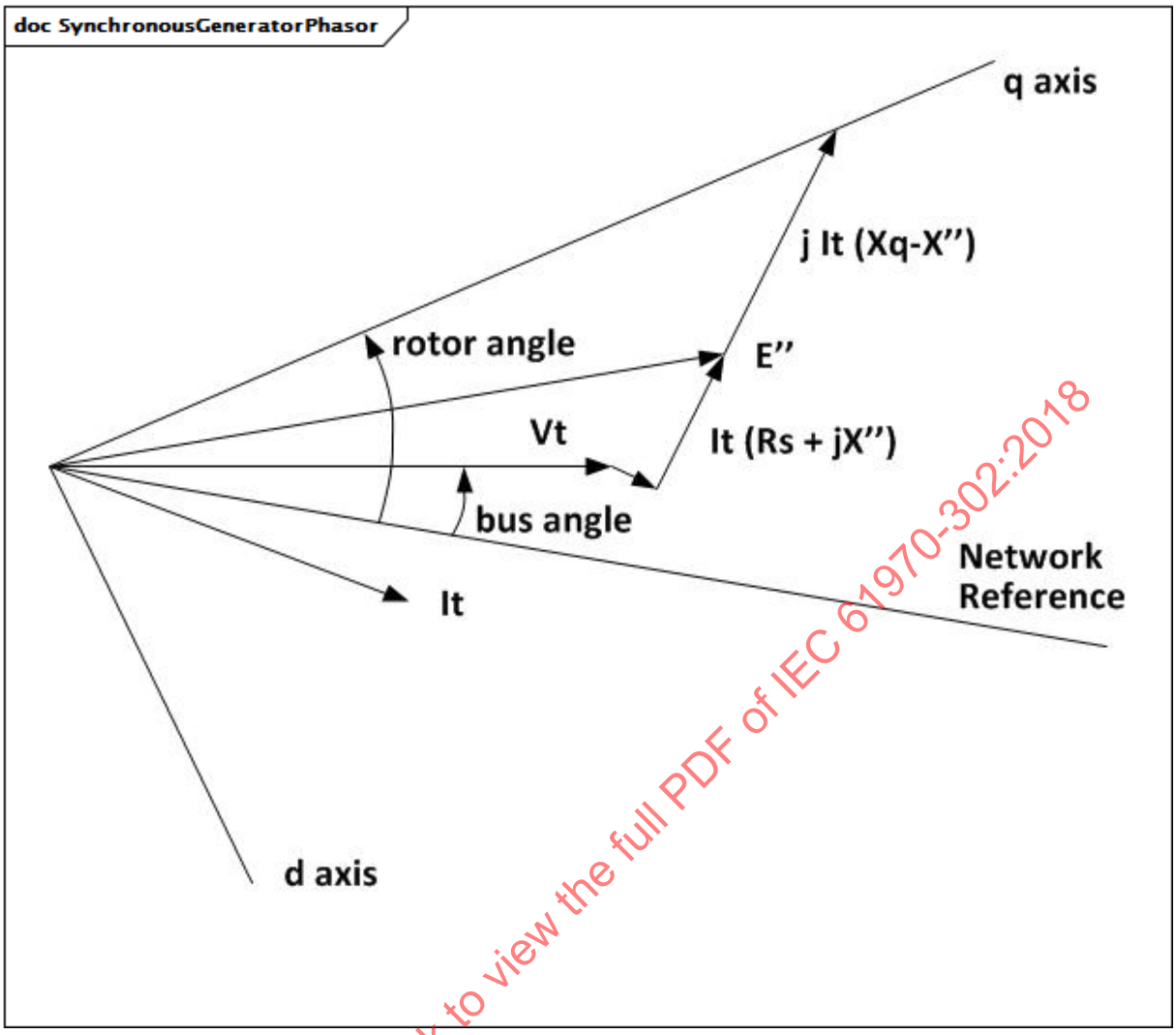

Anglais	Français
q axis	axe q
rotor angle	angle du rotor
bus angle	angle du bus
Network Reference	Référence du réseau
d axis	axe d

Figure 22 – SynchronousGeneratorPhasor

Figure 22: Détails sur les paramètres:

1) La définition des variables de l'axe d et de l'axe q s'appuie sur le diagramme SynchronousGeneratorPhasor (rotation dans le sens inverse des aiguilles d'une montre), dans le cas d'un générateur surexcité (générant la puissance réactive).

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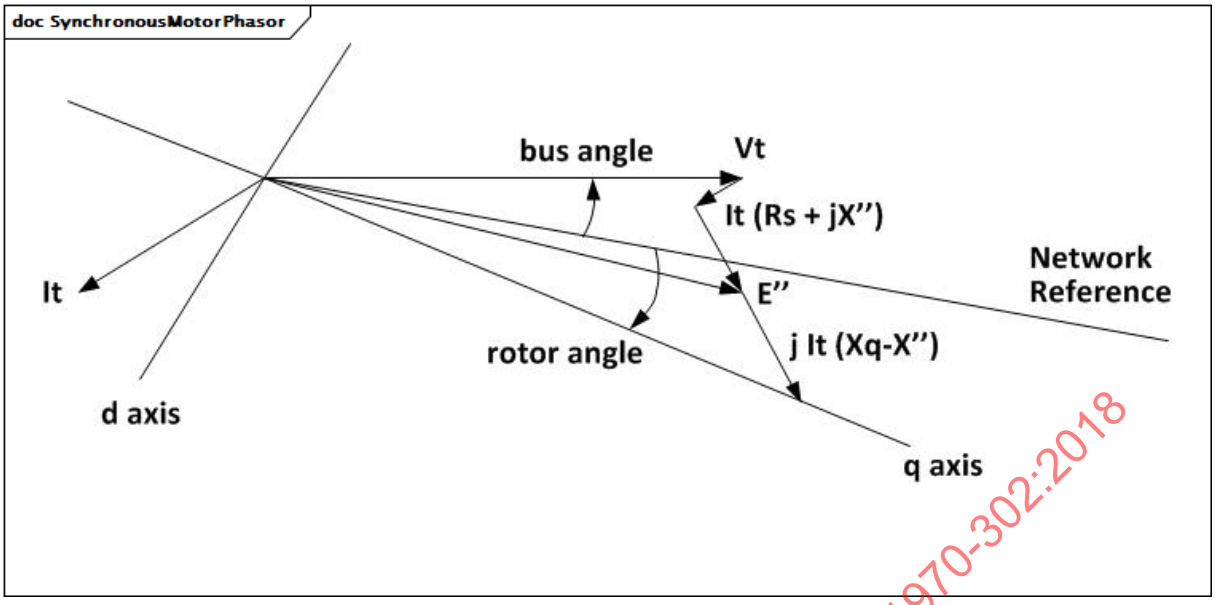

Anglais	Français
d axis	axe d
bus angle	angle du bus
rotor angle	angle du rotor
Network Reference	Référence du réseau
q axis	axe q

Figure 23 – SynchronousMotorPhasor

Figure 23: Détails sur les paramètres:

1) La définition des variables de l'axe d et de l'axe q s'appuie sur le diagramme SynchronousMotorPhasor (rotation dans le sens inverse des aiguilles d'une montre), dans le cas d'un moteur consommant la puissance active et surexcité (générant la puissance réactive).

5.3.4.2 SynchronousMachineDynamics

Une machine synchrone dont le comportement est décrit par référence à un modèle normalisé exprimé sous l'une des formes suivantes:

- simplifiée (ou classique), dans laquelle un groupe de générateurs ou de moteurs n'est pas modélisé en détail;
- détaillée, sous forme de circuit équivalent;
- détaillée, sous forme de réactance à constante de temps; ou
- par définition d'un modèle défini par l'utilisateur.

Lors des simulations dynamiques, il est de pratique commune de représenter les petits générateurs par une charge négative plutôt que par un modèle de générateur dynamique. Dans ce cas, un SynchronousMachine dans le modèle statique n'est pas représenté dans le modèle dynamique. Il est plutôt traité comme une charge ordinaire.

Détails sur les paramètres:

1) Les paramètres de machine synchrone (Xl, Xd, Xp, etc.) sont réellement utilisés comme des inductances dans les modèles, mais ils sont souvent appelés réactances car, à la fréquence nominale, les valeurs des PU sont les mêmes. Toutefois, certaines références utilisent le symbole L en lieu et place de X.

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Le Tableau 8 présente tous les attributs de SynchronousMachineDynamics.

Tableau 8 – Attributs de SynchronousMachineDynamics::SynchronousMachineDynamics

nom	mult	type	description
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 9 présente toutes les extrémités d'association de SynchronousMachineDynamics avec d'autres classes.

Tableau 9 – Extrémités d'association de SynchronousMachineDynamics::SynchronousMachineDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	Machine synchrone à laquelle s'applique le modèle dynamique de machine synchrone.
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	Modèle de régulateur de turbine associé à ce modèle de machine synchrone. La multiplicité supérieure à un est destinée à prendre en charge les unités hydrauliques qui ont plusieurs turbines sur un générateur.
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	Compensation du générateur de compensateur de variation de tension pour le courant circulant à l'extérieur de ce générateur.
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	Modèle de système d'excitation associé à ce modèle de machine synchrone.
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	Régulateur de turbine cross-compound auquel cette machine synchrone basse pression est associée.
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	Régulateur de turbine cross-compound auquel cette machine synchrone haute pression est associée.
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	Modèle de charge mécanique associé à ce modèle de machine synchrone.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.4.3 SynchronousMachineSimplified

Le modèle simplifié représente un générateur synchrone sous la forme d'une tension interne constante derrière une impédance (Rs + jXp) comme indiqué dans le diagramme simplifié.

La tension interne étant maintenue constante, il n'y a pas d'entrée Efd et le modèle de système d'excitation est ignoré. Il n'y a pas non plus de sortie Ifd.

Il convient de ne pas utiliser ce modèle pour représenter un véritable générateur sauf, peut-être, les petits générateurs dont la réponse est insignifiante.

Les paramètres utilisés pour le modèle simplifié incluent:

- RotatingMachineDynamics.damping (D);
- RotatingMachineDynamics.inertia (H);
- RotatingMachineDynamics.statorLeakageReactance (utilisé pour échanger jXp pour SynchronousMachineSimplified);
- RotatingMachineDynamics.statorResistance (Rs).

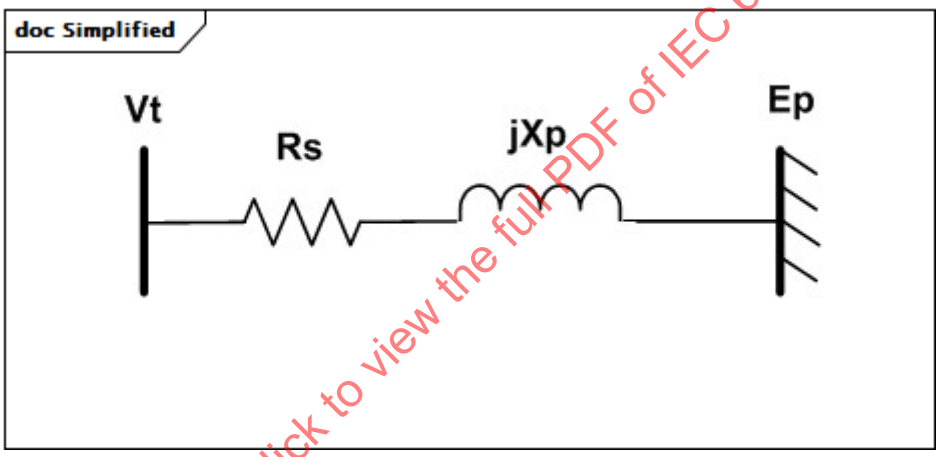

Figure 24 – Modèle simplifié

Figure 24: Ce diagramme décrit le modèle simplifié de générateur synchrone.

Détails sur les paramètres:

1) Le modèle est souvent utilisé pour les équivalents bruts des parties d'un système qui ne sont pas représentées en détail. Dans ce cas, la caractéristique assignée MVA est la caractéristique assignée combinée de tous les générateurs dans la zone d'équivalence.
2) Rs + jXp est l'impédance équivalente de court-circuit à l'emplacement du générateur équivalent sur la base de la caractéristique assignée MVA du générateur. Les valeurs de constante d'inertie (H) sont classiques ou moyennes pour les générateurs dans la zone d'équivalence.
3) La réactance interne (Xp) peut être étiquetée de différentes manières (X', X", X'd, X"d) et par différents outils de simulation.

Le Tableau 10 présente tous les attributs de SynchronousMachineSimplified.

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Tableau 10 – Attributs de SynchronousMachineDynamics::SynchronousMachineSimplified

nom	mult	type	description
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 11 présente toutes les extrémités d'association de SynchronousMachineSimplified avec d'autres classes.

Tableau 11 – Extrémités d'association de SynchronousMachineDynamics::SynchronousMachineSimplified avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	hérité de: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	hérité de: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.4.4 SynchronousMachineDetailed

Tous les types détaillés de machines synchrones utilisent un sous-ensemble des mêmes paramètres de données et variables d'entrée/de sortie.

Toutes les variations diffèrent de la manière suivante:

- le nombre d'enroulements équivalents qui sont inclus;
- la manière dont la saturation est intégrée dans le modèle;
- si le "relief subtransitoire" (X''q différent de X''d) est représenté.

Il n'est pas nécessaire que chaque outil de simulation dispose de modèles distincts pour chacun des types de modèles. Le même modèle peut souvent être utilisé pour plusieurs types par une logique alternative au sein du modèle. De même, les différences de représentation de la saturation peuvent ne pas se traduire par des différences significatives de performances du modèle, les substitutions de modèle étant donc souvent acceptables.

Le Tableau 12 présente tous les attributs de SynchronousMachineDetailed.

Tableau 12 – Attributs de SynchronousMachineDynamics::SynchronousMachineDetailed

nom	mult	type	description
efdBaseRatio	0..1	Float	Rapport (tension de l'excitatrice/tension du générateur) des bases Efd des modèles d'excitatrice et de générateur (> 0). Valeur classique = 1.
ifdBaseType	0..1	IfdBaseKind	Mode du système de base d'excitation. Il convient qu'il soit égal à la valeur de WLMDV donnée par l'utilisateur. WLMDV est le rapport en PU entre la tension de champ et le courant d'excitation: Efd = WLMDV x Ifd. Valeur classique = ifag.
saturationFactor120QAxis	0..1	Float	Facteur de saturation transversale à 120 % de la tension assignée aux bornes (S12q) (>= SynchonousMachineDetailed.saturationFactorQAxis). Valeur classique = 0,12.
saturationFactorQAxis	0..1	Float	Facteur de saturation transversale à la tension assignée aux bornes (S1q) (>= 0). Valeur classique = 0,02.
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 13 présente toutes les extrémités d'association de SynchronousMachineDetailed avec d'autres classes.

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Tableau 13 – Extrémités d'association de SynchronousMachineDynamics::SynchronousMachineDetailed avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	hérité de: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	hérité de: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.4.5 SynchronousMachineTimeConstantReactance

Les types détaillés de modélisation de la machine synchrone sont définis par la combinaison des attributs SynchronousMachineTimeConstantReactance.modelType et SynchronousMachineTimeConstantReactance.rotorType.

Détails sur les paramètres:

1) Le "p" des noms d'attribut liés au temps indique "prime" (principal) dans la notation habituelle des paramètres (par exemple, tpdo fait référence à T'do).
2) Les paramètres utilisés pour les modèles exprimés sous forme de réactance à constante de temps sont les suivants:
   - RotatingMachine.ratedS (MVAbase);
   - RotatingMachineDynamics.damping (D);
   - RotatingMachineDynamics.inertia (H);
   - RotatingMachineDynamics.saturationFactor (S1);
   - RotatingMachineDynamics.saturationFactor120 (S12);
   - RotatingMachineDynamics.statorLeakageReactance (Xl);
   - RotatingMachineDynamics.statorResistance (Rs);
   - SynchronousMachineTimeConstantReactance.ks (Ks);
   - SynchronousMachineDetailed.saturationFactorQAxis (S1q);
   - SynchronousMachineDetailed.saturationFactor120QAxis (S12q);
   - SynchronousMachineDetailed.efdBaseRatio;
   - SynchronousMachineDetailed.ifdBaseType;
   - .xDirectSync (Xd);
   - .xDirectTrans (X'd);
   - .xDirectSubtrans (X''d);
   - .xQuadSync (Xq);
   - .xQuadTrans (X'q);

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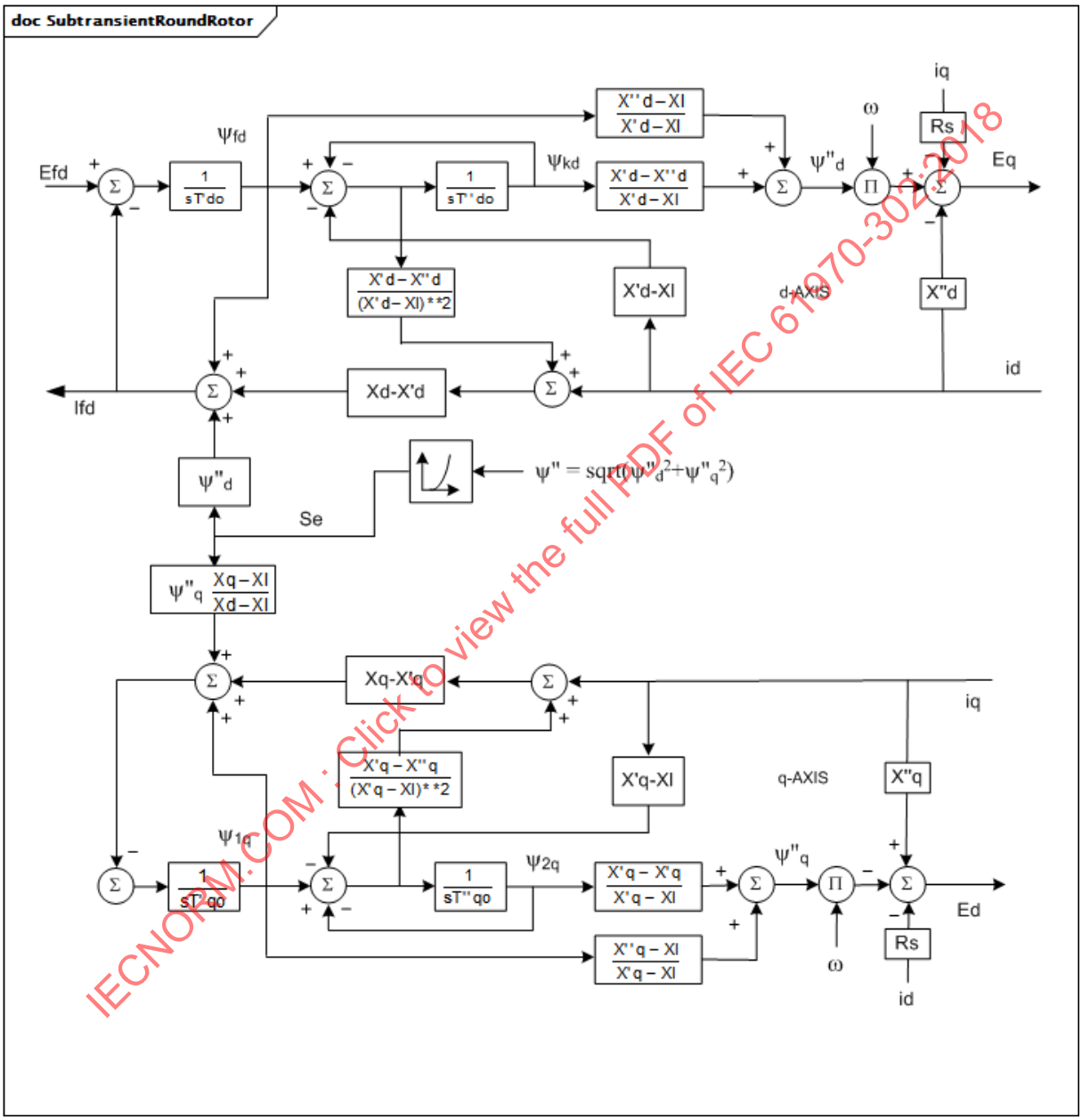
– .xQuadSubtrans (X''q);
– .tpdo (T'do);
– .tppdo (T''do);
– .tpqo (T'qo);
– .tppqo (T''qo);
– .tc.



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Anglais	Français
d-AXIS	AXE d
q-AXIS	AXE q

Figure 25 – SubtransientRoundRotor

Figure 25: Le type de rotor rond substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe

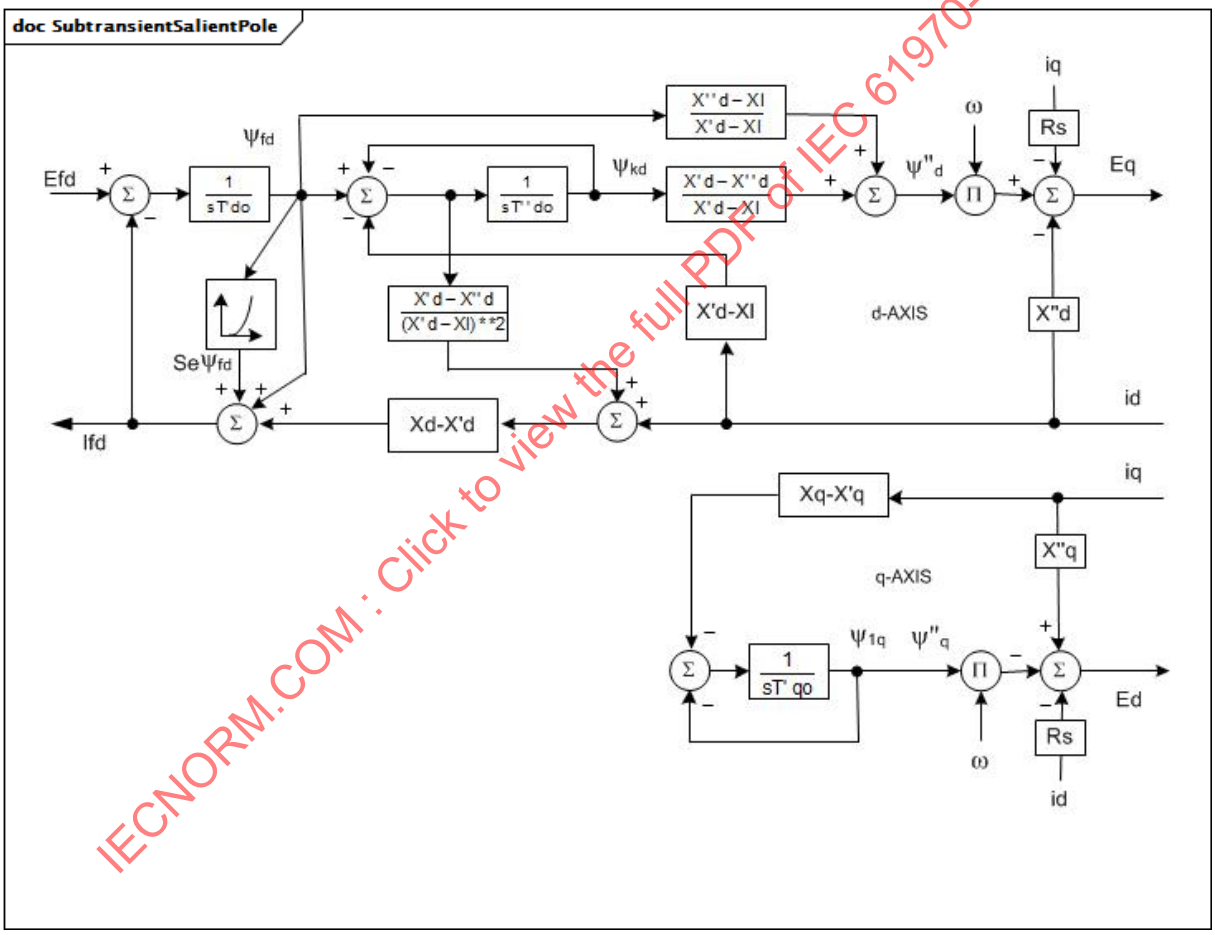
SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransient et .rotorType = roundRotor.

Le circuit équivalent complet est utilisé avec deux enroulements de rotor dans chaque axe.

Ifd représente LadIfd (XadIfd) et est une tension proportionnelle au courant de champ en PU (IEEE 421.5-2005, Annexe B). Il est égal à Efd en régime établi.

Détails sur les paramètres:

1) X''q peut par hypothèse être égal à X''d (pas de relief subtransitoire).
2) La saturation est modélisée sur l'axe longitudinal et sur l'axe transversal.
3) Pour les générateurs, les paramètres suivants peuvent être ignorés avec les valeurs par défaut indiquées: X''q (= X''d), Ks (= 0), S1q (= S1), S12q (= S12), Tc (= 0).
4) Pour les moteurs, le paramètre suivant n'est pas utilisé: X''q.



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Anglais	Français
d-AXIS	AXE d
q-AXIS	AXE q

Figure 26 – SubtransientSalientPole

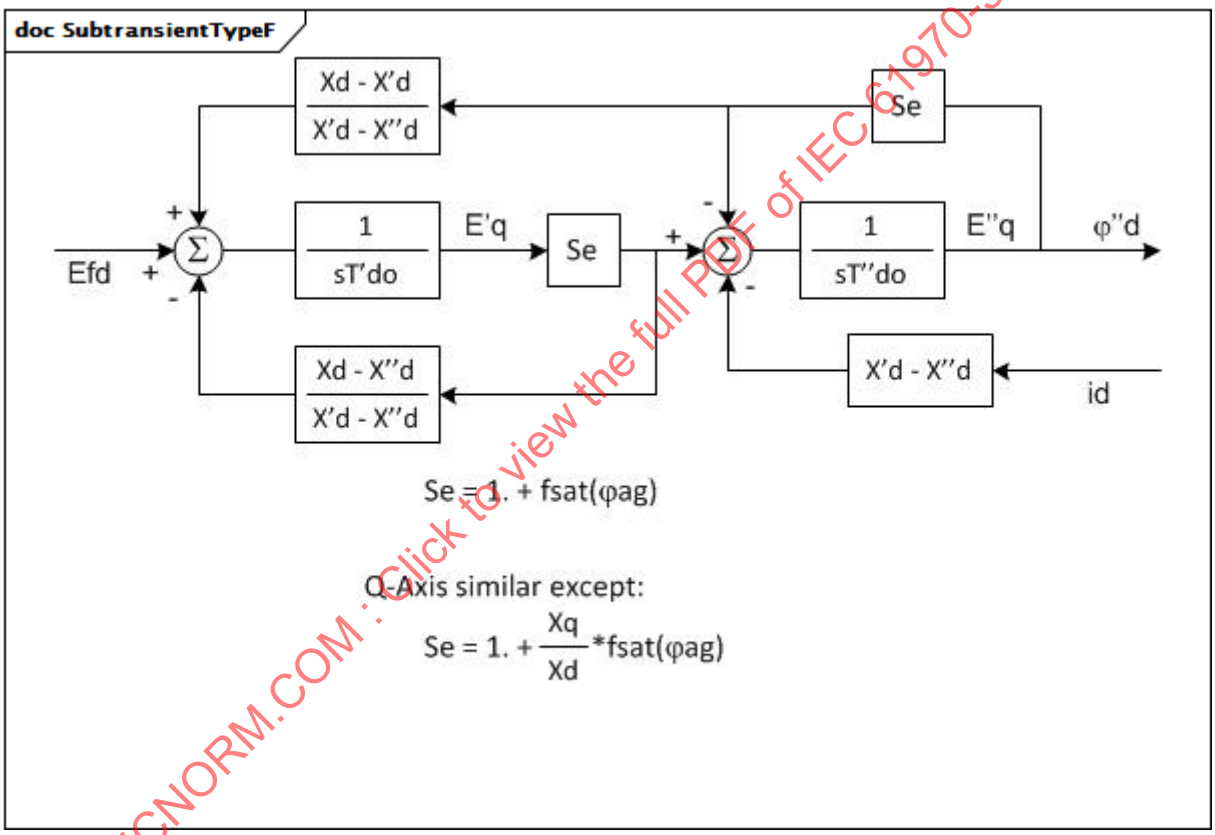
Figure 26: Le type de pôle saillant substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransient et .rotorKind = salientPole.

Le circuit équivalent de l'axe d est le même que celui du type de rotor rond subtransitoire. L'axe q ne comporte qu'un enroulement de rotor équivalent, qui peut être étiqueté comme étant transitoire (X'q) ou subtransitoire (X''q). X'q est utilisé pour la description CIM.

Ifd représente LadIfd (XadIfd) et est une tension proportionnelle au courant de champ en PU (IEEE 421.5-2005, Annexe B). Il est égal à Efd en régime établi.

Détails sur les paramètres:

1) X''q (=X'q) est par hypothèse égal à X''d (pas de relief subtransitoire).
2) La saturation est modélisée dans l'axe d uniquement.
3) Pour les générateurs, les paramètres d'entrée suivants peuvent être ignorés avec la valeur par défaut indiquée: X'q (=X''d), X''q (=X''d), T''qo, Ks (=0), S1q (=0), S12q (=0), Tc (=0).
4) Pour les moteurs, les paramètres d'entrée suivants ne sont pas utilisés: X'q, X''q, T''qo.



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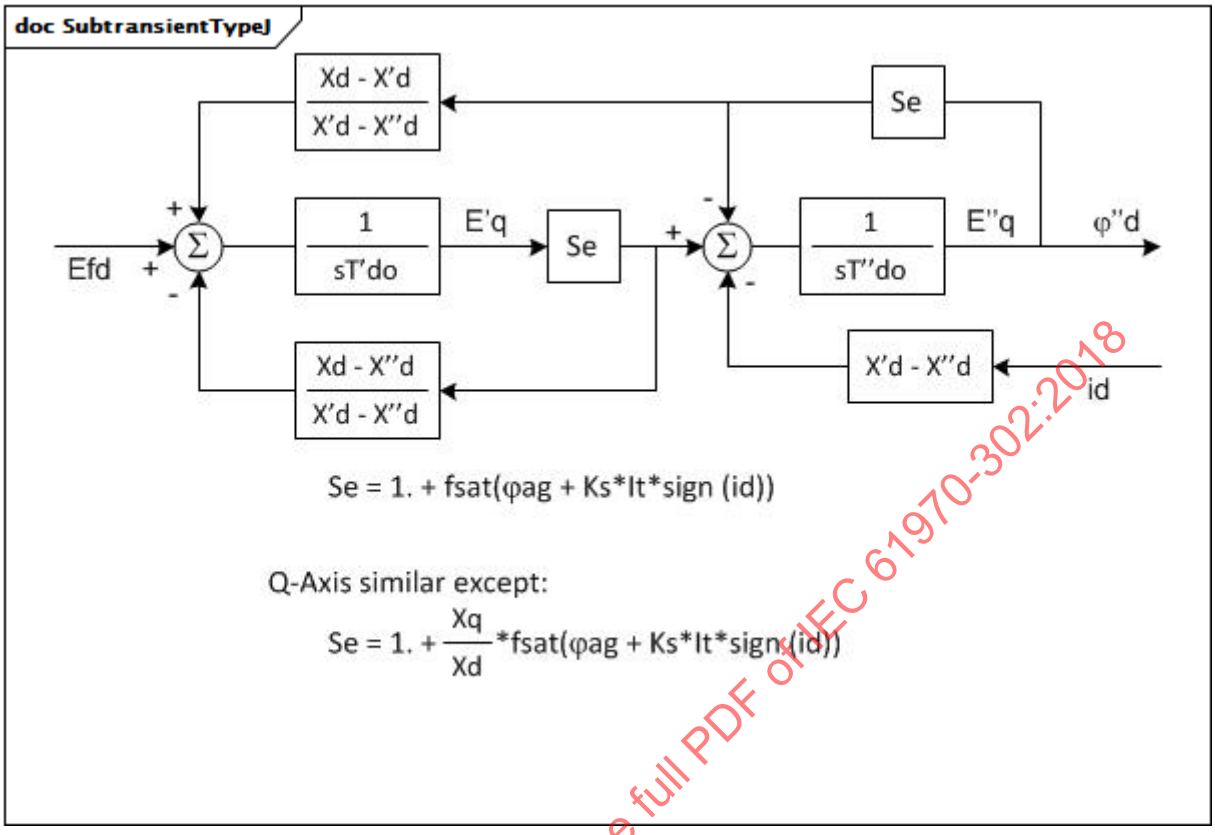
Anglais	Français
Q-Axis similar except:	Axe Q similaire, à l'exception de:

Figure 27 – SubtransientTypeF

Figure 27: Le type F de type substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransientTypeF.

Il s'agit du modèle F de type WECC avec modélisation de rotor à inductance uniforme. Les effets de la vitesse de l'arbre ne sont pas pris en compte. Son niveau de détail est similaire à celui du type de rotor rond subtransitoire, sauf qu'il permet un relief subtransitoire (X''q différent de X''d) et qu'il modélise la saturation différemment. Le type de rotor rond subtransitoire peut souvent être remplacé sans perte importante d'exactitude.

La saturation est modélisée sur l'axe longitudinal et sur l'axe transversal.



Anglais	Français
Q-Axis similar except:	Axe Q similaire, à l'exception de:

Figure 28 – SubtransientTypeJ

Figure 28: Le type J de type substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransientTypeJ.

Il s'agit du modèle J de type WECC avec modélisation de rotor des rapports d'inductance uniformes et modèle de saturation modifié. Les effets de la vitesse de l'arbre ne sont pas pris en compte. Ce modèle est le même que le type F subtransitoire, sauf qu'il inclut les effets de chargement du générateur sur la saturation. Avec le paramètre (Ks) de la constante de saturation, il permet de reproduire les "courbes V" mesurées sur toute la plage de puissances réactives, en particulier sur certaines machines hydrauliques (pôle saillant).

La saturation est modélisée sur l'axe longitudinal et sur l'axe transversal.

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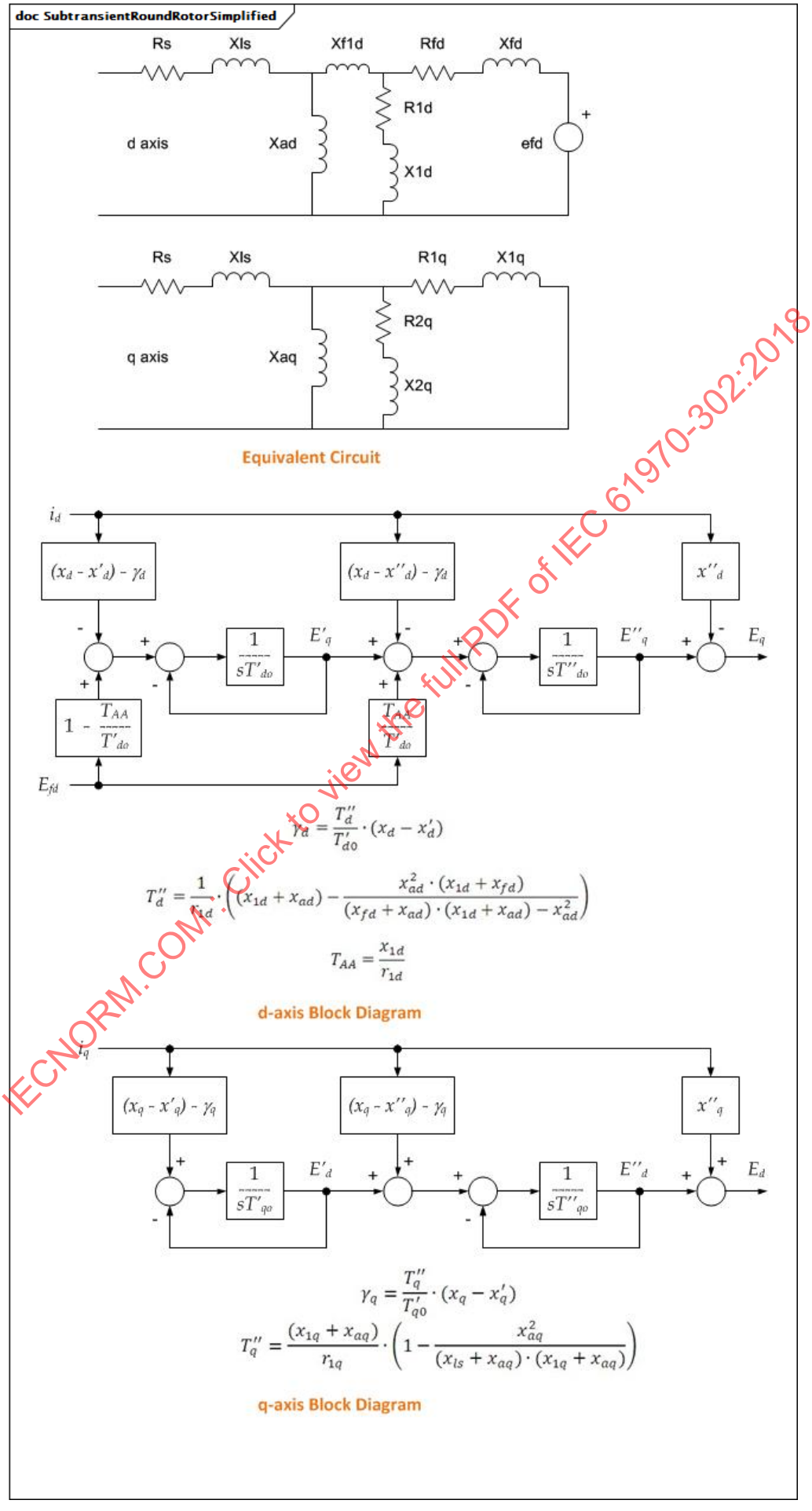

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Anglais	Français
Equivalent circuit	Circuit équivalent
d-axis Block Diagram	Diagramme de bloc de l'axe d
q-axis Block Diagram	Diagramme de bloc de l'axe q

Figure 29 – SubtransientRoundRotorSimplified

Figure 29: Le type simplifié de rotor rond substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransientSimplified et .rotorKind = roundRotor.

Il s'agit d'une version simplifiée du type de rotor rond subtransitoire, le couplage magnétique entre l'axe longitudinal et l'axe transversal étant ignoré.

Détails sur les paramètres:

1) Les effets de la variation de vitesse sont ignorés.
2) Pas de résistance d'induit.
3) Pas d'effet de saturation.
4) Pas de relief subtransitoire.
5) Axe longitudinal avec le circuit de champ et un circuit d'amortisseur équivalent, X'd différent de X''d.
6) Axe transversal avec deux circuits amortisseurs équivalents, X''q différent de X'q.
7) Pour les générateurs et les moteurs, les paramètres d'entrée suivants sont nécessaires: Xd, X'd, X''d, T'do, T''do et Xq, X'q, X''q, T'qo, T''qo.

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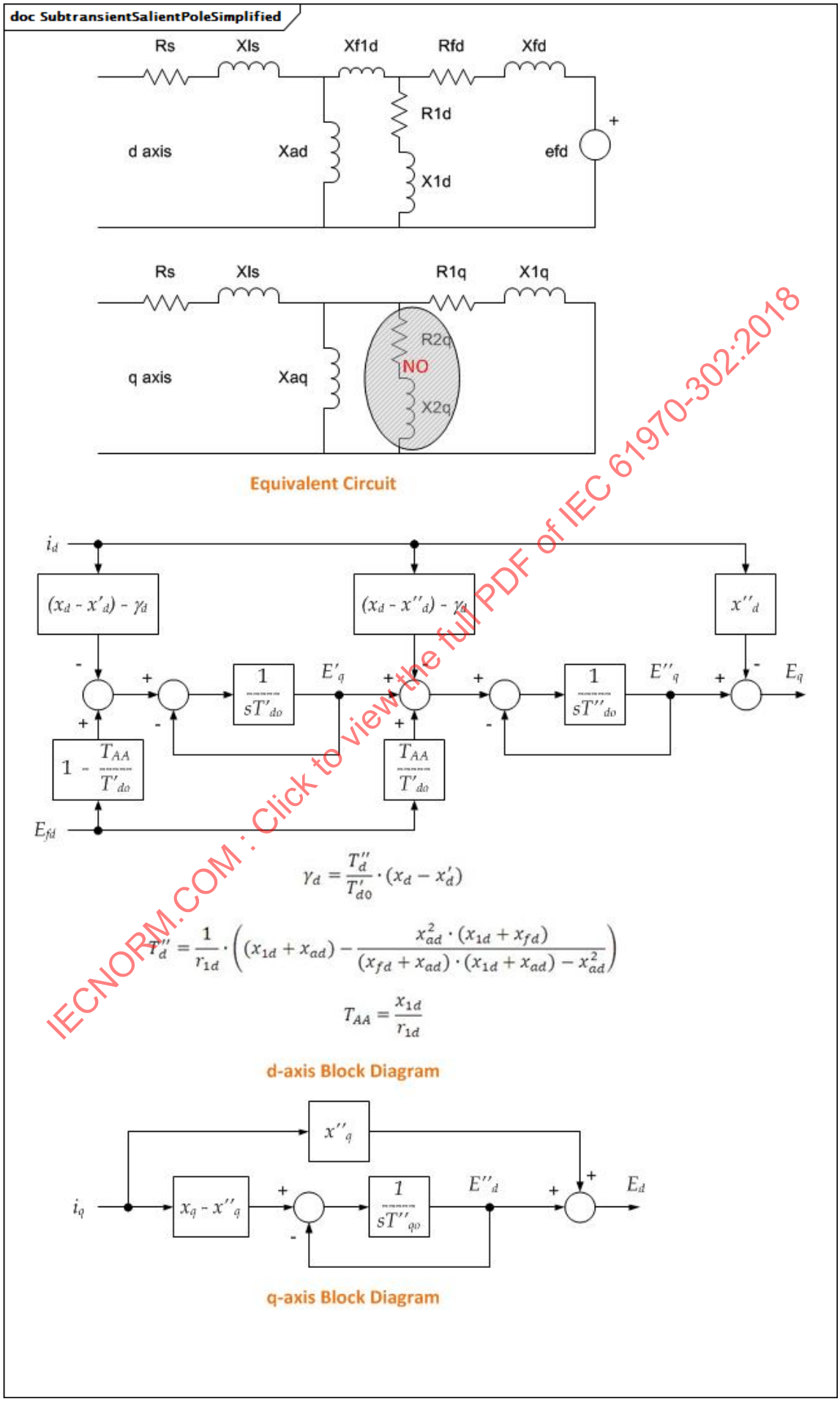

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Anglais	Français
Equivalent circuit	Circuit équivalent
d-axis Block Diagram	Diagramme de bloc de l'axe d
q-axis Block Diagram	Diagramme de bloc de l'axe q

Figure 30 – SubtransientSalientPoleSimplified

Figure 30: Le type simplifié de pôle saillant substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, .modelType = subtransientSimplified et .rotorKind = salientPole.

Il s'agit d'une version simplifiée de type de pôle saillant subtransitoire, le couplage magnétique entre l'axe longitudinal et l'axe transversal étant ignoré.

Détails sur les paramètres:

1) Les effets de la variation de vitesse sont ignorés.
2) Pas de résistance d'induit.
3) Pas d'effet de saturation.
4) Pas de relief subtransitoire.
5) Axe longitudinal avec le circuit de champ et un circuit d'amortisseur équivalent, X'd différent de X''d.
6) L'axe transversal avec un seul circuit amortisseur équivalent, étiqueté comme étant transitoire (X''q), X''q =X'q.
7) Pour les générateurs et les moteurs, les paramètres d'entrée suivants sont nécessaires: Xd, X'd, X''d, T'do, T''do et Xq, X''q, T''qo.

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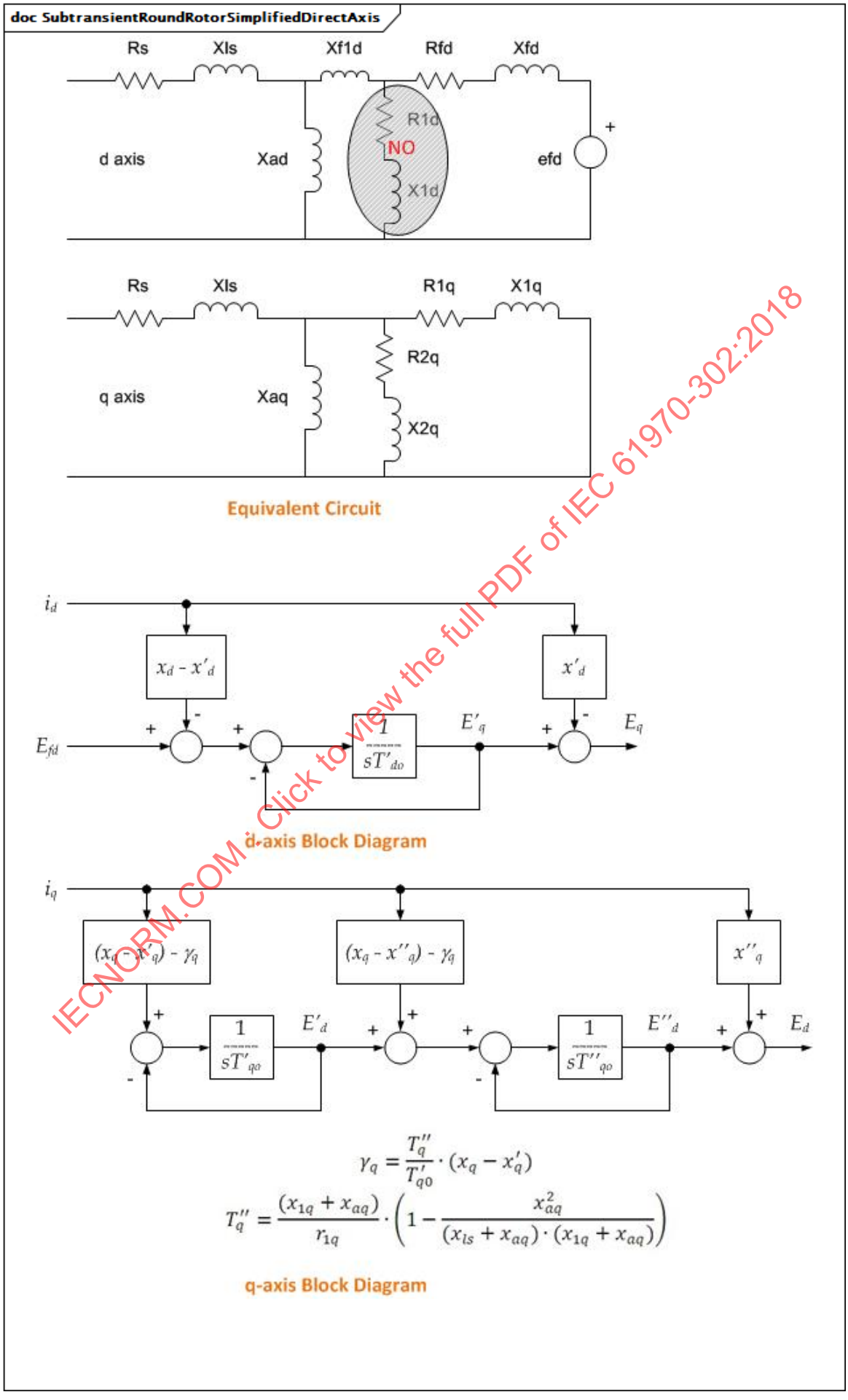

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Anglais	Français
Equivalent circuit	Circuit équivalent
d-axis Block Diagram	Diagramme de bloc de l'axe d
q-axis Block Diagram	Diagramme de bloc de l'axe q

Figure 31 – SubtransientRoundRotorSimplifiedDirectAxis

Figure 31: Le type d'axe longitudinal simplifié de rotor rond substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, modelType = subtransientSimplifiedDirectAxis et .rotorKind = roundRotor.

Il s'agit d'une version simplifiée d'un type de rotor rond subtransitoire sans circuit amortisseur sur l'axe d. Cette simplification contribue à réduire l'effort informatique en réduisant l'ordre du système d'équations différentielles. L'axe q comporte deux enroulements de rotor équivalents. Le couplage magnétique entre l'axe longitudinal et l'axe transversal est ignoré.

Détails sur les paramètres:

1) Les effets de la variation de vitesse sont ignorés.
2) Pas de résistance d'induit.
3) Pas d'effet de saturation.
4) Pas de relief subtransitoire.
5) Axe longitudinal avec circuit de champ uniquement, pas de circuit amortisseur équivalent. Approximation: X'd = X''d.
6) Axe transversal avec deux circuits amortisseurs équivalents, X''q différent de X'q.
7) Pour les générateurs et les moteurs, les paramètres d'entrée suivants sont nécessaires: Xd, X'd, T'do et Xq, X'q, X''q, T'qo, T''qo.

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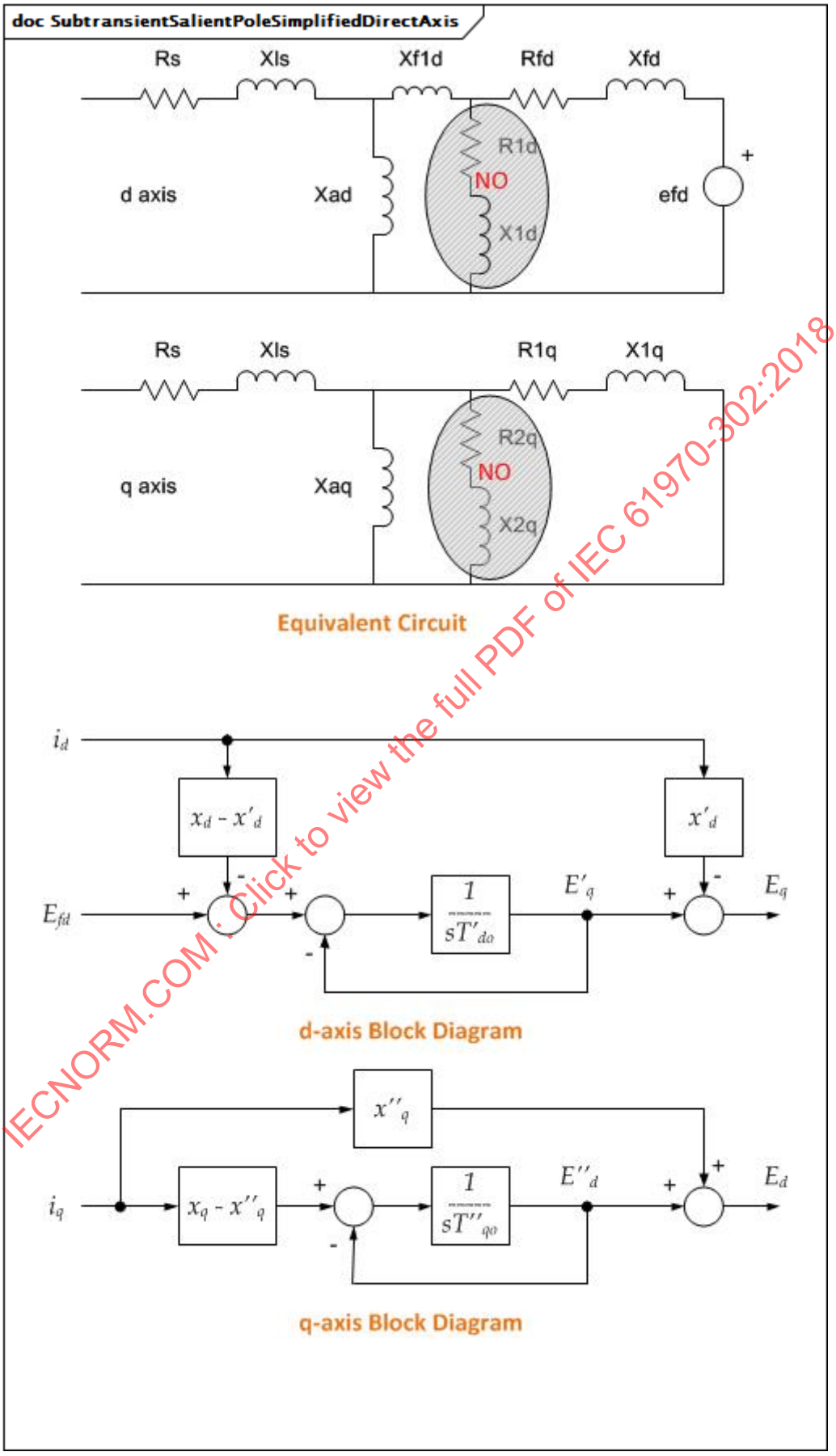

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Anglais	Français
Equivalent circuit	Circuit équivalent
d-axis Block Diagram	Diagramme de bloc de l'axe d
q-axis Block Diagram	Diagramme de bloc de l'axe q

Figure 32 – SubtransientSalientPoleSimplifiedDirectAxis

Figure 32: Le type d'axe longitudinal simplifié de pôle saillant substransitoire est modélisé grâce à l'une des classes enfants concrètes de la classe SynchronousMachineDetailed. Si la classe SynchronousMachineTimeConstantReactance est utilisée, modelType = subtransientSimplifiedDirectAxis et .rotorKind = salientPole. Il s'agit d'une version simplifiée d'un type de pôle saillant subtransitoire sans circuit amortisseur sur l'axe d. Cette simplification contribue à réduire l'effort informatique en réduisant l'ordre du système d'équations différentielles. L'axe q ne comporte qu'un seul enroulement de rotor équivalent. Le couplage magnétique entre l'axe longitudinal et l'axe transversal est ignoré.

Détails sur les paramètres:

1) Les effets de la variation de vitesse sont ignorés.
2) Pas de résistance d'induit.
3) Pas d'effet de saturation.
4) Pas de relief subtransitoire.
5) Axe longitudinal avec circuit de champ uniquement, pas de circuit amortisseur équivalent. Approximation: X'd = X''d.
6) Axe transversal avec un seul circuit amortisseur équivalent, étiqueté comme étant subtransitoire (X''q), X''q =X'q.
7) Pour les générateurs et les moteurs, les paramètres d'entrée suivants sont nécessaires: Xd, X'd, T'do et Xq, X''q, T''qo.

Le Tableau 14 présente tous les attributs de SynchronousMachineTimeConstantReactance.

Tableau 14 – Attributs de SynchronousMachineDynamics::SynchronousMachineTimeConstantReactance

nom	mult	type	description
rotorType	0..1	RotorKind	Type de rotor sur une machine physique.
modelType	0..1	SynchronousMachineModelKind	Type de modèle de machine synchrone utilisé dans des applications de simulation dynamique.
ks	0..1	Float	Facteur de correction de la charge de saturation (Ks) (>= 0). Utilisé uniquement par le modèle Type J. Valeur classique = 0.
xDirectSync	0..1	PU	Réactance synchrone longitudinale (Xd) (>= SynchronousMachineTimeConstantReactance.xDirectTrans). Quotient, pour une machine fonctionnant à une vitesse assignée, de la valeur permanente de la composante alternative de la tension d'induit, produit par le flux longitudinal dû au courant d'induit longitudinal et de la valeur de la composante alternative de ce courant. Valeur classique = 1,8.
xDirectTrans	0..1	PU	Réactance transitoire longitudinale (non saturée) (X'd) (>= SynchronousMachineTimeConstantReactance.xDirectSubtrans). Valeur classique = 0,5.
xDirectSubtrans	0..1	PU	Réactance subtransitoire longitudinale (non saturée) (X''d) (> RotatingMachineDynamics.statorLeakageReactance). Valeur classique = 0,2.

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nom	mult	type	description
xQuadSync	0..1	PU	Réactance synchrone transversale (Xq) (>= SynchronousMachineTimeConstantReactance.xQuadTrans). Rapport entre la composante de la tension réactive d'induit, due à la composante transversale du courant d'induit, et cette composante du courant, dans les conditions de régime établi et à la fréquence assignée. Valeur classique = 1,6.
xQuadTrans	0..1	PU	Réactance transitoire transversale (X'q) (>= SynchronousMachineTimeConstantReactance.xQuadSubtrans). Valeur classique = 0,3.
xQuadSubtrans	0..1	PU	Réactance subtransitoire transversale (X''q) (> RotatingMachineDynamics.statorLeakageReactance). Valeur classique = 0,2.
tpdo	0..1	Seconds	Constante de temps longitudinale transitoire du rotor (T'do) (> SynchronousMachineTimeConstantReactance.tppdo). Valeur classique = 5.
tppdo	0..1	Seconds	Constante de temps longitudinale subtransitoire du rotor (T''do) (> 0). Valeur classique = 0,03.
tpqo	0..1	Seconds	Constante de temps transversale transitoire du rotor (T'qo) (> SynchronousMachineTimeConstantReactance.tppqo). Valeur classique = 0,5.
tppqo	0..1	Seconds	Constante de temps transversale subtransitoire du rotor (T''do) (> 0) Valeur classique = 0,03.
tc	0..1	Seconds	Constante de temps d'amortissement pour la réactance "Canay" (>= 0). Valeur classique = 0.
efdBaseRatio	0..1	Float	hérité de: SynchronousMachineDetailed
ifdBaseType	0..1	IfdBaseKind	hérité de: SynchronousMachineDetailed
saturationFactor120QAxis	0..1	Float	hérité de: SynchronousMachineDetailed
saturationFactorQAxis	0..1	Float	hérité de: SynchronousMachineDetailed
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 15 présente toutes les extrémités d'association de SynchronousMachineTimeConstantReactance avec d'autres classes.

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Tableau 15 – Extrémités d'association de SynchronousMachineDynamics::SynchronousMachineTimeConstantReactance avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	hérité de: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	hérité de: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.4.6 SynchronousMachineEquivalentCircuit

Les équations électriques pour toutes les variations des modèles synchrones reposent sur le diagramme SynchronousEquivalentCircuit pour l'axe longitudinal et l'axe transversal.

Les équations de conversion entre le circuit équivalent et la réactance à constante de temps sont les suivantes:

Xd = Xad + Xl

X'd = Xl + Xad x Xfd / (Xad + Xfd)

X"d = Xl + Xad x Xfd x X1d / (Xad x Xfd + Xad x X1d + Xfd x X1d)

Xq = Xaq + Xl

X'q = Xl + Xaq x X1q / (Xaq + X1q)

X"q = Xl + Xaq x X1q x X2q / (Xaq x X1q + Xaq x X2q + X1q x X2q)

T'do = (Xad + Xfd) / (omega0 x Rfd)

T"do = (Xad x Xfd + Xad x X1d + Xfd x X1d) / (omega0 x R1d x (Xad + Xfd)

T'qo = (Xaq + X1q) / (omega0 x R1q)

T"qo = (Xaq x X1q + Xaq x X2q + X1q x X2q) / (omega0 x R2q x (Xaq + X1q)

Mêmes équations utilisant les attributs CIM de la classe SynchronousMachineTimeConstantReactance à gauche du signe égal (=) et la classe SynchronousMachineEquivalentCircuit à sa droite (sauf comme indiqué):

xDirectSync = xad + RotatingMachineDynamics.statorLeakageReactance

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xDirectTrans = RotatingMachineDynamics.statorLeakageReactance + xad x xfd / (xad + xfd)

xDirectSubtrans = RotatingMachineDynamics.statorLeakageReactance + xad x xfd x x1d / (xad x xfd + xad x x1d + xfd x x1d)

xQuadSync = xaq + RotatingMachineDynamics.statorLeakageReactance

xQuadTrans = RotatingMachineDynamics.statorLeakageReactance + xaq x x1q / (xaq+ x1q)

xQuadSubtrans = RotatingMachineDynamics.statorLeakageReactance + xaq x x1q x x2q / (xaq x x1q + xaq x x2q + x1q x x2q)

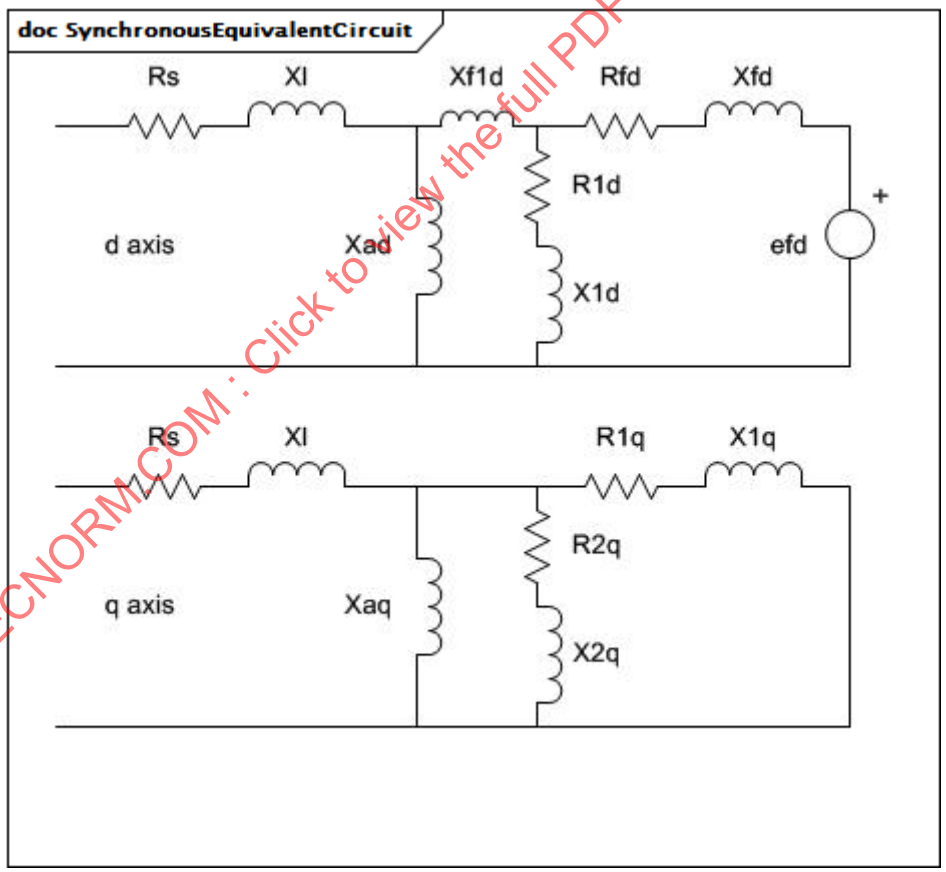
tpdo = (xad + xfd) / (2 x pi x fréquence nominale x rfd)

tppdo = (xad x xfd + xad x x1d + xfd x x1d) / (2 x pi x fréquence nominale x r1d x (xad + xfd)

tpqo = (xaq + x1q) / (2 x pi x fréquence nominale x r1q)

tppqo = (xaq x x1q + xaq x x2q + x1q x x2q) / (2 x pi x fréquence nominale x r2q x (xaq + x1q)

Ne sont valides que pour un modèle simplifié, dans lequel la réactance "Canay" est nulle.



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Anglais	Français
d axis	axe d
q axis	axe q

Figure 33 – SynchronousEquivalentCircuit

Figure 33: Dans chaque axe, les branches représentent la réactance (Xl) et la résistance (Rs) de fuite du stator, la réactance magnétisante (Xad, Xaq), l'enroulement de champ physique (Rfd, Xfd) sur le rotor et les enroulements équivalents pour le flux de courant de Foucault dans le fer du rotor.

Le Tableau 16 présente tous les attributs de SynchronousMachineEquivalentCircuit.

Tableau 16 – Attributs de SynchronousMachineDynamics:: SynchronousMachineEquivalentCircuit

nom	mult	type	description
xad	0..1	PU	Réactance mutuelle sur l'axe longitudinal.
rfd	0..1	PU	Résistance de l'enroulement de champ.
xfd	0..1	PU	Réctance de fuite de l'enroulement de champ.
r1d	0..1	PU	Résistance de l'enroulement amortisseur 1 sur l'axe longitudinal.
x1d	0..1	PU	Réactance de fuite de l'enroulement amortisseur 1 sur l'axe longitudinal.
xf1d	0..1	PU	Réactance mutuelle différentielle ("Canay").
xaq	0..1	PU	Réactance mutuelle sur l'axe transversal.
r1q	0..1	PU	Résistance de l'enroulement amortisseur 1 sur l'axe transversal.
x1q	0..1	PU	Réactance de fuite de l'enroulement amortisseur 1 sur l'axe transversal.
r2q	0..1	PU	Résistance de l'enroulement amortisseur 2 sur l'axe transversal.
x2q	0..1	PU	Réactance de fuite de l'enroulement amortisseur 2 sur l'axe transversal.
efdBaseRatio	0..1	Float	hérité de: SynchronousMachineDetailed
ifdBaseType	0..1	IfdBaseKind	hérité de: SynchronousMachineDetailed
saturationFactor120QAxis	0..1	Float	hérité de: SynchronousMachineDetailed
saturationFactorQAxis	0..1	Float	hérité de: SynchronousMachineDetailed
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 17 présente toutes les extrémités d'association de SynchronousMachineEquivalentCircuit avec d'autres classes.

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Tableau 17 – Extrémités d'association de SynchronousMachineDynamics:: SynchronousMachineEquivalentCircuit avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine	1..1	SynchronousMachine	hérité de: SynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..*	TurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	GenICompensationForGenJ	0..*	GenICompensationForGenJ	hérité de: SynchronousMachineDynamics
1..1	ExcitationSystemDynamics	0..1	ExcitationSystemDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
1..1	CrossCompoundTurbineGovernorDynamics	0..1	CrossCompoundTurbineGovernorDynamics	hérité de: SynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: SynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.4.7 Énumération IfdBaseKind

Mode du système de base d'excitation.

Le Tableau 18 présente tous les libellés d'IfdBaseKind.

Tableau 18 – Libellés de SynchronousMachineDynamics::IfdBaseKind

libellé	valeur	description
ifag		Mode ligne d'entrefer.
ifnl		Pas de système de charge avec mode de saturation.
iffl		Mode de système pleine charge.

5.3.4.8 Énumération SynchronousMachineModelKind

Type de modèle de machine synchrone utilisé dans des applications de simulation dynamique.

Le Tableau 19 présente tous les libellés de SynchronousMachineModelKind.

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Tableau 19 – Libellés de SynchronousMachineDynamics::SynchronousMachineModelKind

libellé	valeur	description
subtransient		Modèle de machine synchrone subtransitoire.
subtransientTypeF		Variante de type F WECC du modèle de machine synchrone subtransitoire.
subtransientTypeJ		Variante de type J WECC du modèle de machine synchrone subtransitoire.
subtransientSimplified		Version simplifiée du modèle de machine synchrone subtransitoire, dont le couplage magnétique entre l'axe longitudinal et l'axe transversal est ignoré.
subtransientSimplifiedDirectAxis		Version simplifiée d'un modèle de machine synchrone subtransitoire sans circuit amortisseur sur l'axe longitudinal.

5.3.4.9 Énumération RotorKind

Type de rotor sur une machine physique.

Le Tableau 20 présente tous les libellés de RotorKind.

Tableau 20 – Libellés de SynchronousMachineDynamics::RotorKind

libellé	valeur	description
roundRotor		Type de rotor rond de la machine synchrone.
salientPole		Type de pôle saillant de la machine synchrone.

5.3.5 Paquetage AsynchronousMachineDynamics

5.3.5.1 Généralités

Un modèle de machine asynchrone représente un générateur ou un moteur (à induction) sans connexion externe aux enroulements du rotor (une machine à induction à cage d'écureuil, par exemple).

L'interconnexion avec les équations du réseau électrique peut différer selon les outils de simulation. Le programme a simplement besoin de savoir à quelle borne est connectée cette machine asynchrone afin d'établir l'interconnexion correcte. L'interconnexion avec l'équipement du moteur peut également différer en raison des signaux d'entrée et de sortie exigés par les modèles normalisés.

Le modèle de machine asynchrone est utilisé pour modéliser les aérogénérateurs de type 1 et de type 2. La pratique normale consiste à inclure les transitoires de flux du rotor et à ignorer les transitoires de flux du stator.

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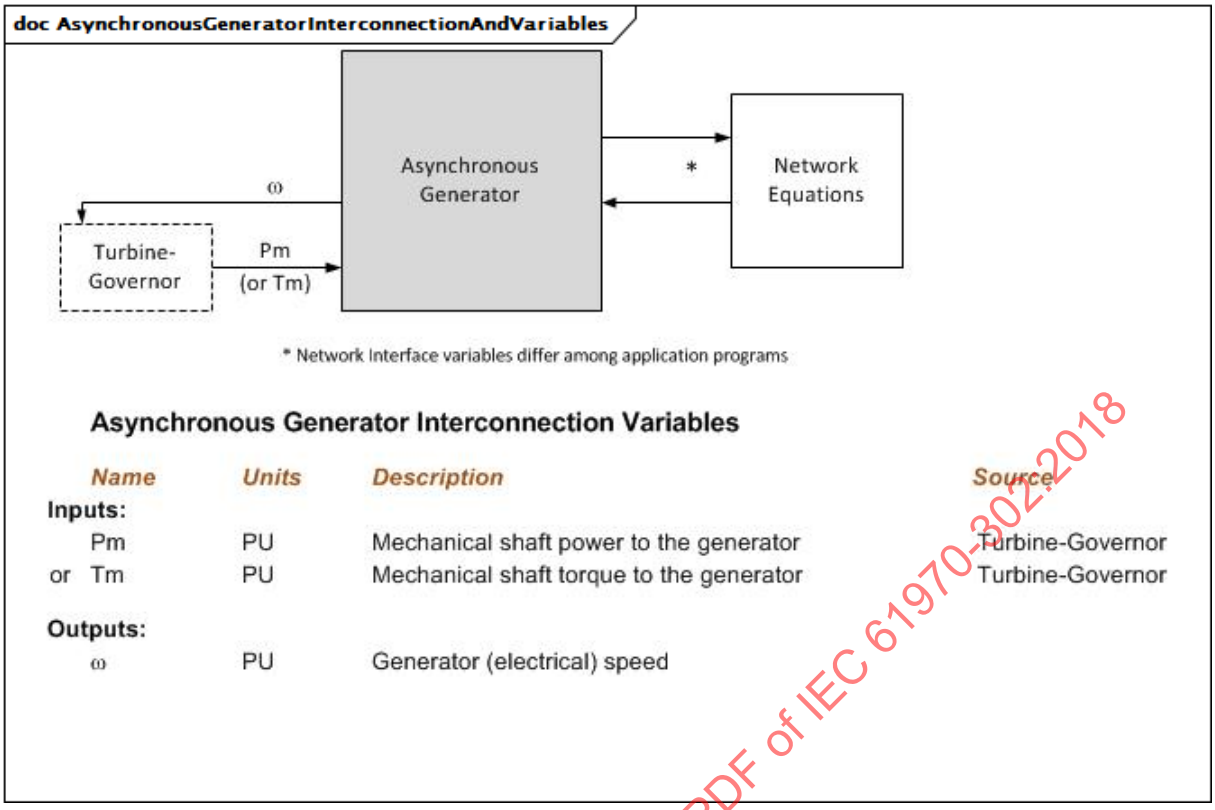

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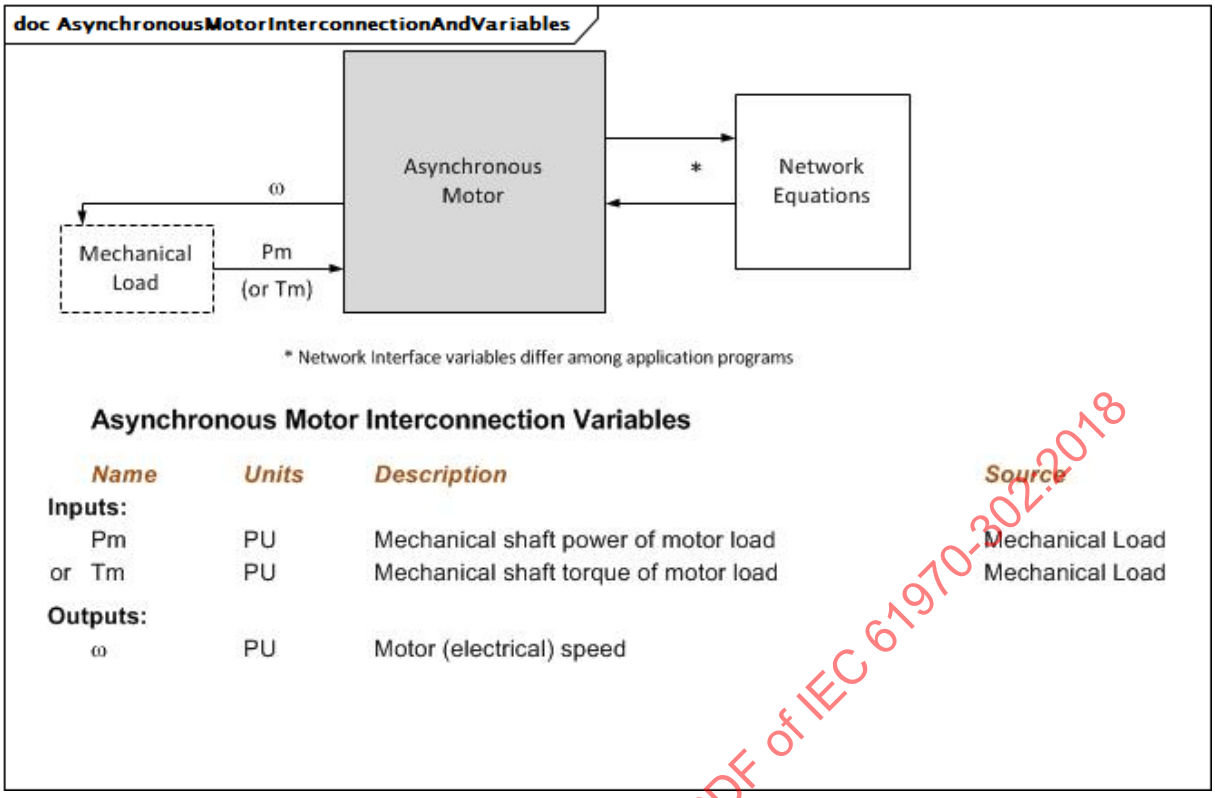
Anglais	Français
Turbine-Governor	Régulateur de turbine
Asynchronous generator	Générateur asynchrone
Network Equations	Équations du réseau
*Network interface variables differ among application programs	*Les variables d'interface de réseau diffèrent selon les programmes d'application
Asynchronous Generator Interconnection variables	Variables d'interconnexion de générateur asynchrone
Name	Nom
Units	Unités
Inputs	Entrées
Pm or Tm	Pm ou Tm
Outputs	Sorties
Mechanical shaft power to the generator	Puissance à l'arbre mécanique vers le générateur
Mechanical shaft torque to the generator	Couple de l'arbre mécanique vers le générateur
Generator (electrical) speed	Vitesse (électrique) du générateur

Figure 34 – AsynchronousGeneratorInterconnectionAndVariables

Figure 34: Ce diagramme représente les entrées et sorties d'un générateur asynchrone.



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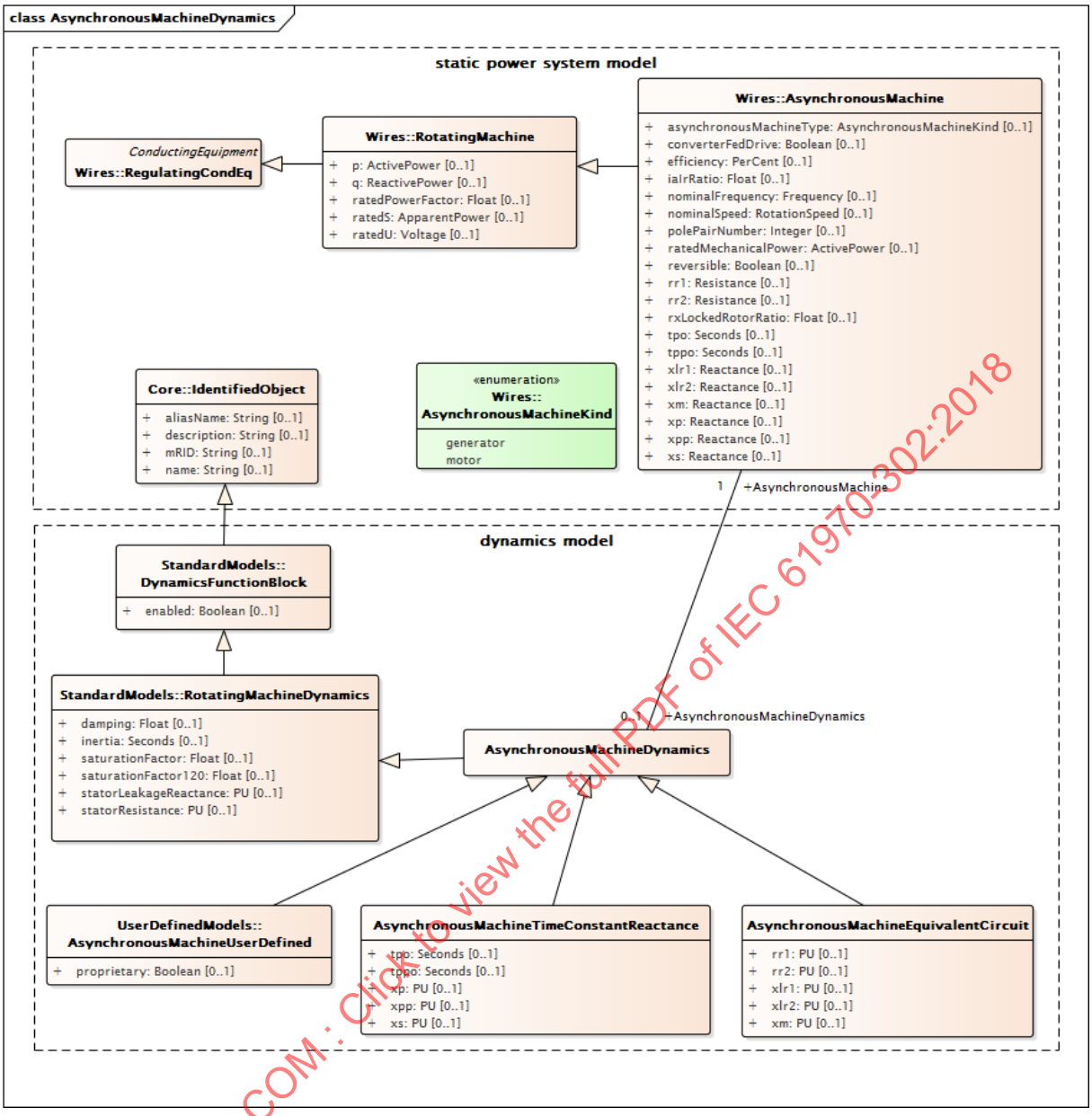
Anglais	Français
Mechanical load	Charge mécanique
Asynchronous motor	Moteur asynchrone
Network Equations	Équations du réseau
*Network interface variables differ among application programs	*Les variables d'interface de réseau diffèrent selon les programmes d'application
Asynchronous Motor Interconnection variables	Variables d'interconnexion de moteur asynchrone
Name	Nom
Units	Unités
Inputs	Entrées
Pm or Tm	Pm ou Tm
Outputs	Sorties
Mechanical shaft power of motor load	Puissance à l'arbre mécanique de la charge du moteur
Mechanical shaft torque of motor load	Couple de l'arbre mécanique de la charge du moteur
Motor (electrical) speed	Vitesse (électrique) du moteur

Figure 35 – AsynchronousMotorInterconnectionAndVariables

Figure 35: Ce diagramme représente les entrées et sorties d'un moteur asynchrone.



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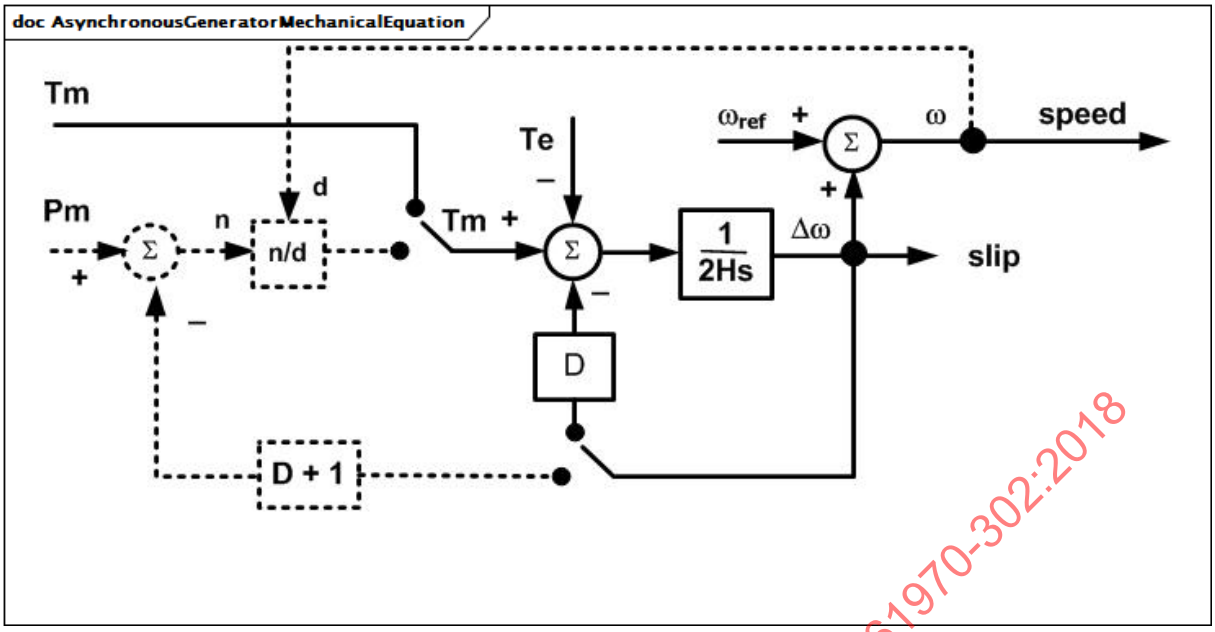
Anglais	Français
static power system model	modèle de système de puissance statique
dynamics model	modèle dynamique

Figure 36 – Diagramme de classe AsynchronousMachineDynamics::AsynchronousMachineDynamics

Figure 36: Ce diagramme représente les classes de modèle de système de puissance statique et les classes de modèle dynamique liées au modèle dynamique de machine asynchrone. Une association entre la classe AsynchronousMachineDynamics et la classe AsynchronousMachine offre un moyen de relier le modèle dynamique au modèle statique.



Anglais	Français
speed	vitesse
slip	glissement

Figure 37 – AsynchronousGeneratorMechanicalEquation

Figure 37: Les équations mécaniques relatives à toutes les variations du modèle de générateur asynchrone sont les mêmes et peuvent être représentées par le diagramme de bloc AsynchronousGeneratorMechanicalEquation.

Détails sur les paramètres:

1) Toutes les variables sont des PU sur la base du MVA du moteur, sauf l'angle, qui est exprimé en radians.
2) omega0 est la fréquence synchrone du système en radians par s. omegaref est la fréquence du système en PU (ou fréquence de zone isolée), qui peut être constante à la fréquence initiale ou varier lors d'une simulation en fonction du programme d'application.

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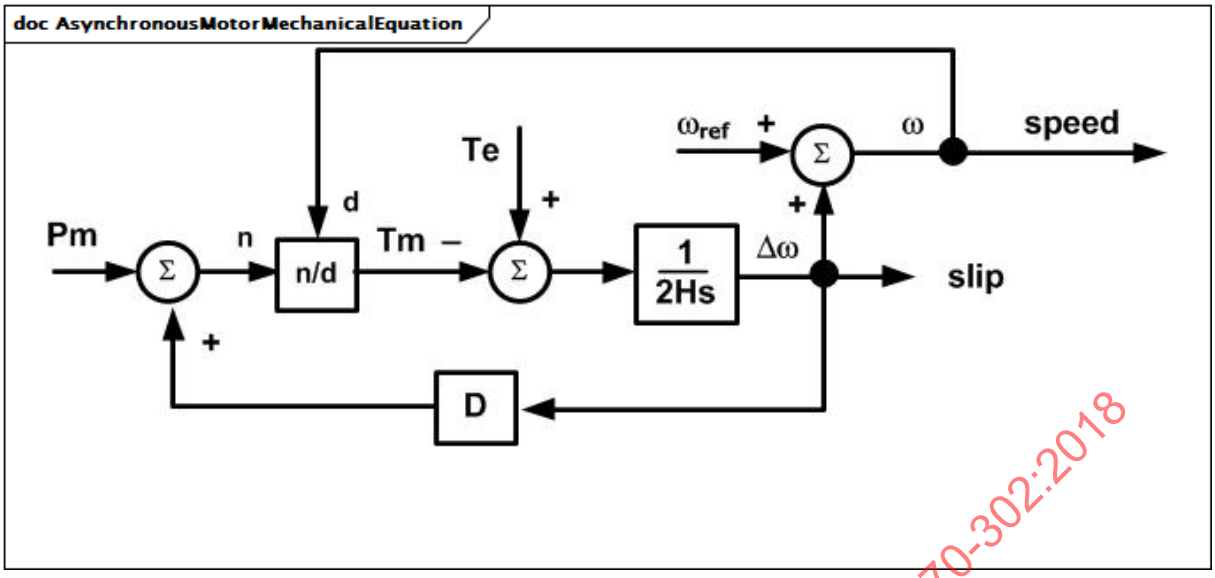

Anglais	Français
speed	vitesse
slip	glissement

Figure 38 – AsynchronousMotorMechanicalEquation

Figure 38: Les équations mécaniques relatives à toutes les variations du modèle de moteur asynchrone sont les mêmes et peuvent être représentées par le diagramme de bloc AsynchronousMotorMechanicalEquation.

Détails sur les paramètres:

1) Toutes les variables sont des PU sur la base du MVA du moteur, sauf l'angle, qui est exprimé en radians.
2) omega0 est la fréquence synchrone du système en radians par s. omegaref est la fréquence du système en PU (ou fréquence de zone isolée), qui peut être constante à la fréquence initiale ou varier lors d'une simulation en fonction du programme d'application.

5.3.5.2 AsynchronousMachineDynamics

Machine asynchrone dont le comportement est décrit par référence au modèle normalisé exprimé sous la forme d'une réactance à constante de temps, sous la forme d'un circuit équivalent ou par définition d'un modèle défini par l'utilisateur.

Détails sur les paramètres:

1) Les paramètres de machine asynchrone (Xl, Xs, etc.) sont réellement utilisés comme des inductances (L) dans le modèle, mais ils sont souvent appelés réactances car, à la fréquence nominale, les valeurs des PU sont les mêmes. Toutefois, certaines références utilisent le symbole L en lieu et place de X.

Le Tableau 21 présente tous les attributs d'AsynchronousMachineDynamics.

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Tableau 21 – Attributs d'AsynchronousMachineDynamics::AsynchronousMachineDynamics

nom	mult	type	description
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 22 présente toutes les extrémités d'association d'AsynchronousMachineDynamics avec d'autres classes.

Tableau 22 – Extrémités d'association d'AsynchronousMachineDynamics::AsynchronousMachineDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	Machine asynchrone à laquelle s'applique ce modèle dynamique de machine asynchrone.
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	Modèle de régulateur de turbine associé à ce modèle de machine asynchrone.
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	Modèle de charge mécanique associé à ce modèle de machine asynchrone.
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	Modèle d'aérogénérateur de type 1 ou de type 2 associé à ce modèle de machine asynchrone.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.5.3 AsynchronousMachineTimeConstantReactance

Détails sur les paramètres:

1) Si X'' = X', une seule cage (un enroulement de rotor équivalent par axe) est modélisée.
2) Le "p" des noms d'attribut indique "prime" (principal) dans la notation habituelle des paramètres (par exemple, tpo fait référence à T'o).

Les paramètres utilisés pour les modèles exprimés sous forme de réactance à constante de temps sont les suivants:

- RotatingMachine.ratedS (MVAbase);
- RotatingMachineDynamics.damping (D);
- RotatingMachineDynamics.inertia (H);
- RotatingMachineDynamics.saturationFactor (S1);
- RotatingMachineDynamics.saturationFactor120 (S12);
- RotatingMachineDynamics.statorLeakageReactance (Xl);

- RotatingMachineDynamics.statorResistance (Rs);
- .xs (Xs);
- .xp (X');
- .xpp (X'');
- .tpo (T'o);
- .tppo (T''o).

Le Tableau 23 présente tous les attributs d'AsynchronousMachineTimeConstantReactance.

Tableau 23 – Attributs d'AsynchronousMachineDynamics::AsynchronousMachineTimeConstantReactance

nom	mult	type	description
xs	0..1	PU	Réactance synchrone (Xs) (>= AsynchronousMachineTimeConstantReactance.xp). Valeur classique = 1,8.
xp	0..1	PU	Réactance transitoire (non saturée) (X') (>= AsynchronousMachineTimeConstantReactance.xpp). Valeur classique = 0,5.
xpp	0..1	PU	Réactance subtransitoire (non saturée) (X'') (> RotatingMachineDynamics.statorLeakageReactance). Valeur classique = 0,2.
tpo	0..1	Seconds	Constante de temps transitoire du rotor (T'o) (> AsynchronousMachineTimeConstantReactance.tppo). Valeur classique = 5.
tppo	0..1	Seconds	Constante de temps subtransitoire du rotor (T''o) (> 0) Valeur classique = 0,03.
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 24 présente toutes les extrémités d'association d'AsynchronousMachineTimeConstantReactance avec d'autres classes.

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Tableau 24 – Extrémités d'association d'AsynchronousMachineDynamics::AsynchronousMachineTimeConstantReactance avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	hérité de: AsynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	hérité de: AsynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: AsynchronousMachineDynamics
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	hérité de: AsynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.5.4 AsynchronousMachineEquivalentCircuit

Les équations électriques de toutes les variations du modèle asynchrone reposent sur le diagramme AsynchronousEquivalentCircuit pour l'axe longitudinal et l'axe transversal, avec deux enroulements de rotor équivalents dans chaque axe.

Les équations de conversion entre le circuit équivalent et la réactance à constante de temps sont les suivantes:

Xs = Xm + Xl

X' = Xl + Xm x Xlr1 / (Xm + Xlr1)

X'' = Xl + Xm x Xlr1 x Xlr2 / (Xm x Xlr1 + Xm x Xlr2 + Xlr1 x Xlr2)

T'o = (Xm + Xlr1) / (omega0 x Rr1)

T''o = (Xm x Xlr1 + Xm x Xlr2 + Xlr1 x Xlr2) / (omega0 x Rr2 x (Xm + Xlr1)

Mêmes équations utilisant les attributs CIM de la classe AsynchronousMachineTimeConstantReactance à gauche du signe égal (=) et la classe AsynchronousMachineEquivalentCircuit à sa droite (sauf comme indiqué):

xs = xm + RotatingMachineDynamics.statorLeakageReactance

xp = RotatingMachineDynamics.statorLeakageReactance + xm x xlr1 / (xm + xlr1)

xpp = RotatingMachineDynamics.statorLeakageReactance + xm x xlr1 x xlr2 / (xm x xlr1 + xm x xlr2 + xlr1 x xlr2)

tpo = (xm + xlr1) / (2 x pi x fréquence nominale x rr1)

tppo = (xm x xlr1 + xm x xlr2 + xlr1 x xlr2) / (2 x pi x fréquence nominale x rr2 x (xm + xlr1).

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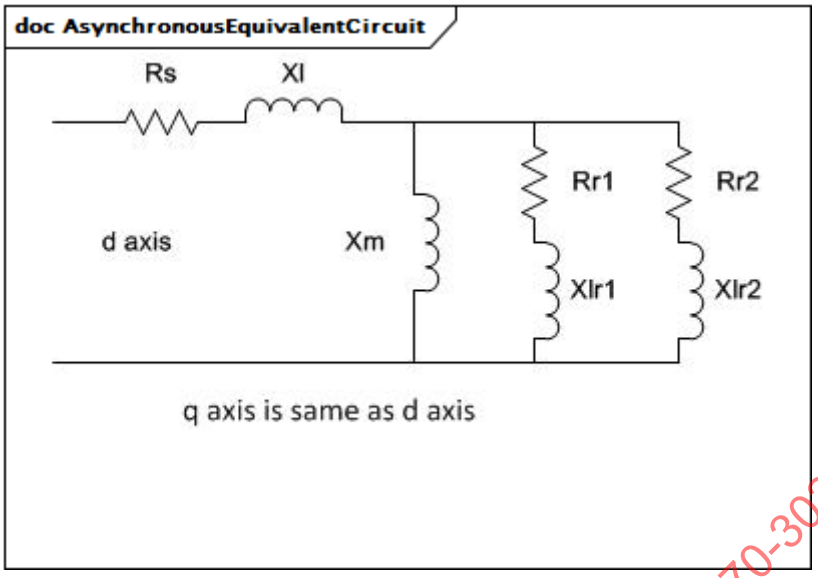

Anglais	Français
d axis	axe d
q axis is same as d axis	l'axe q est identique à l'axe d

Figure 39 – AsynchronousEquivalentCircuit

Figure 39: Dans chaque axe, les branches représentent la réactance (Xl) et la résistance (Rs) de fuite du stator, la réactance magnétisante (Xm) et la résistance et réactance de fuite des enroulements équivalents (Rr1, Xlr1, etc.) sur le rotor.

Le Tableau 25 présente tous les attributs d'AsynchronousMachineEquivalentCircuit.

Tableau 25 – Attributs d'AsynchronousMachineDynamics::AsynchronousMachineEquivalentCircuit

nom	mult	type	description
xm	0..1	PU	Réactance magnétisante.
rr1	0..1	PU	Résistance de l'enroulement amortisseur 1.
xlr1	0..1	PU	Réactance de fuite de l'enroulement amortisseur 1.
rr2	0..1	PU	Résistance de l'enroulement amortisseur 2.
xlr2	0..1	PU	Réactance de fuite de l'enroulement amortisseur 2.
damping	0..1	Float	hérité de: RotatingMachineDynamics
inertia	0..1	Seconds	hérité de: RotatingMachineDynamics
saturationFactor	0..1	Float	hérité de: RotatingMachineDynamics
saturationFactor120	0..1	Float	hérité de: RotatingMachineDynamics
statorLeakageReactance	0..1	PU	hérité de: RotatingMachineDynamics
statorResistance	0..1	PU	hérité de: RotatingMachineDynamics
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 26 présente toutes les extrémités d'association d'AsynchronousMachineEquivalentCircuit avec d'autres classes.

Tableau 26 – Extrémités d'association d'AsynchronousMachineDynamics::AsynchronousMachineEquivalentCircuit avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachine	1..1	AsynchronousMachine	hérité de: AsynchronousMachineDynamics
0..1	TurbineGovernorDynamics	0..1	TurbineGovernorDynamics	hérité de: AsynchronousMachineDynamics
0..1	MechanicalLoadDynamics	0..1	MechanicalLoadDynamics	hérité de: AsynchronousMachineDynamics
1..1	WindTurbineType1or2Dynamics	0..1	WindTurbineType1or2Dynamics	hérité de: AsynchronousMachineDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6 Paquetage TurbineGovernorDynamics

5.3.6.1 Généralités

Le modèle de régulateur de turbine est lié à un ou deux générateurs synchrones. Il détermine la puissance mécanique (Pm) ou le couple (Tm) de l'arbre du modèle de générateur.

À l'inverse des modèles normalisés IEEE d'autres blocs fonctionnels, les trois modèles normalisés IEEE de régulateur de turbine (GovHydroIEEE0, GovHydroIEEE2 et GovSteamIEEE1) sont présentés dans les transactions IEEE, pas dans les normes IEEE. C'est la raison pour laquelle des diagrammes sont fournis pour ces modèles.

Un rapport de l'IEEE publié en 2012 (*Dynamic Models for Turbine-Governors in Power System Studies*) donne des informations à jour relatives à différents modèles, y compris les modèles de l'IEEE, du fournisseur et de l'autorité compétente. L'intégration complète des résultats de ce rapport dans le modèle dynamique CIM est prévue.

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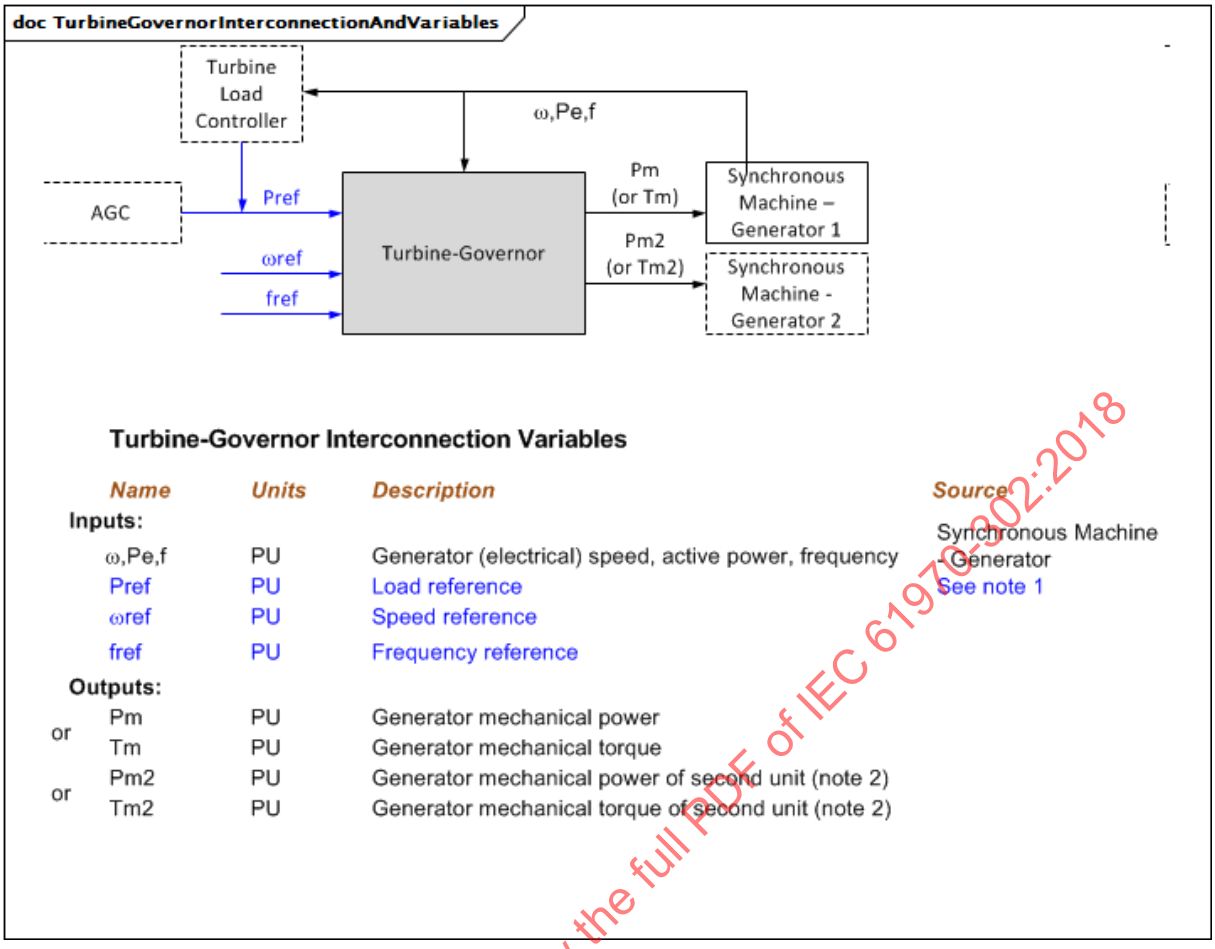

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Anglais	Français
Turbine Load Controller	Régulateur de puissance de la turbine
Turbine-Governor	Régulateur de la turbine
Pm (or Tm)	Pm (ou Tm)
Synchronous Machine – Generator 1	Machine synchrone – Générateur 1
Synchronous Machine – Generator 2	Machine synchrone – Générateur 2
Turbine-Governor Interconnection Variables	Variables d'interconnexion du régulateur de turbine
Name	Nom
Units	Unités
Inputs	Entrées
Outputs	Sorties
Generator (electrical) speed, active power, frequency	Vitesse, puissance active, fréquence (électrique) du générateur
Load reference	Référence de charge
Speed reference	Référence de vitesse
Frequency reference	Référence de fréquence
Synchronous Machine – Generator	Machine synchrone – Générateur
See note 1	Voir la Note 1
Generator mechanical power	Puissance mécanique du générateur
Generator mechanical torque	Couple mécanique du générateur
Generator mechanical power of second unit (note 2)	Puissance mécanique du générateur de la deuxième unité (note 2)
Generator mechanical torque of second unit (note 2)	Couple mécanique du générateur de la deuxième unité (note 2)

Figure 40 – TurbineGovernorInterconnectionAndVariables

Figure 40: Ce diagramme représente les entrées et sorties d'un régulateur de turbine. Certains modèles de régulateur de turbine sont utilisés dans les interconnexions transversales (GovSteam1, par exemple) dans lesquelles ils sont connectés à deux générateurs (machines synchrones).

Détails sur les paramètres:

1) Pref est en principe maintenu constant pour l'analyse de stabilité, mais il peut être déterminé par un modèle défini par l'utilisateur ou, pour les dynamiques à long terme, par un modèle de contrôle automatique de production (AGC – automatic generation control) étendu. Pour certains modèles, l'unité de Pref est la vitesse PU au lieu de la puissance PU.
2) La grande majorité de modèles de régulateur de turbine comporte un paramètre MWbase. Ce paramètre correspond à GeneratingUnit.ratedGrossMaxP du paquetage Production. Toutefois, la prise en charge d'une valeur différente par des outils d'analyse transitoire est spécifiée de manière explicite dans le paquetage Dynamics, le cas échéant.

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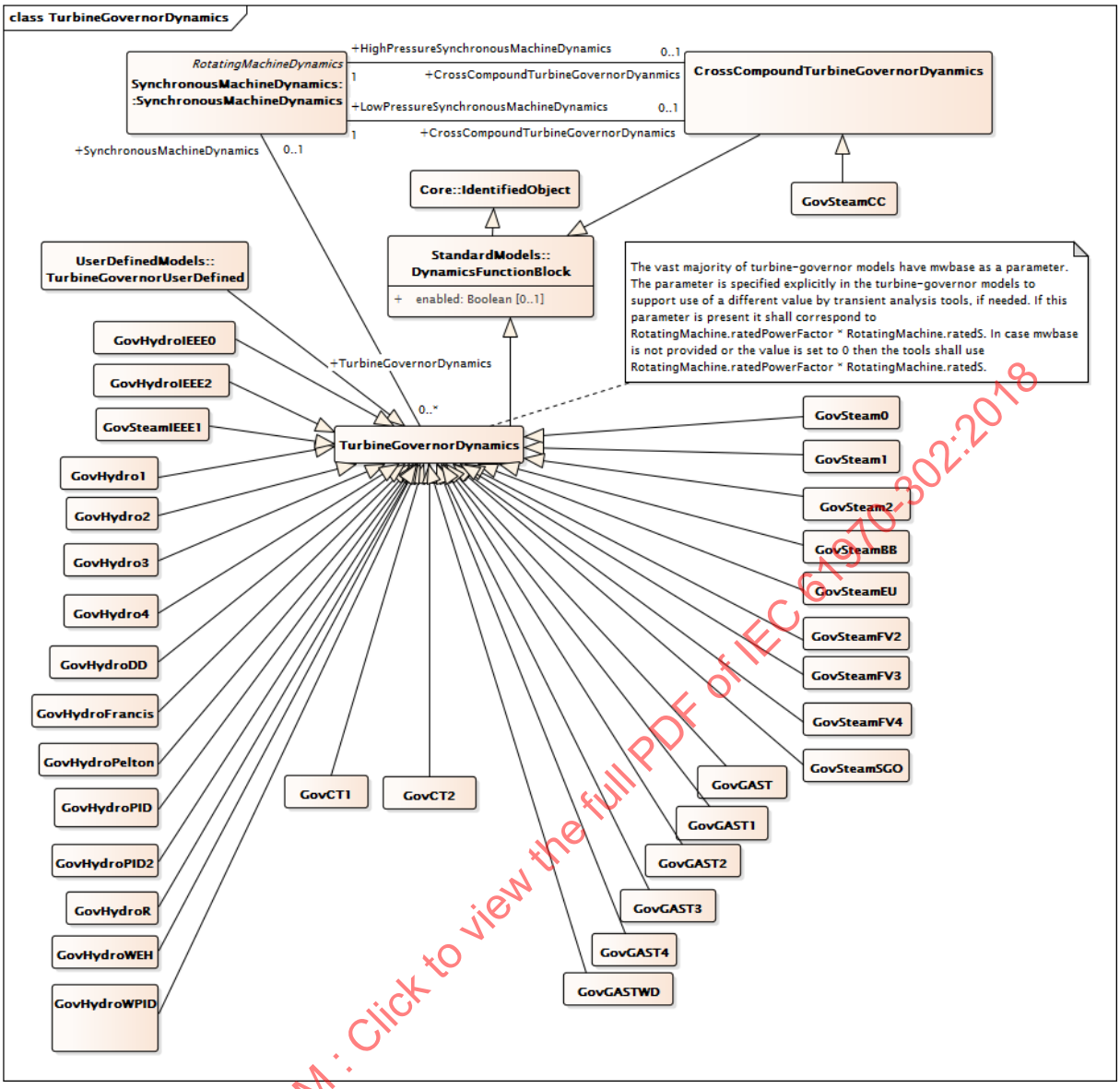

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Anglais	Français
The vast majority of turbine-governor models have mwbase as a parameter. The parameter is specified explicitly in the turbine-governor models to support use of a different value by transient analysis tools, if needed. If this parameter is present, it shall correspond to RotatingMachine.ratedPowerFactor * RotatingMachine.ratedS. In case mwbase is not provided or the value is set to 0, then the tools shall use RotatingMachine.ratedPowerFactor * RotatingMachine.ratedS	La grande majorité de modèles de régulateur de turbine comporte un paramètre mwbase. Le paramètre est spécifié dans manière explicite dans les modèles de régulateur de turbine pour la prise en charge d'une valeur différente par des outils d'analyse transitoire, le cas échéant. Si ce paramètre est présent, il doit correspondre à RotatingMachine.ratedPowerFactor * RotatingMachine.ratedS. Si mwbase n'est pas présent, les outils doivent utiliser RotatingMachine.ratedPowerFactor * RotatingMachine.ratedS.

Figure 41 – Diagramme de classe TurbineGovernorDynamics::TurbineGovernorDynamics

Figure 41: Ce diagramme représente les classes de régulateur de turbine du modèle normalisé dynamique et leur héritage de la classe TurbineGovernorDynamics.

5.3.6.2 CrossCompoundTurbineGovernorDynamics

Bloc fonctionnel cross-compound du régulateur de turbine dont le comportement est décrit en référence au modèle normalisé ou en établissant un modèle défini par l'utilisateur.

Le Tableau 27 présente tous les attributs de CrossCompoundTurbineGovernorDyanmics.

Tableau 27 – Attributs de TurbineGovernorDynamics::CrossCompoundTurbineGovernorDyanmics

nom	mult	type	description
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 28 présente toutes les extrémités d'association de CrossCompoundTurbineGovernorDyanmics avec d'autres classes.

Tableau 28 – Extrémités d'association de TurbineGovernorDynamics::CrossCompoundTurbineGovernorDyanmics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	LowPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	Machine synchrone basse tension à laquelle ce régulateur de turbine cross-compound est associé.
0..1	HighPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	Machine synchrone haute tension à laquelle ce régulateur de turbine cross-compound est associé.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.3 TurbineGovernorDynamics

Bloc fonctionnel du régulateur de turbine dont le comportement est décrit en référence au modèle normalisé ou en établissant un modèle défini par l'utilisateur.

Le Tableau 29 présente tous les attributs de TurbineGovernorDynamics.

Tableau 29 – Attributs de TurbineGovernorDynamics::TurbineGovernorDynamics

nom	mult	type	description
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 30 présente toutes les extrémités d'association de TurbineGovernorDynamics avec d'autres classes.

Tableau 30 – Extrémités d'association de TurbineGovernorDynamics::TurbineGovernorDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	Modèle de machine asynchrone auquel ce modèle de régulateur de turbine est associé. TurbineGovernorDynamics doit avoir une association avec SynchronousMachineDynamics ou avec AsynchronousMachineDynamics.
0..*	SynchronousMachineDynamics	0..*	SynchronousMachineDynamics	Modèle de machine synchrone auquel ce modèle de régulateur de turbine est associé. TurbineGovernorDynamics doit avoir une association avec SynchronousMachineDynamics ou avec AsynchronousMachineDynamics.
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	Régulateur de charge de la turbine fournissant une entrée à ce régulateur de turbine.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.4 GovHydroIEEE0

Modèle de régulateur de turbine hydro simplifié IEEE. Utilisé pour les régulateurs de turbine mécaniques-hydrauliques et électro-hydrauliques, avec ou sans retour de vapeur. Les valeurs classiques concernent les régulateurs mécaniques-hydrauliques.

Référence: IEEE Transactions on Power Apparatus and Systems, novembre/décembre 1973, Volume PAS-92, Numéro 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

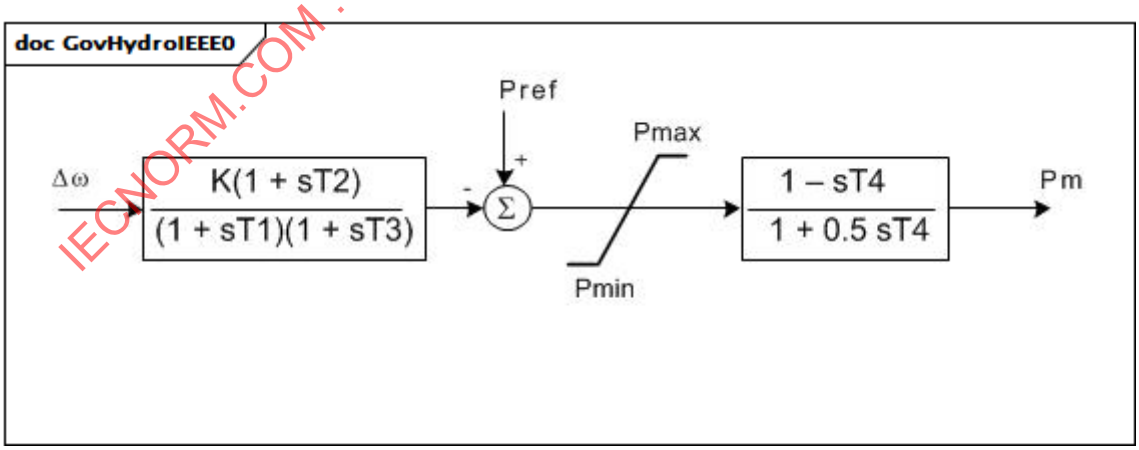

Figure 42 – GovHydroIEEE0

Figure 42: Ce diagramme décrit l'interprétation du modèle CIM du modèle de régulateur de turbine hydro simplifié IEEE.

Le Tableau 31 présente tous les attributs de GovHydroIEEE0.

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Tableau 31 – Attributs de TurbineGovernorDynamics::GovHydroIEEE0

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
k	0..1	PU	Gain du régulateur (K).
t1	0..1	Seconds	Constante de temps de réponse du régulateur (T1) (>= 0). Valeur classique = 0,25.
t2	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T2) (>= 0). Valeur classique = 0.
t3	0..1	Seconds	Constante de temps de l'actionneur de vanne (T3) (>= 0). Valeur classique = 0,1.
t4	0..1	Seconds	Temps au démarrage de l'écoulement de l'eau (T4) (>= 0).
pmax	0..1	PU	Vanne au maximum (Pmax) (> GovHydroIEEE0.pmin).
pmin	0..1	PU	Vanne au minimum (Pmin) (< GovHydroIEEE.pmax).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 32 présente toutes les extrémités d'association de GovHydroIEEE0 avec d'autres classes.

Tableau 32 – Extrémités d'association de TurbineGovernorDynamics::GovHydroIEEE0 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..*	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.6.5 GovHydroIEEE2

Le modèle de régulateur d'hydroturbine IEEE représente des centrales à conduites forcées directes et à régulateurs à amortisseur hydraulique.

Référence: IEEE Transactions on Power Apparatus and Systems, novembre/décembre 1973, Volume PAS-92, Numéro 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

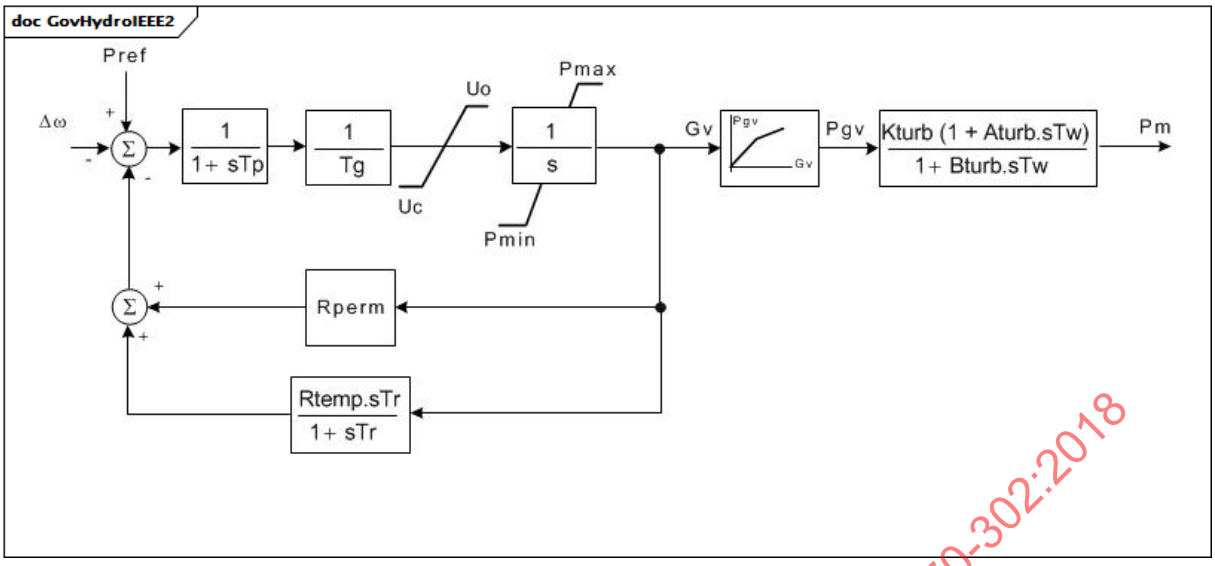

Figure 43 – GovHydroIEEE2

Figure 43: Ce diagramme décrit l'interprétation du modèle CIM du modèle de régulateur d'hydroturbine IEEE représentant des centrales à conduites forcées directes et à régulateurs à amortisseur hydraulique.

Détails sur les paramètres:

1) Les paramètres des PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.
2) Ce modèle de régulateur de turbine est une approximation raisonnable des performances des centrales hydroélectriques simples pour de petits mouvements des vannes en fonction d'une charge donnée. Toutefois, il représente la variation des effets d'inertie de l'eau en fonction de la charge uniquement si l'utilisateur ajuste correctement les valeurs des paramètres de la turbine au fur et à mesure de la variation de charge. Pour un modèle de turbine idéal, définir Kturb = 1, Aturb = -1, Bturb = 0,5.
3) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un chiffre négatif ou des valeurs nulles, la courbe hydraulique par défaut (entre 0,0 , 0,0 et 1,0 , 1,0) est utilisée.

Le Tableau 33 présente tous les attributs de GovHydroIEEE2.

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Tableau 33 – Attributs de TurbineGovernorDynamics::GovHydroIEEE2

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
tg	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tg) (>= 0). Valeur classique = 0,5.
tp	0..1	Seconds	Constante de temps du servodistributeur du pilote (Tp) (>= 0). Valeur classique = 0,03.
uo	0..1	Float	Vitesse maximale d'ouverture de la vanne (Uo). Unité = PU / s. Valeur classique = 0,1.
uc	0..1	Float	Vitesse de fermeture maximale de la vanne (Uc) (< 0). Valeur classique = -0,1.
pmax	0..1	PU	Ouverture maximale de la vanne (Pmax) (> GovHydroIEEE2.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne (Pmin) (<GovHydroIEEE2.pmax). Valeur classique = 0.
rperm	0..1	PU	Statisme permanent (Rperm). Valeur classique = 0,05.
rtemp	0..1	PU	Statisme temporaire (Rtemp). Valeur classique = 0,5.
tr	0..1	Seconds	Constante de temps de l'amortisseur (Tr) (>= 0). Valeur classique = 12.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (>= 0). Valeur classique = 2.
kturb	0..1	PU	Gain de la turbine (Kturb). Valeur classique = 1.
aturb	0..1	PU	Multiplicateur numérateur de la turbine (Aturb). Valeur classique = -1.
bturb	0..1	PU	Multiplicateur dénominateur de la turbine (Bturb) (> 0). Valeur classique = 0,5.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 34 présente toutes les extrémités d'association de GovHydroIEEE2 avec d'autres classes.

Tableau 34 – Extrémités d'association de TurbineGovernorDynamics::GovHydroIEEE2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.6 GovSteamIEEE1

Modèle de régulateur de turbine à vapeur IEEE.

Référence: IEEE Transactions on Power Apparatus and Systems, novembre/décembre 1973, Volume PAS-92, Numéro 6, Dynamic Models for Steam and Hydro Turbines in Power System Studies, page 1904.

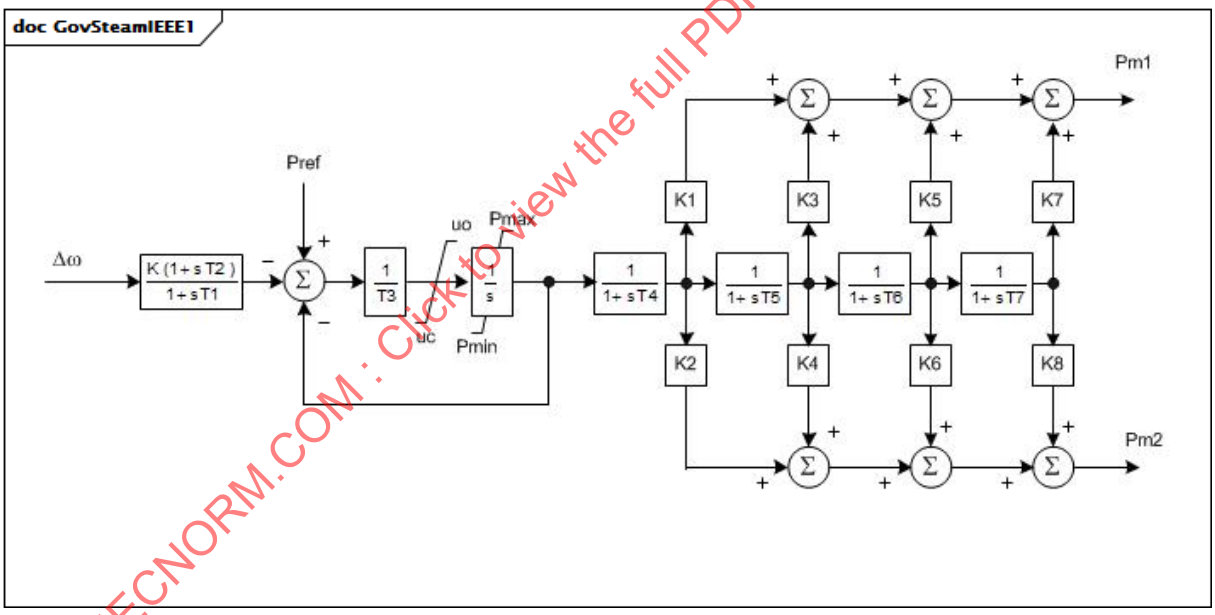

Figure 44 – GovSteamIEEE1

Figure 44: Ce diagramme décrit l'interprétation du modèle CIM du modèle de régulateur de turbine à vapeur IEEE.

Détails sur les paramètres:

1) Les paramètres PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.
2) Pour une turbine à simple ligne d'arbres, les paramètres K2, K4, K6 et K8 sont ignorés. Pour une turbine à deux lignes d'arbres, deux générateurs sont connectés à ce modèle de régulateur de turbine.
3) Chaque générateur doit être représenté dans le flux de puissance par des données relatives à sa base MVA. Les valeurs de K1, K3, K5 et K7 doivent être spécifiées pour

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décrire le développement proportionnel de la puissance sur le premier arbre de turbine. K2, K4, K6 et K8 doivent décrire le deuxième arbre de turbine. En principe, K1 + K3 + K5 + K7 = 1,0 et K2 + K4 + K6 + K8 = 1,0 (si le deuxième générateur est présent).

4) La répartition de puissance entre les deux arbres est proportionnelle aux valeurs des bases MVA des deux générateurs. Par conséquent, dans les conditions initiales de flux de puissance, il convient que les deux générateurs soient chargés sur la même fraction de chacune des bases MVA.

Le Tableau 35 présente tous les attributs de GovSteamIEEE1.

Tableau 35 – Attributs de TurbineGovernorDynamics::GovSteamIEEE1

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
k	0..1	PU	Gain du régulateur (réciproque du statisme) (K) (> 0). Valeur classique = 25.
t1	0..1	Seconds	Constante de temps de réponse du régulateur (T1) (>= 0). Valeur classique = 0.
t2	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T2) (>= 0). Valeur classique = 0.
t3	0..1	Seconds	Constante de temps du positionneur de vanne (T3) (> 0). Valeur classique = 0,1.
uo	0..1	Float	Vitesse d'ouverture maximale de la vanne (Uo) (> 0). Unité = PU / s. Valeur classique = 1.
uc	0..1	Float	Vitesse de fermeture maximale de la vanne (Uc) (< 0). Unité = PU / s. Valeur classique = -10.
pmax	0..1	PU	Ouverture maximale de la vanne (Pmax) (> GovSteamIEEE1.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne (Pmin) (>= 0 et < GovSteamIEEE1.pmax). Valeur classique = 0.
t4	0..1	Seconds	Constante de temps de la tuyauterie d'amenée d'air/du coffre de vapeur (T4) (>= 0). Valeur classique = 0,3.
k1	0..1	Float	Fraction de la puissance de l'arbre haute pression après le premier passage de la chaudière (K1). Valeur classique = 0,2.
k2	0..1	Float	Fraction de la puissance de l'arbre basse pression après le premier passage de la chaudière (K2). Valeur classique = 0.
t5	0..1	Seconds	Constante de temps du deuxième passage de la chaudière (T5) (>= 0). Valeur classique = 5.
k3	0..1	Float	Fraction de la puissance de l'arbre haute pression après le deuxième passage de la chaudière (K3). Valeur classique = 0,3.
k4	0..1	Float	Fraction de la puissance de l'arbre basse pression après le deuxième passage de la chaudière (K4). Valeur classique = 0.
t6	0..1	Seconds	Constante de temps du troisième passage de la chaudière (T6) (>= 0). Valeur classique = 0,5.
k5	0..1	Float	Fraction de la puissance de l'arbre haute pression après le troisième passage de la chaudière (K5). Valeur classique = 0,5.
k6	0..1	Float	Fraction de la puissance de l'arbre basse pression après le troisième passage de la chaudière (K6). Valeur classique = 0.
t7	0..1	Seconds	Constante de temps du quatrième passage de la chaudière (T7) (>= 0). Valeur classique = 0.
k7	0..1	Float	Fraction de la puissance de l'arbre haute pression après le quatrième passage de la chaudière (K7). Valeur classique = 0.
k8	0..1	Float	Fraction de la puissance de l'arbre basse pression après le quatrième passage de la chaudière (K8). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 36 présente toutes les extrémités d'association de GovSteamIEEE1 avec d'autres classes.

Tableau 36 – Extrémités d'association de TurbineGovernorDynamics::GovSteamIEEE1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.7 GovCT1

Modèle général de moteur primaire avec un régulateur PID, essentiellement utilisé pour les turbines à combustion et les centrales à cycle combiné.

Ce modèle peut être utilisé pour représenter un éventail de moteurs primaires contrôlés par des régulateurs PID. Il est par exemple adapté à la représentation

- des turbines à gaz et des turbines à cycle combiné monoarbre
- des moteurs diesel à régulateurs électroniques ou numériques modernes
- des turbines à vapeur alimentées en vapeur par un grand tambour de chaudière ou une large embase dont la pression est en grande partie constante sur la période à l'étude
- des turbines hydrauliques simples dans des configurations dans lesquelles la longueur de la colonne d'eau est courte et les effets de l'inertie de l'eau sont limités.

Des informations supplémentaires relatives à ce modèle sont disponibles dans le rapport IEEE de 2012 intitulé *Dynamic Models for Turbine-Governors in Power System Studies*, 3.1.2.3 pages 3-4 (GGOV1).

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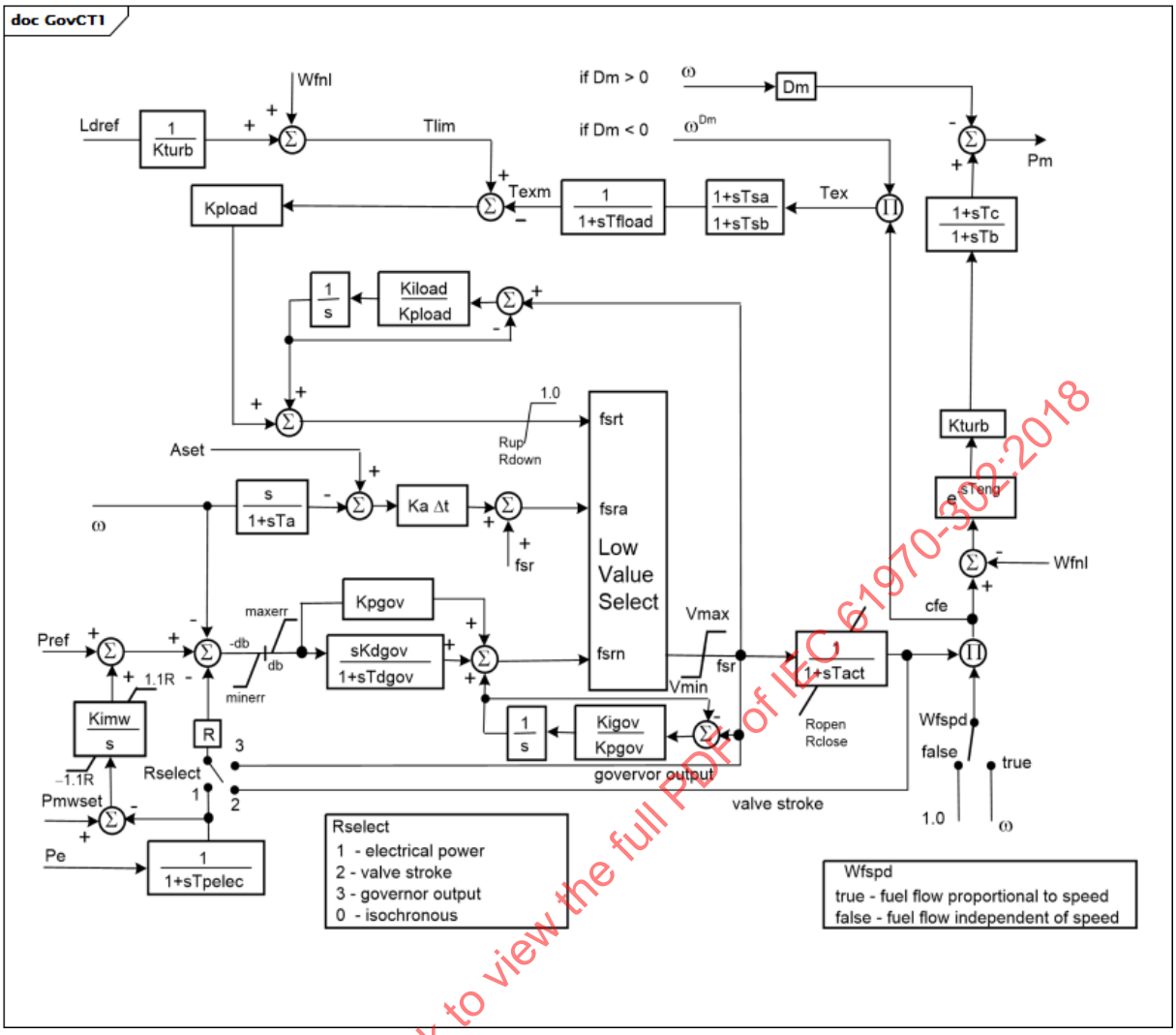

Anglais	Français
if	si
Low Value Select	Sélection d'une valeur faible
governor output	sortie du régulateur
electrical power	puissance électrique
valve stroke	course de vanne
isochronous	isochrone
true – fuel flow proportional to speed	true – débit de combustible proportionnel à la vitesse
false – fuel flow independant of speed	false – débit de combustible indépendant de la vitesse

Figure 45 – GovCT1

Figure 45: Ce diagramme décrit le modèle de régulateur de turbine GovCT1.

Détails sur les paramètres:

1) Les paramètres PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.

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2) La plage de déplacement de la vanne à combustible et le débit de combustible est l'unité. Par conséquent, la plus grande valeur possible de Vmax est 1,0 et la plus petite valeur possible de Vmin est zéro. Toutefois, Vmax peut être réduit sous l'unité afin de représenter une limite de charge imposée par l'opérateur ou un système de commande de surveillance. Pour les turbines à gaz, il convient que Vmin soit en principe supérieur à zéro et inférieur à Wfnl afin de représenter une limite minimale d'allumage. La valeur du débit de combustible à la sortie maximale doit être inférieure ou égale à l'unité, selon la valeur de Kturb.

3) Le module de limitation de charge peut être utilisé pour imposer une limite maximale de sortie (telle qu'une limite de température d'échappement). Pour ce faire, il convient que la constante de temps Tfload soit définie pour représenter la constante de temps dans le mesurage de la température (ou d'un autre signal). Il convient également que les gains du limiteur (Kpload et Kiload) soient définis de manière à assurer un contrôle stable et rapide à la limite. La limite de charge peut être désactivée en attribuant une valeur élevée au paramètre Ldref.

4) Ce modèle inclut une représentation simple d'un régulateur de puissance de surveillance. Ce contrôleur est actif si le paramètre Kimw est non nul. Le régulateur de puissance est une boucle de réinitialisation à action lente qui ajuste la référence vitesse/charge du régulateur de la turbine pour maintenir la puissance électrique restituée de l'unité à sa valeur de condition initiale. Cette valeur est enregistrée dans le paramètre Pmwset (qui est égal à Pe, puissance produite initiale) lors de l'initialisation du modèle et peut être modifiée par la suite. Le régulateur de puissance doit être réglé de manière à répondre doucement en fonction du régulateur de vitesse.

5) Les paramètres Aset, Ka et Ta décrivent un limiteur d'accélération. Ta doit être non nul, mais le limiteur d'accélération peut être désactivé en attribuant une valeur élevée à Aset, telle que la valeur 1.

6) Les paramètres Tsa et Tsb sont fournis pour augmenter le sous-système de mesure de la température du gaz d'échappement dans les turbines à gaz. Par exemple, ils peuvent être définis sur la valeur 4,0 ou 5,0 pour représenter l'élément "écran thermique" de turbines à gaz importantes.

7) Les paramètres Rup et Rdown spécifient la vitesse maximale d'augmentation et de diminution de la sortie du régulateur de limite de charge (Kpload / Kiload). Il convient que ces paramètres soient en principe définis ou que les valeurs 99 / -99 leur soient attribuées par défaut. Toutefois, des valeurs particulières peuvent leur être attribuées pour représenter les commandes de limite de température de certaines commandes de moteur General Electric™ de grosse cylindrée. [Note: Les commandes de moteur General Electric™ de grosse cylindrée sont des exemples de produits appropriés disponibles dans le commerce. Ces informations sont fournies à des fins de commodité des utilisateurs du présent document et ne constituent pas un entérinement de ces produits de la part de l'IEC.]

8) La commande fsr de débit de combustible est déterminée par la plus petite des valeurs fsrt, fsra et fsrn. Même si le diagramme GovCT1 ne le montre pas explicitement, les signaux ne se trouvent pas dans la piste d'asservissement fsr, et donc ne "s'extraient" pas au-delà de cette valeur. Cela représente la commande de turbine à gaz GE, mais peut ne pas être vrai pour d'autres conceptions de régulateurs.

9) Comme le montre le diagramme GovCT1, si Kpgov est différent de zéro, la commande PI du régulateur est mise en œuvre sur la "piste" fsr pour éviter les enroulements lorsque fsr est limité par un autre signal (fsrt, fsra) ou par Vmax/Vmin. Si Kpgov est égal à zéro, le chemin entier est mis en œuvre directement. Il en va de même pour la commande PI du limiteur de charge en fonction de Kpload.

10) . Le paramètre delta t dans le diagramme de bloc est l'intervalle de simulation. Il n'est pas échangé avec l'ensemble de données. Lorsque les applications utilisent des intervalles variables, les résultats des simulations peuvent varier. Dans ces cas, l'application concerne une valeur par défaut de 0,001.

Le Tableau 37 présente tous les attributs de GovCT1.

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Tableau 37 – Attributs de TurbineGovernorDynamics::GovCT1

nom	mult	type	description
aset	0..1	Float	Point de consigne du limiteur d'accélération (Aset). Unité = PU / s. Valeur classique = 0,01.
db	0..1	PU	Zone d'insensibilité du régulateur de vitesse en vitesse PU (db). Dans la plupart des applications, il est recommandé de définir cette valeur sur zéro. Valeur classique = 0.
dm	0..1	PU	Coefficient de sensibilité de la vitesse (Dm). Dm peut représenter soit la variation de la puissance du moteur en fonction de la vitesse de l'arbre, soit la variation de la capacité maximale de puissance en fonction de la vitesse de l'arbre. S'il est positif, il décrit la pente descendante de la vitesse du moteur en fonction des caractéristiques de puissance au fur et à mesure de l'augmentation de vitesse. Une caractéristique légèrement chutante est classique des moteurs alternatifs et de certaines turbines aérodérivées. S'il est négatif, la puissance du moteur est considérée par hypothèse comme n'étant pas affectée par la vitesse de l'arbre, mais le débit maximal admis de combustible diminue avec le ralentissement de la vitesse de l'arbre. Cela est caractéristique des turbines industrielles monoarbres en raison des limites de température d'échappement. Valeur classique = 0.
ka	0..1	PU	Gain du limiteur d'accélération (Ka). Valeur classique = 10.
kdgov	0..1	PU	Gain par dérivation du régulateur (Kdgov). Valeur classique = 0.
kigov	0..1	PU	Gain intégral du régulateur (Kigov). Valeur classique = 2.
kiload	0..1	PU	Gain intégral du limiteur de charge pour le régulateur PI (Kiload). Valeur classique = 0,67.
kimw	0..1	PU	Gain (réinitialisation) du régulateur de puissance (Kimw). La valeur par défaut 0,01 correspond à un temps de réinitialisation de 100 s. Une valeur de 0,001 correspond à un régulateur de puissance à action relativement lente. Valeur classique = 0,01.
kpgov	0..1	PU	Gain proportionnel du régulateur (Kpgov). Valeur classique = 10.
kpload	0..1	PU	Gain proportionnel du limiteur de charge pour le régulateur PI (Kpload). Valeur classique = 2.
kturb	0..1	PU	Gain de la turbine (Kturb) (> 0). Valeur classique = 1,5.
ldref	0..1	PU	Valeur de référence du limiteur de charge (Ldref). Valeur classique = 1.
maxerr	0..1	PU	Valeur maximale du signal d'erreur de vitesse (maxerr) (> GovCT1.minerr). Valeur classique = 0,05.
minerr	0..1	PU	Valeur minimale du signal d'erreur de vitesse (minerr) (< GovCT1.maxerr). Valeur classique = −0,05.
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
r	0..1	PU	Statisme permanent (R). Valeur classique = 0,04.
rclose	0..1	Float	Vitesse de fermeture minimale de la vanne (Rclose). Unité = PU / s. Valeur classique = -0,1.
rdown	0..1	PU	Vitesse maximale de diminution de la limite de charge (Rdown). Valeur classique = -99.
ropen	0..1	Float	Vitesse maximale d'ouverture de la vanne (Ropen). Unité = PU / s. Valeur classique = 0,10.
rselect	0..1	DroopSignalFeedbackKind	Signal de retour pour le statisme (Rselect). Valeur classique = electricalPower.
rup	0..1	PU	Vitesse maximale d'augmentation de la limite de charge (Rup). Valeur classique = 99.
ta	0..1	Seconds	Constante de temps du limiteur d'accélération (Ta) (> 0). Valeur classique = 0,1.

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nom	mult	type	description
tact	0..1	Seconds	Constante de temps de l'actionneur (Tact) (>= 0). Valeur classique = 0,5.
tb	0..1	Seconds	Constante de temps de réponse de la turbine (Tb) (> 0). Valeur classique = 0,5.
tc	0..1	Seconds	Constante de délai de mise en œuvre de la turbine (Tc) (>= 0). Valeur classique = 0.
tdgov	0..1	Seconds	Constante de temps du régulateur par dérivation du régulateur (Tdgov) (>= 0). Valeur classique = 1.
teng	0..1	Seconds	Retard de transport du moteur diesel utilisé pour représenter les moteurs diesel faisant l'objet d'un retard de transport limité mais mesurable entre un changement de réglage du débit de combustible et le développement du couple (Teng) (>= 0). Il convient que Teng soit égal à zéro dans tous les cas particuliers dans lesquels ce retard de transport présente un problème particulier. Valeur classique = 0.
tfload	0..1	Seconds	Constante de temps du limiteur de charge (Tfload) (> 0). Valeur classique = 3.
tpelec	0..1	Seconds	Constante de temps du transducteur de puissance électrique (Tpelec) (> 0). Valeur classique = 1.
tsa	0..1	Seconds	Constante de délai de mise en œuvre de la détection de température (Tsa) (>= 0). Valeur classique = 4.
tsb	0..1	Seconds	Constante de temps de réponse de la détection de température (Tsb) (>= 0). Valeur classique = 5.
vmax	0..1	PU	Limite maximale de position de la vanne (Vmax) (> GovCT1.vmin). Valeur classique = 1.
vmin	0..1	PU	Limite minimale de position de la vanne (Vmin) (< GovCT1.vmax). Valeur classique = 0,15.
wfnl	0..1	PU	Débit de combustible sans charge (Wfnl). Valeur classique = 0,2.
wfspd	0..1	Boolean	Manœuvre pour la caractéristique de source de combustible permettant de reconnaître que le débit de combustible, pour une course de vanne à combustible donnée, peut être proportionnel à la vitesse du moteur (Wfspd). true = débit de combustible proportionnel à la vitesse (pour certaines turbines à gaz et certains moteurs diesel avec injecteurs à déplacement positif) false = le système de commande du combustible maintient le débit de combustible indépendant de la vitesse du moteur. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 38 présente toutes les extrémités d'association de GovCT1 avec d'autres classes.

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Tableau 38 – Extrémités d'association de TurbineGovernorDynamics::GovCT1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.8 GovCT2

Régulateur général avec limite de débit de combustible en fonction de la fréquence. Ce modèle est une modification du modèle GovCT1 visant à représenter la limite de débit de combustible en fonction de la fréquence d'un fabricant de turbines à gaz particulier.

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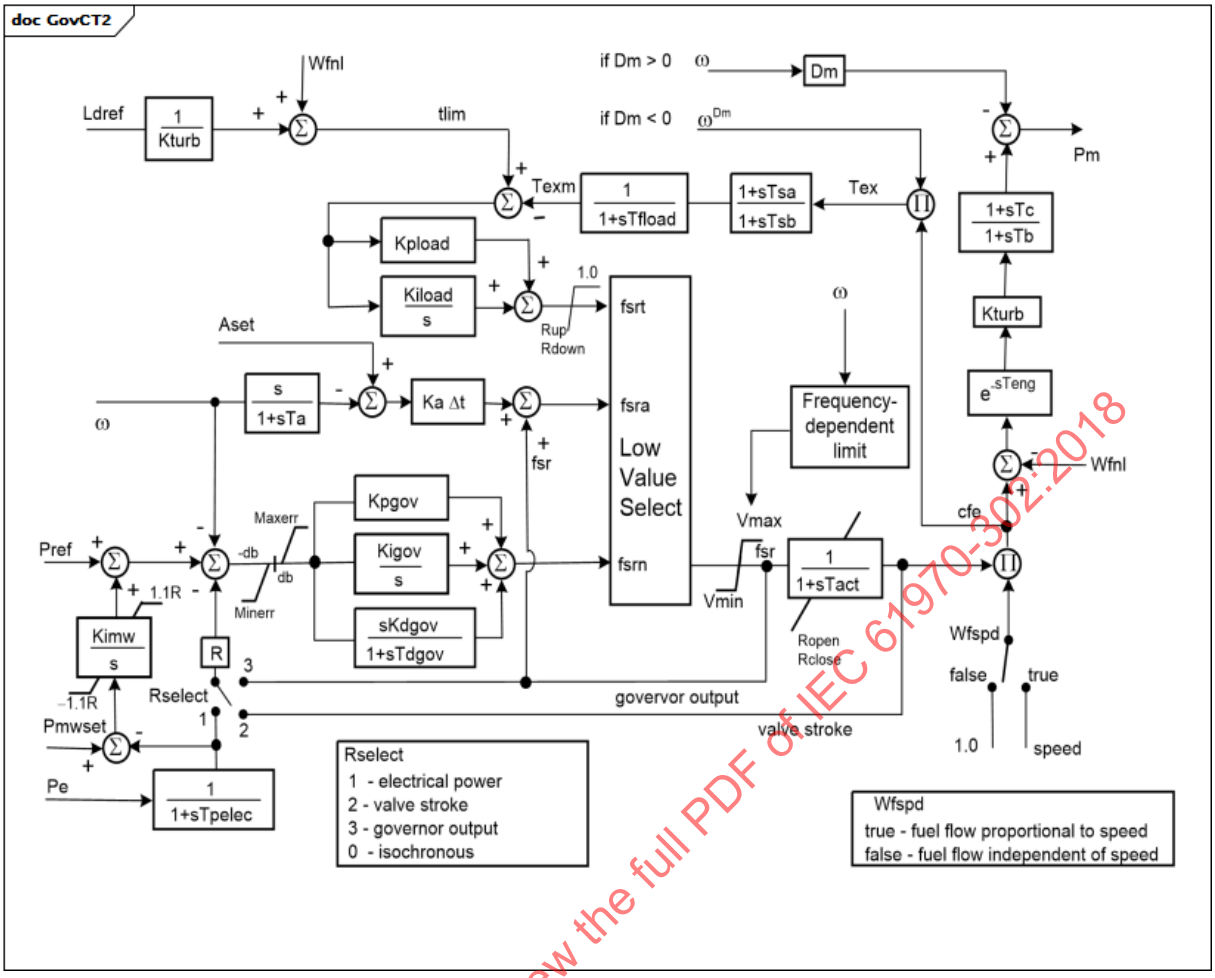

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Anglais	Français
if	si
Low Value Select	Sélection d'une valeur faible
Frequency-dependent limit	Limite en fonction de la fréquence
electrical power	puissance électrique
valve stroke	course de la vanne
governor output	sortie du régulateur
isochronous	isochrone
speed	vitesse
true – fuel flow proportional to speed	True – débit de combustible proportionnel à la vitesse
false – fuel flow independent of speed	False – débit de combustible indépendant de la vitesse

Figure 46 – GovCT2

Figure 46: Ce diagramme décrit le modèle de régulateur de turbine GovCT2.

Détails sur les paramètres:

1) La limite en fonction de la fréquence réduit la limite Vmax sur le signal de débit de combustible (fsr). Pour le fonctionnement normal, le limiteur n'exécute aucune action. Si la fréquence (vitesse du générateur) passe sous Flim1 (point de données de fréquence la plus élevée), la valeur souhaitée de limite de puissance (Plim) est déterminée par interpolation linéaire entre les paires de données associées. La valeur maximale du limiteur (Vmax) passe à la valeur fsr correspondant à Plim (Plim/Kturb + Wfnl) au taux de variation Prate. Plim est mis à jour au fur et à mesure de la variation de fréquence. Si la fréquence repasse au-dessus de Flim1, la valeur de la limite passe au-dessus du taux Prate jusqu'à la valeur normale de Vmax.
2) La limite en fonction de la fréquence est définie par un ensemble de 10 paires de points relatifs à la fréquence (vitesse du générateur, en Hz) et à la puissance. Les points doivent diminuer de manière monotone tant en amplitude de fréquence que de puissance. Si moins de 10 points sont nécessaires pour définir la relation, les valeurs nulles doivent être entrées pour les autres fréquences et limites de puissance. La valeur de la dernière paire de données non nulles est utilisée comme limite basse, c'est-à-dire que les deux dernières valeurs ne sont pas extrapolées pour calculer les limites de puissance basses. En présence d'un seul ensemble de limites de fréquence et de puissance, ces valeurs sont utilisées comme limite simple de puissance appliquée à cette fréquence et en dessous.
3) Voir le modèle GovCT1 pour d'autres détails sur les paramètres. Outre la limite en fonction de la fréquence, GovCT2 est identique à GovCT1, sauf que la commande fsrt de température du combustible ne suit pas fsr lorsqu'il n'est pas contrôlé. Elle reste plutôt à sa limite supérieure (1.).
4) Les régulateurs Kpgov/Kigov et Kpload/Kiload incluent une logique de suivi visant à assurer un transfert régulier entre les régulateurs actifs. Cette logique n'est pas présentée sur le diagramme GovCT2.
5) Pmwset équivaut à Pe, la puissance générée initiale.
6) Le paramètre delta t dans le diagramme de bloc est l'intervalle de simulation. Il n'est pas échangé avec l'ensemble de données. Lorsque les applications utilisent des intervalles variables, les résultats des simulations peuvent varier. Dans ces cas, l'application concerne une valeur par défaut de 0,001.

Le Tableau 39 présente tous les attributs de GovCT2.

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Tableau 39 – Attributs de TurbineGovernorDynamics::GovCT2

nom	mult	type	description
aset	0..1	Float	Point de consigne du limiteur d'accélération (Aset). Unité = PU / s. Valeur classique = 10.
db	0..1	PU	Zone d'insensibilité du régulateur de vitesse en vitesse PU (db). Dans la plupart des applications, il est recommandé de définir cette valeur sur zéro. Valeur classique = 0.
dm	0..1	PU	Coefficient de sensibilité de la vitesse (Dm). Dm peut représenter soit la variation de la puissance du moteur en fonction de la vitesse de l'arbre, soit la variation de la capacité de puissance maximale en fonction de la vitesse de l'arbre. S'il est positif, il décrit la pente descendante de la vitesse du moteur en fonction des caractéristiques de puissance au fur et à mesure de l'augmentation de vitesse. Une caractéristique légèrement chutante est classique des moteurs alternatifs et de certaines turbines aérodérivées. S'il est négatif, la puissance du moteur est considérée par hypothèse comme n'étant pas affectée par la vitesse de l'arbre, mais le débit maximal admis de combustible diminue avec le ralentissement de la vitesse de l'arbre. Cela est caractéristique des turbines industrielles monoarbres en raison des limites de température d'échappement. Valeur classique = 0.
flim1	0..1	Frequency	Seuil de fréquence 1 (Flim1). Unité = Hz. Valeur classique = 59.
flim10	0..1	Frequency	Seuil de fréquence 10 (Flim10). Unité = Hz. Valeur classique = 0.
flim2	0..1	Frequency	Seuil de fréquence 2 (Flim2). Unité = Hz. Valeur classique = 0.
flim3	0..1	Frequency	Seuil de fréquence 3 (Flim3). Unité = Hz. Valeur classique = 0.
flim4	0..1	Frequency	Seuil de fréquence 4 (Flim4). Unité = Hz. Valeur classique = 0.
flim5	0..1	Frequency	Seuil de fréquence 5 (Flim5). Unité = Hz. Valeur classique = 0.
flim6	0..1	Frequency	Seuil de fréquence 6 (Flim6). Unité = Hz. Valeur classique = 0.
flim7	0..1	Frequency	Seuil de fréquence 7 (Flim7). Unité = Hz. Valeur classique = 0.
flim8	0..1	Frequency	Seuil de fréquence 8 (Flim8). Unité = Hz. Valeur classique = 0.
flim9	0..1	Frequency	Seuil de fréquence 9 (Flim9). Unité = Hz. Valeur classique = 0.
ka	0..1	PU	Gain du limiteur d'accélération (Ka). Valeur classique = 10.
kdgov	0..1	PU	Gain par dérivation du régulateur (Kdgov). Valeur classique = 0.
kigov	0..1	PU	Gain intégral du régulateur (Kigov). Valeur classique = 0,45.
kiload	0..1	PU	Gain intégral du limiteur de charge pour le régulateur PI (Kiload). Valeur classique = 1.
kimw	0..1	PU	Gain (réinitialisation) du régulateur de puissance (Kimw). La valeur par défaut 0,01 correspond à un temps de réinitialisation de 100 s. Une valeur de 0,001 correspond à un régulateur de puissance à action relativement lente. Valeur classique = 0.
kpgov	0..1	PU	Gain proportionnel du régulateur (Kpgov). Valeur classique = 4.
kpload	0..1	PU	Gain proportionnel du limiteur de charge pour le régulateur PI (Kpload). Valeur classique = 1.
kturb	0..1	PU	Gain de la turbine (Kturb). Valeur classique = 1,9168.

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nom	mult	type	description
ldref	0..1	PU	Valeur de référence du limiteur de charge (Ldref). Valeur classique = 1.
maxerr	0..1	PU	Valeur maximale du signal d'erreur de vitesse (Maxerr) (> GovCT2.minerr). Valeur classique = 1.
minerr	0..1	PU	Valeur minimale du signal d'erreur de vitesse (Minerr) (< GovCT2.maxerr). Valeur classique = -1.
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
plim1	0..1	PU	Limite de puissance 1 (Plim1). Valeur classique = 0,8325.
plim10	0..1	PU	Limite de puissance 10 (Plim10). Valeur classique = 0.
plim2	0..1	PU	Limite de puissance 2 (Plim2). Valeur classique = 0.
plim3	0..1	PU	Limite de puissance 3 (Plim3). Valeur classique = 0.
plim4	0..1	PU	Limite de puissance 4 (Plim4). Valeur classique = 0.
plim5	0..1	PU	Limite de puissance 5 (Plim5). Valeur classique = 0.
plim6	0..1	PU	Limite de puissance 6 (Plim6). Valeur classique = 0.
plim7	0..1	PU	Limite de puissance 7 (Plim7). Valeur classique = 0.
plim8	0..1	PU	Limite de puissance 8 (Plim8). Valeur classique = 0.
plim9	0..1	PU	Limite de puissance 9 (Plim9). Valeur classique = 0.
prate	0..1	PU	Taux de variation pour la limite de puissance en fonction de la fréquence (Prate). Valeur classique = 0,017.
r	0..1	PU	Statisme permanent (R). Valeur classique = 0,05.
rclose	0..1	Float	Vitesse minimale de fermeture de la vanne (Rclose). Unité = PU / s. Valeur classique = -99.
rdown	0..1	PU	Vitesse maximale de diminution de la limite de charge (Rdown). Valeur classique = -99.
ropen	0..1	Float	Vitesse maximale d'ouverture de la vanne (Ropen). Unité = PU / s. Valeur classique = 99.
rselect	0..1	DroopSignalFeedbackKind	Signal de retour pour le statisme (Rselect). Valeur classique = electricalPower.
rup	0..1	PU	Vitesse maximale d'augmentation de la limite de charge (Rup). Valeur classique = 99.
ta	0..1	Seconds	Constante de temps du limiteur d'accélération (Ta) (>= 0). Valeur classique = 1.
tact	0..1	Seconds	Constante de temps de l'actionneur (Tact) (>= 0). Valeur classique = 0,4.
tb	0..1	Seconds	Constante de temps de réponse de la turbine (Tb) (>= 0). Valeur classique = 0,1.
tc	0..1	Seconds	Constante de délai de mise en œuvre de la turbine (Tc) (>= 0). Valeur classique = 0.
tdgov	0..1	Seconds	Constante de temps du régulateur par dérivation du régulateur (Tdgov) (>= 0). Valeur classique = 1.
teng	0..1	Seconds	Retard de transport du moteur diesel utilisé pour représenter les moteurs diesel faisant l'objet d'un retard de transport limité mais mesurable entre un changement de réglage du débit de combustible et le développement du couple (Teng) (>= 0). Il convient que Teng soit égal à zéro dans tous les cas particuliers dans lesquels ce retard de transport présente un problème particulier. Valeur classique = 0.
tfload	0..1	Seconds	Constante de temps du limiteur de charge (Tfload) (>= 0). Valeur classique = 3.
tpelec	0..1	Seconds	Constante de temps du transducteur de puissance électrique (Tpelec) (>= 0). Valeur classique = 2,5.
tsa	0..1	Seconds	Constante de délai de mise en œuvre de la détection de température (Tsa) (>= 0). Valeur classique = 0.

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nom	mult	type	description
tsb	0..1	Seconds	Constante de temps de réponse de la détection de température (Tsb) (>= 0). Valeur classique = 50.
vmax	0..1	PU	Limite maximale de position de la vanne (Vmax) (> GovCT2.vmin). Valeur classique = 1.
vmin	0..1	PU	Limite minimale de position de la vanne (Vmin) (< GovCT2.vmax). Valeur classique = 0,175.
wfnl	0..1	PU	Débit de combustible sans charge (Wfnl). Valeur classique = 0,187.
wfspd	0..1	Boolean	Manœuvre pour la caractéristique de source de combustible permettant de reconnaître que le débit de combustible, pour une course de vanne à combustible donnée, peut être proportionnel à la vitesse du moteur (Wfspd). true = débit de combustible proportionnel à la vitesse (pour certaines turbines à gaz et certains moteurs diesel avec injecteurs à déplacement positif) false = le système de commande du combustible maintient le débit de combustible indépendant de la vitesse du moteur. Valeur classique = false.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 40 présente toutes les extrémités d'association de GovCT2 avec d'autres classes.

Tableau 40 – Extrémités d'association de TurbineGovernorDynamics::GovCT2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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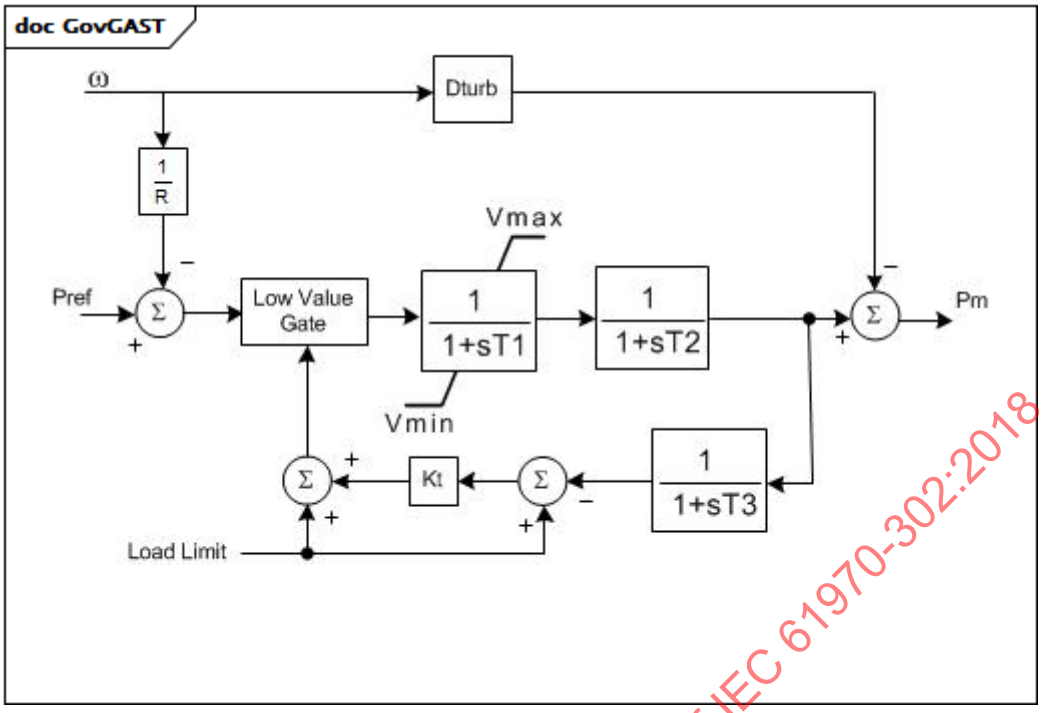
5.3.6.9 GovGAST

Turbine à gaz monoarbre.



Anglais	Français
Low Value Gate	Vanne de faible valeur
Load Limit	Limite de charge

Figure 47 – GovGAST

Figure 47: Ce diagramme décrit le modèle de régulateur de turbine GovGAST.

Le Tableau 41 présente tous les attributs de GovGAST.

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Tableau 41 – Attributs de TurbineGovernorDynamics::GovGAST

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
r	0..1	PU	Statisme permanent (R) (> 0). Valeur classique = 0,04.
t1	0..1	Seconds	Constante de temps du mécanisme du régulateur (T1) (>= 0). T1 représente la constante de temps du positionnement naturel de la vanne du régulateur pour de petites perturbations, comme cela est le cas lorsque la limitation de vitesse de réaction n'est pas active. Valeur classique = 0,5.
t2	0..1	Seconds	Constante de temps de la puissance de la turbine (T2) (>= 0). T2 représente le retard dû au stockage d'énergie interne du moteur de la turbine à gaz. T2 peut être utilisé pour donner une approximation grossière du retard lié à l'accélération du tambour de compresseur d'un moteur à plusieurs arbres ou à la compressibilité du gaz dans la chambre de répartition d'air de la turbine libre d'une unité aérodérivée, par exemple. Valeur classique = 0,5.
t3	0..1	Seconds	Constante de temps de la température d'échappement de la turbine (T3) (>= 0). Valeur classique = 3.
at	0..1	PU	Limite de charge à température ambiante (limite de charge). Valeur classique = 1.
kt	0..1	PU	Gain du limiteur de température (Kt). Valeur classique = 3.
vmax	0..1	PU	Puissance maximale de la turbine, PU de MWbase (Vmax) (> GovGAST.vmin). Valeur classique = 1.
vmin	0..1	PU	Puissance minimale de la turbine, PU de MWbase (Vmin) (< GovGAST.vmax). Valeur classique = 0.
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb). Valeur classique = 0,18.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 42 présente toutes les extrémités d'association de GovGAST avec d'autres classes.

Tableau 42 – Extrémités d'association de TurbineGovernorDynamics::GovGAST avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.10 GovGAST1

Turbine à gaz monoarbre modifiée.

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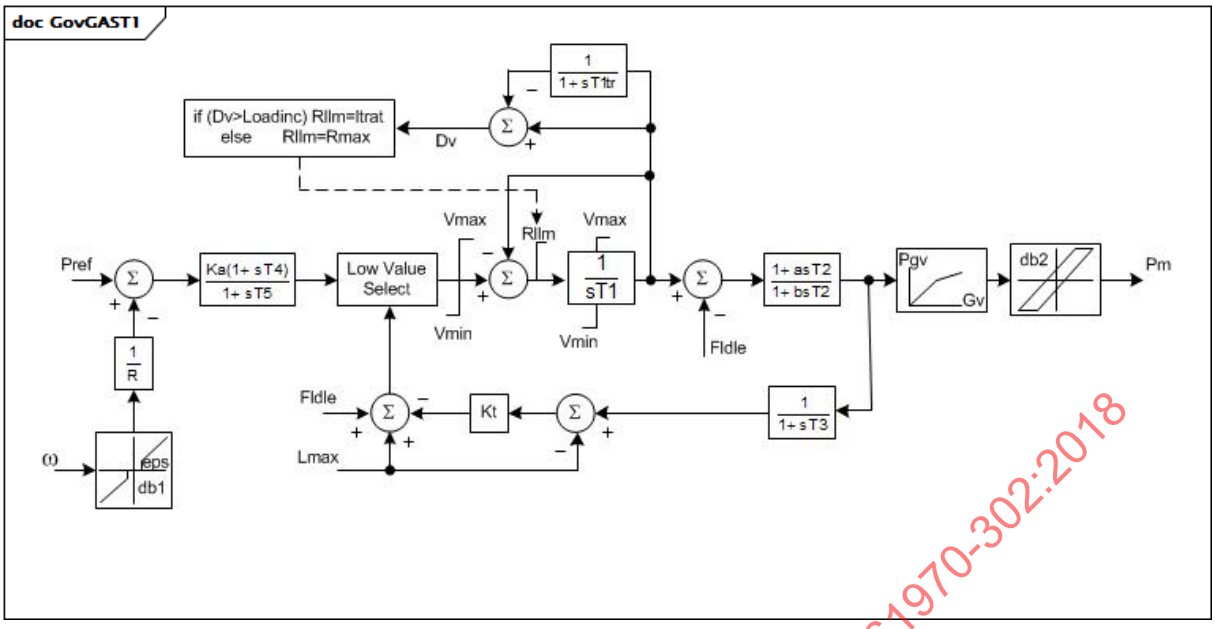

Anglais	Français
si	si
else	sinon

Figure 48 – GovGAST1

Figure 48: Ce diagramme décrit le modèle de régulateur de turbine GovGAST1.

Détails sur les paramètres:

1) Rmax, Linc, Tltr et Ltrate représentent un sous-système à limite de taux de charge. Pour les petites excursions par rapport à une charge fixe, la vanne à combustible peut s'ouvrir à une vitesse de Rmax PU/s. La constante de temps, Tltr, est utilisée pour obtenir une position moyenne de vanne à long terme. Si une augmentation importante de la sortie est demandée, l'ouverture totale de la vanne à combustible est admise tant que son ouverture ne s'est pas déplacée vers l'avant de la position moyenne à long terme par Linc PU. Après cela, l'ouverture de la vanne est admise uniquement à la vitesse, Ltrat, tant que la position moyenne à long terme n'est pas atteinte.
2) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0. et 1,0. Toutefois, si Vmax > 1,0, l'entrée et la sortie sont mises à l'échelle avec Vmax. Si Gv1 est un nombre négatif ou des valeurs nulles, la courbe par défaut (entre 0,0 , 0,0 et 1,0 , 1,0) est utilisée.

Le Tableau 43 présente tous les attributs de GovGAST1.

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Tableau 43 – Attributs de TurbineGovernorDynamics::GovGAST1

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
r	0..1	PU	Statisme permanent (R) (> 0). Valeur classique = 0,04.
t1	0..1	Seconds	Constante de temps du mécanisme du régulateur (T1) (>= 0). T1 représente la constante de temps du positionnement naturel de la vanne du régulateur pour de petites perturbations, comme cela est le cas lorsque la limitation de vitesse de réaction n'est pas active. Valeur classique = 0,5.
t2	0..1	Seconds	Constante de temps de la puissance de la turbine (T2) (>= 0). T2 représente le retard dû au stockage d'énergie interne du moteur de la turbine à gaz. T2 peut être utilisé pour donner une approximation grossière du retard lié à l'accélération du tambour de compresseur d'un moteur à plusieurs arbres ou à la compressibilité du gaz dans la chambre de répartition d'air de la turbine libre d'une unité aérodérivée, par exemple. Valeur classique = 0,5.
t3	0..1	Seconds	Constante de temps de la température d'échappement de la turbine (T3) (>= 0). T3 représente le retard dans la température d'échappement et le système de limitation de charge. Valeur classique = 3.
lmax	0..1	PU	Limite de charge à température ambiante (Lmax). Lmax est la puissance restituée de la turbine correspondant à la limitation de température du gaz d'échappement. Valeur classique = 1.
kt	0..1	PU	Gain du limiteur de température (Kt). Valeur classique = 3.
vmax	0..1	PU	Puissance maximale de la turbine, PU de MWbase (Vmax) (> GovGAST1.vmin). Valeur classique = 1.
vmin	0..1	PU	Puissance minimale de la turbine, PU de MWbase (Vmin) (< GovGAST1.vmax). Valeur classique = 0.
fidle	0..1	PU	Débit de combustible à puissance restituée nulle (Fidle). Valeur classique = 0,18.
rmax	0..1	Float	Vitesse maximale d'ouverture de la vanne à combustible (Rmax). Unité = PU / s. Valeur classique = 1.
loadinc	0..1	PU	Changement rapide de position de la vanne admis (Loadinc). Valeur classique = 0,05.
tltr	0..1	Seconds	Constante de temps d'intégration de position de la vanne (Tltr) (>= 0). Valeur classique = 10.
ltrate	0..1	Float	Vitesse maximale d'ouverture à long terme de la vanne à combustible (Ltrate). Valeur classique = 0,02.
a	0..1	Float	Facteur d'échelle du numérateur de constante de temps de puissance de la turbine (a). Valeur classique = 0,8.
b	0..1	Float	Facteur d'échelle du dénominateur de constante de temps de puissance de la turbine (b) (> 0). Valeur classique = 1.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.

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nom	mult	type	description
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur (Ka). Valeur classique = 0.
t4	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T4) (>= 0). Valeur classique = 0.
t5	0..1	Seconds	Constante de temps de réponse du régulateur (T5) (>= 0). Si cette valeur est égale à zéro, le gain entier et le bloc d'avance-retard sont contournés. Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 44 présente toutes les extrémités d'association de GovGAST1 avec d'autres classes.

Tableau 44 – Extrémités d'association de TurbineGovernorDynamics:: GovGAST1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.11 GovGAST2

Turbine à gaz.

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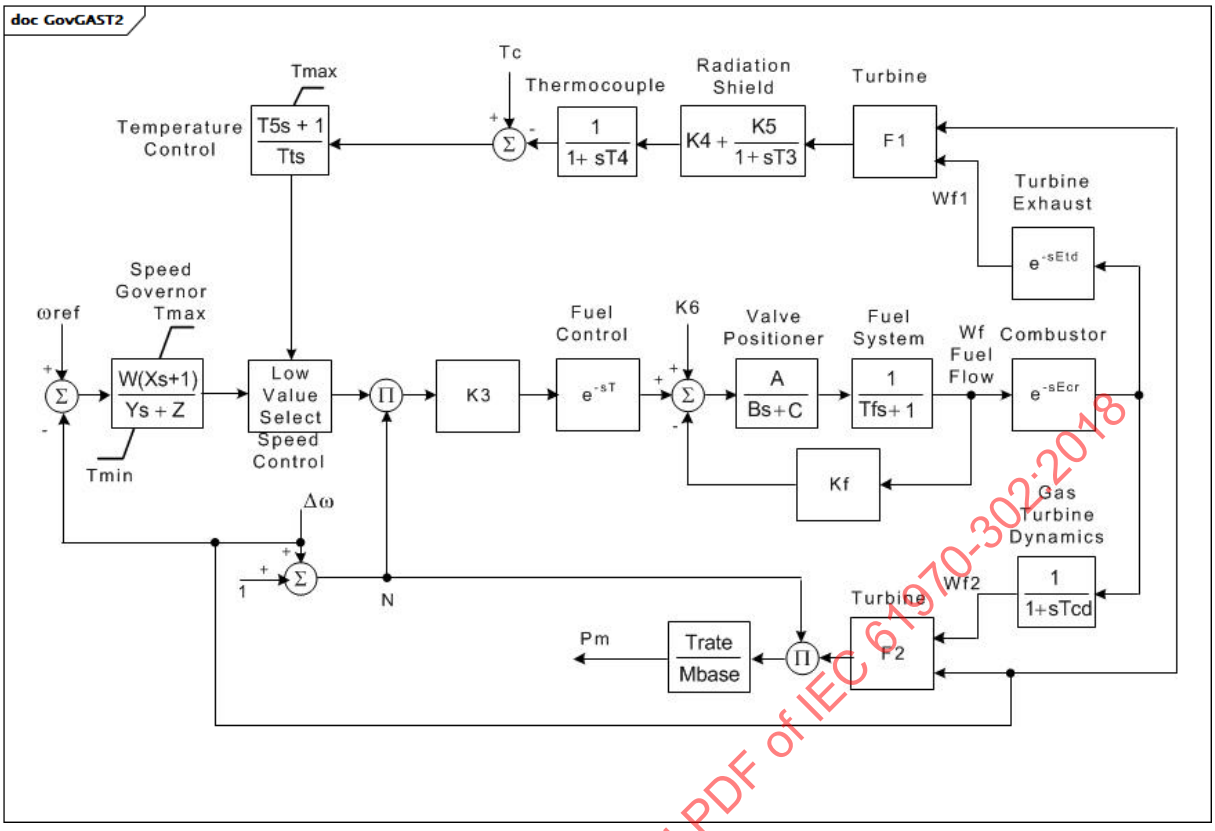

Anglais	Français
Temperature Control	Commande de température
Thermocouple	Thermocouple
Radiation Shield	Écran thermique
Turbine Exhaust	Échappement de la turbine
Speed Governor	Régulateur de vitesse
Low Value Select	Sélection de valeur faible
Speed Control	Commande de vitesse
Fuel Control	Commande du combustible
Valve Positioner	Positionneur de vanne
Fuel System	Circuit de combustible
Fuel Flow	Débit de combustible
Combustor	Chambre de combustion
Gas Turbine Dynamics	Dynamique de la turbine à gaz

Figure 49 – GovGAST2

Figure 49:Ce diagramme décrit le modèle de régulateur de turbine GovGAST2.

Détails sur les paramètres:

1) La sortie de commande de température est définie sur la sortie du régulateur de vitesse lorsque l'entrée de commande de température positive devient négative.
2) F1 = Tr – Af1(1 – Wf1) – Bf1(delta omega).
3) F2 = Af2 + Bf2(Wf2) – Cf2(delta omega).

Le Tableau 45 présente tous les attributs de GovGAST2.

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Tableau 45 – Attributs de TurbineGovernorDynamics::GovGAST2

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
w	0..1	PU	Gain du régulateur (1/statisme) sur la caractéristique assignée de la turbine (W).
x	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (X) (>= 0).
y	0..1	Seconds	Constante de temps de réponse du régulateur (Y) (> 0).
z	0..1	Integer	Mode du régulateur (Z). 1 = Statisme 0 = isochrone.
etd	0..1	Seconds	Turbine et retard d'échappement (Etd) (>= 0).
tcd	0..1	Seconds	Constante de temps de décharge du compresseur (Tcd) (>= 0).
trate	0..1	ActivePower	Caractéristique assignée de la turbine (Trate). Unité = MW.
t	0..1	Seconds	Constante de temps de commande du combustible (T) (>= 0).
tmax	0..1	PU	Limite maximale de la turbine (Tmax) (> GovGAST2.tmin).
tmin	0..1	PU	Limite minimale de la turbine (Tmin) (< GovGAST2.tmax).
ecr	0..1	Seconds	Retard de réaction de la combustion (Ecr) (>= 0).
k3	0..1	PU	Rapport de l'ajustement du combustible (K3).
a	0..1	Float	Positionneur de vanne (A).
b	0..1	Float	Positionneur de vanne (B).
c	0..1	Float	Positionneur de vanne (C).
tf	0..1	Seconds	Constante de temps du circuit de combustible (Tf) (>= 0).
kf	0..1	PU	Retour du circuit de combustible (Kf).
k5	0..1	PU	Gain de l'écran thermique (K5).
k4	0..1	PU	Gain de l'écran thermique (K4).
t3	0..1	Seconds	Constante de temps de l'écran thermique (T3) (>= 0).
t4	0..1	Seconds	Constante de temps du thermocouple (T4) (>= 0).
tt	0..1	Seconds	Taux d'intégration du régulateur de température (Tt) (>= 0).
t5	0..1	Seconds	Constante de temps du régulateur de température (T5) (>= 0).
af1	0..1	PU	Paramètre de température d'échappement (Af1). Unité = température PU. Selon la température, en °C.
bf1	0..1	PU	(Bf1). Bf1 = E(1 – W), où E (coefficient de sensibilité de la vitesse) est égal à 0,55 à 0,65 x Tr. Unité = température PU. Selon la température, en °C.
af2	0..1	PU	Coefficient égal à 0,5(1-vitesse) (Af2).
bf2	0..1	PU	Coefficient de couple de la turbine Khhv (dépend du pouvoir calorifique du flux de combustible dans la chambre de combustion) (Bf2).
cf2	0..1	PU	Coefficient définissant le débit de combustible lorsque la puissance restituée est de 0 % (Cf2). Synchrone, mais pas de sortie. En général 0,23 x Khhv (23 % du débit de combustible).
tr	0..1	Temperature	Température assignée (Tr). Unité = °C selon les paramètres Af1 et Bf1.
k6	0..1	PU	Débit minimal de combustible (K6).
tc	0..1	Temperature	Commande de température (Tc). Unité = °F ou °C selon les paramètres Af1 et Bf1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 46 présente toutes les extrémités d'association de GovGAST2 avec d'autres classes.

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Tableau 46 – Extrémités d'association de TurbineGovernorDynamics::GovGAST2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.12 GovGAST3

Turbogaz générique avec régulateur d'accélération et de température.

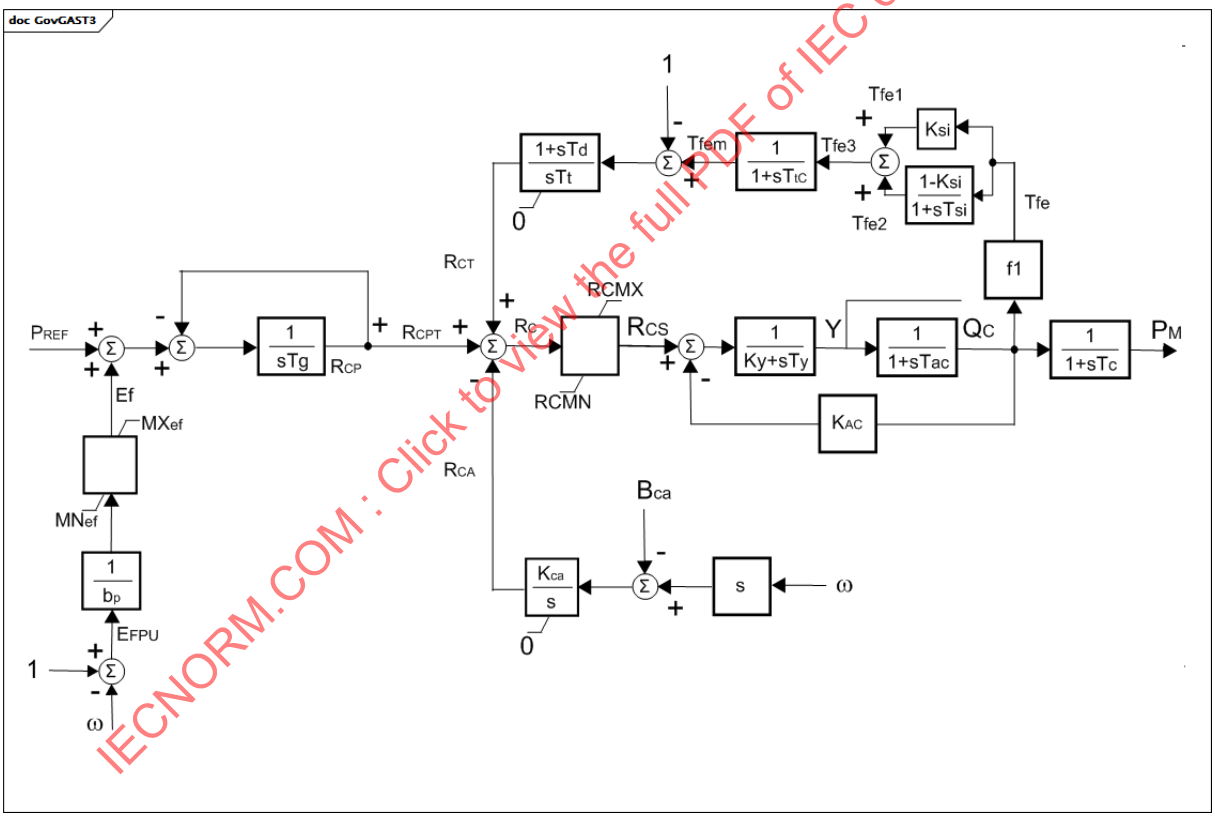

Figure 50 – GovGAST3

Figure 50: Ce diagramme décrit le modèle de régulateur de turbine GovGAST3.

Détails sur les paramètres:

1) Les paramètres PU reposent sur la capacité en MW de la turbine.
2) omega a des unités de vitesse PU.
3) Fonction pour le calcul de la température d'échappement présentée dans le diagramme GovGAST3ExhaustTemperature.

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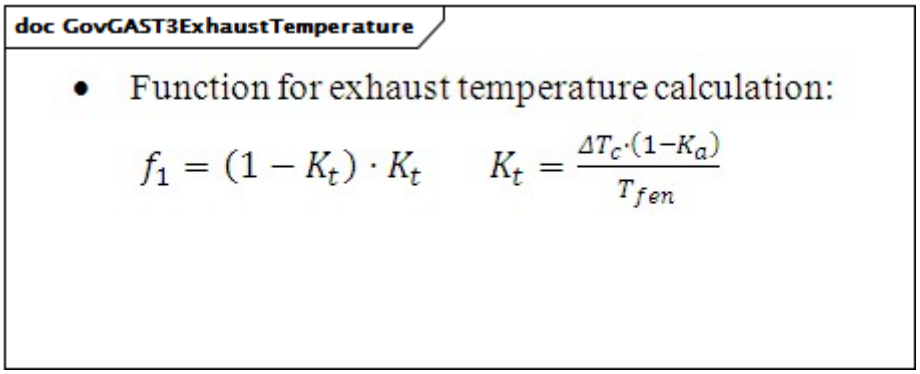

Anglais	Français
Function for exhaust temperature calculation	Fonction pour le calcul de la température d'échappement

Figure 51 – GovGAST3ExhaustTemperature

Figure 51: Ce diagramme représente la fonction pour le calcul de la température d'échappement.

Le Tableau 47 présente tous les attributs de GovGAST3.

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Tableau 47 – Attributs de TurbineGovernorDynamics::GovGAST3

nom	mult	type	description
bp	0..1	PU	Statisme (bp). Valeur classique = 0,05.
tg	0..1	Seconds	Constante de temps du régulateur de vitesse (Tg) (>= 0). Valeur classique = 0,05.
rcmx	0..1	PU	Débit maximal de combustible (RCMX). Valeur classique = 1.
rcmn	0..1	PU	Débit minimal de combustible (RCMN). Valeur classique = −0,1.
ky	0..1	Float	Coefficient de la fonction de transfert du positionneur de vanne à combustible (Ky). Valeur classique = 1.
ty	0..1	Seconds	Constante de temps du positionneur de vanne à combustible (Ty) (>= 0). Valeur classique = 0,2.
tac	0..1	Seconds	Constante de temps de commande du combustible (Tac) (>= 0). Valeur classique = 0,1.
kac	0..1	Float	Retour du circuit de combustible (KAC). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du volume de décharge du compresseur (Tc) (>= 0). Valeur classique = 0,2.
bca	0..1	Float	Point de consigne de la limite d'accélération (Bca). Unité = 1 / s. Valeur classique = 0,01.
kca	0..1	Float	Gain intégral de commande d'accélération (Kca). Unité = 1 / s. Valeur classique = 100.
dtc	0..1	Temperature	Variation de température d'échappement due à une augmentation du débit de combustible de 0 à 1 PU (deltaTc). Valeur classique = 390.
ka	0..1	PU	Débit minimal de combustible (Ka). Valeur classique = 0,23.
tsi	0..1	Seconds	Constante de temps de l'écran thermique (Tsi) (>= 0). Valeur classique = 15.
ksi	0..1	Float	Gain de l'écran thermique (Ksi). Valeur classique = 0,8.
ttc	0..1	Seconds	Constante de temps du thermocouple (Ttc) (>= 0). Valeur classique = 2,5.
tfen	0..1	Temperature	Température d'échappement assignée de la turbine correspondant à Pm = 1 PU (Tfen). Valeur classique = 540.
td	0..1	Seconds	Gain par dérivation du régulateur de température (Td) (>= 0). Valeur classique = 3,3.
tt	0..1	Temperature	Taux d'intégration du régulateur de température (Tt). Valeur classique = 250.
mxef	0..1	PU	Valeur de l'erreur positive maximale du débit de combustible (MXef). Valeur classique = 0,05.
mnef	0..1	PU	Valeur de l'erreur négative maximale du débit de combustible (MNef). Valeur classique = -0,05.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 48 présente toutes les extrémités d'association de GovGAST3 avec d'autres classes.

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Tableau 48 – Extrémités d'association de TurbineGovernorDynamics::GovGAST3 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.13 GovGAST4

Turbogaz générique.

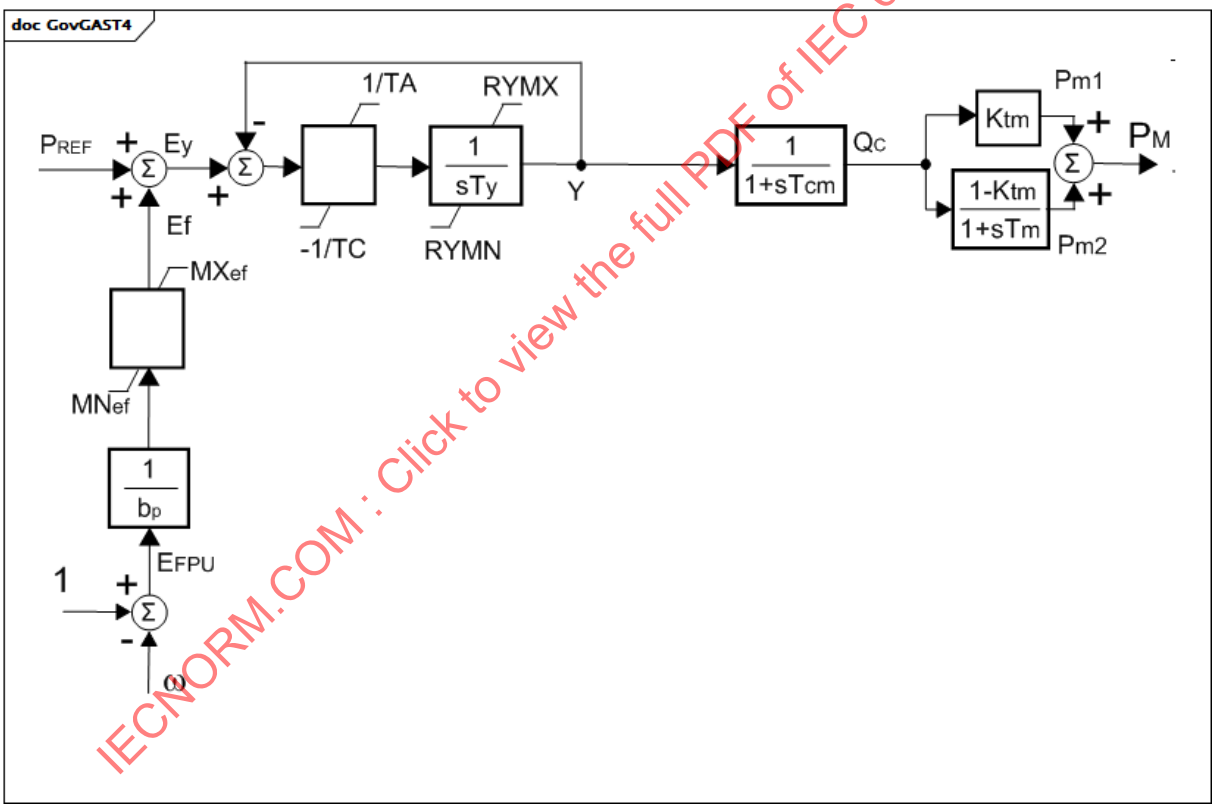

Figure 52 – GovGAST4

Figure 52: Ce diagramme décrit le modèle de régulateur de turbine GovGAST4.

Détails sur les paramètres:

1) Les paramètres PU reposent sur la capacité en MW de la turbine.
2) omega a des unités de vitesse PU.

Le Tableau 49 présente tous les attributs de GovGAST4.

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Tableau 49 – Attributs de TurbineGovernorDynamics::GovGAST4

nom	mult	type	description
bp	0..1	PU	Statisme (bp). Valeur classique = 0,05.
ty	0..1	Seconds	Constante de temps du positionneur de vanne à combustible (Ty) (>= 0). Valeur classique = 0,1.
ta	0..1	Seconds	Vitesse maximale d'ouverture de la vanne (TA) (>= 0). Valeur classique = 3.
tc	0..1	Seconds	Vitesse maximale de fermeture de la vanne (TC) (>= 0). Valeur classique = 0,5.
tcm	0..1	Seconds	Constante de temps de commande du combustible (Tcm) (>= 0). Valeur classique = 0,1.
ktm	0..1	PU	Gain du compresseur (Ktm). Valeur classique = 0.
tm	0..1	Seconds	Constante de temps du volume de décharge du compresseur (Tm) (>= 0). Valeur classique = 0,2.
rymx	0..1	PU	Ouverture maximale de la vanne (RYMX). Valeur classique = 1,1.
rymn	0..1	PU	Ouverture minimale de la vanne (RYMN). Valeur classique = 0.
mxef	0..1	PU	Valeur de l'erreur positive maximale du débit de combustible (MXef). Valeur classique = 0,05.
mnef	0..1	PU	Valeur de l'erreur négative maximale du débit de combustible (MNef). Valeur classique = -0,05.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 50 présente toutes les extrémités d'association de GovGAST4 avec d'autres classes.

Tableau 50 – Extrémités d'association de TurbineGovernorDynamics::GovGAST4 avec d'autres classes

Mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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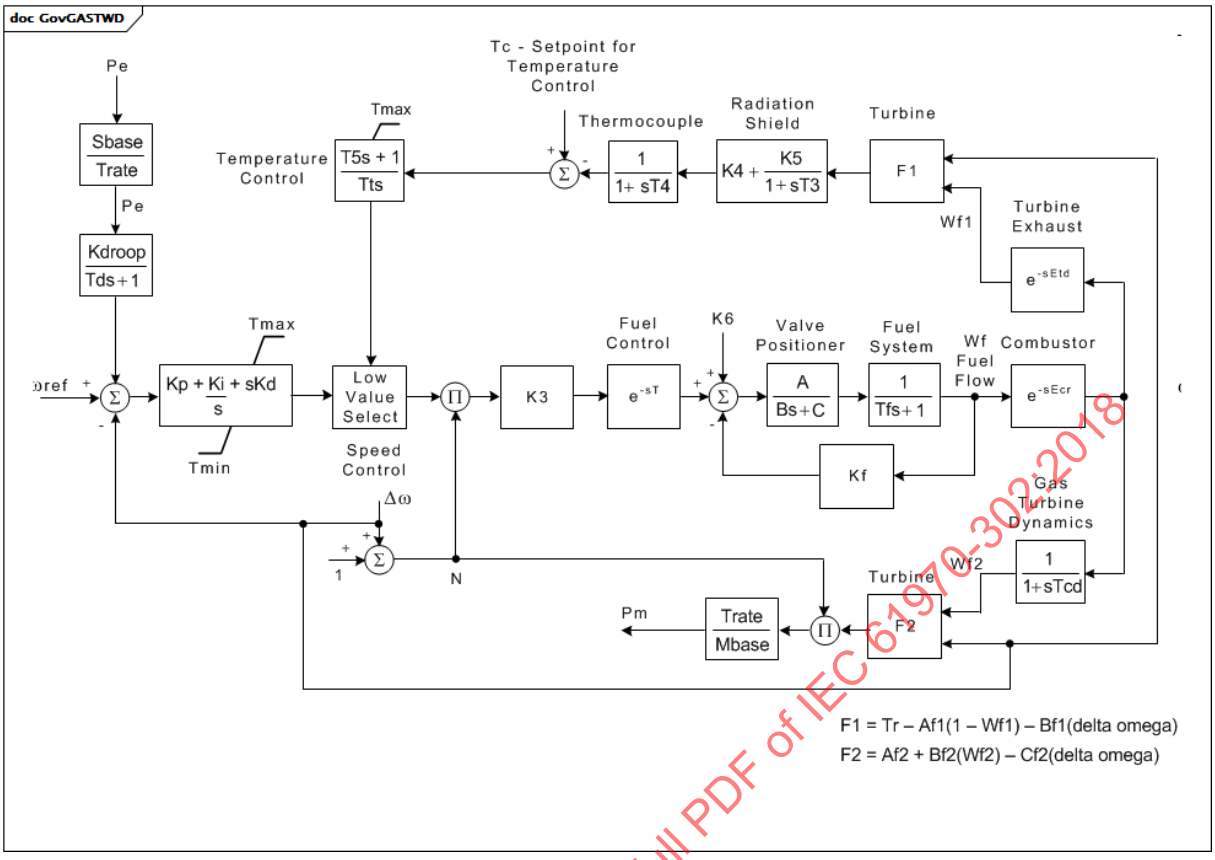
5.3.6.14 GovGASTWD

Régulateur de turbine à gaz Woodward™ [1].

[1] Les turbines à gaz Woodward sont des exemples de produits appropriés disponibles dans le commerce. Ces informations sont fournies à des fins de commodité des utilisateurs du présent document et ne constituent pas un entérinement de ces produits de la part de l'IEC.



Anglais	Français
Setpoint for Temperature Control	Point de consigne pour la commande de température
Temperature Control	Commande de température
Thermocouple	Thermocouple
Radiation Shield	Écran thermique
Turbine Exhaust	Échappement de la turbine
Speed Governor	Régulateur de vitesse
Low Value Select	Sélection de valeur faible
Speed Control	Commande de vitesse
Fuel Control	Commande du combustible
Valve Positioner	Positionneur de vanne
Fuel System	Circuit de combustible
Fuel Flow	Débit de combustible
Combustor	Chambre de combustion
Gas Turbine Dynamics	Dynamique de la turbine à gaz

Figure 53 – GovGASTWD

Figure 53: Ce diagramme décrit le modèle de régulateur de turbine GovGASTWD.

Détails sur les paramètres:

1) La sortie de commande de température est définie sur la sortie du régulateur de vitesse lorsque l'entrée de commande de température positive devient négative.
2) F1 = Tr – Af1(1 – Wf1) – Bf1(delta omega)

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3) F2 = Af2 + Bf2(Wf2) – Cf2(delta omega).

Le Tableau 51 présente tous les attributs de GovGASTWD.

Tableau 51 – Attributs de TurbineGovernorDynamics::GovGASTWD

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
kdroop	0..1	PU	(Kdroop) (>= 0).
kp	0..1	PU	Gain proportionnel du PID (Kp).
ki	0..1	PU	Gain du régulateur isochrone (Ki).
kd	0..1	PU	Gain différentiel du régulateur (Kd).
etd	0..1	Seconds	Turbine et retard d'échappement (Etd) (>= 0).
tcd	0..1	Seconds	Constante de temps de décharge du compresseur (Tcd) (>= 0).
trate	0..1	ActivePower	Caractéristique assignée de la turbine (Trate). Unité = MW.
t	0..1	Seconds	Constante de temps de commande du combustible (T) (>= 0).
tmax	0..1	PU	Limite maximale de la turbine (Tmax) (> GovGASTWD.tmin).
tmin	0..1	PU	Limite minimale de la turbine (Tmin) (< GovGASTWD.tmax).
ecr	0..1	Seconds	Retard de réaction de la combustion (Ecr) (>= 0).
k3	0..1	PU	Rapport de l'ajustement du combustible (K3).
a	0..1	Float	Positionneur de vanne (A).
b	0..1	Float	Positionneur de vanne (B).
c	0..1	Float	Positionneur de vanne (C).
tf	0..1	Seconds	Constante de temps du circuit de combustible (Tf) (>= 0).
kf	0..1	PU	Retour du circuit de combustible (Kf).
k5	0..1	PU	Gain de l'écran thermique (K5).
k4	0..1	PU	Gain de l'écran thermique (K4).
t3	0..1	Seconds	Constante de temps de l'écran thermique (T3) (>= 0).
t4	0..1	Seconds	Constante de temps du thermocouple (T4) (>= 0).
tt	0..1	Seconds	Taux d'intégration du régulateur de température (Tt) (>= 0).
t5	0..1	Seconds	Constante de temps du régulateur de température (T5) (>= 0).
af1	0..1	PU	Paramètre de température d'échappement (Af1).
bf1	0..1	PU	(Bf1). Bf1 = E(1-w), où E (coefficient de sensibilité de la vitesse) est égal à 0,55 à 0,65 x Tr.
af2	0..1	PU	Coefficient égal à 0,5(1-vitesse) (Af2).
bf2	0..1	PU	Coefficient de couple de la turbine Khhv (dépend du pouvoir calorifique du flux de combustible dans la chambre de combustion) (Bf2).
cf2	0..1	PU	Coefficient définissant le débit de combustible lorsque la puissance restituée est de 0 % (Cf2). Synchrone, mais pas de sortie. En général 0,23 x Khhv (23 % du débit de combustible).
tr	0..1	Temperature	Température assignée (Tr).
k6	0..1	PU	Débit de combustible minimal (K6).
tc	0..1	Temperature	Commande de température (Tc).
td	0..1	Seconds	Constante de temps du transducteur de puissance (Td) (>= 0).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 52 présente toutes les extrémités d'association de GovGASTWD avec d'autres classes.

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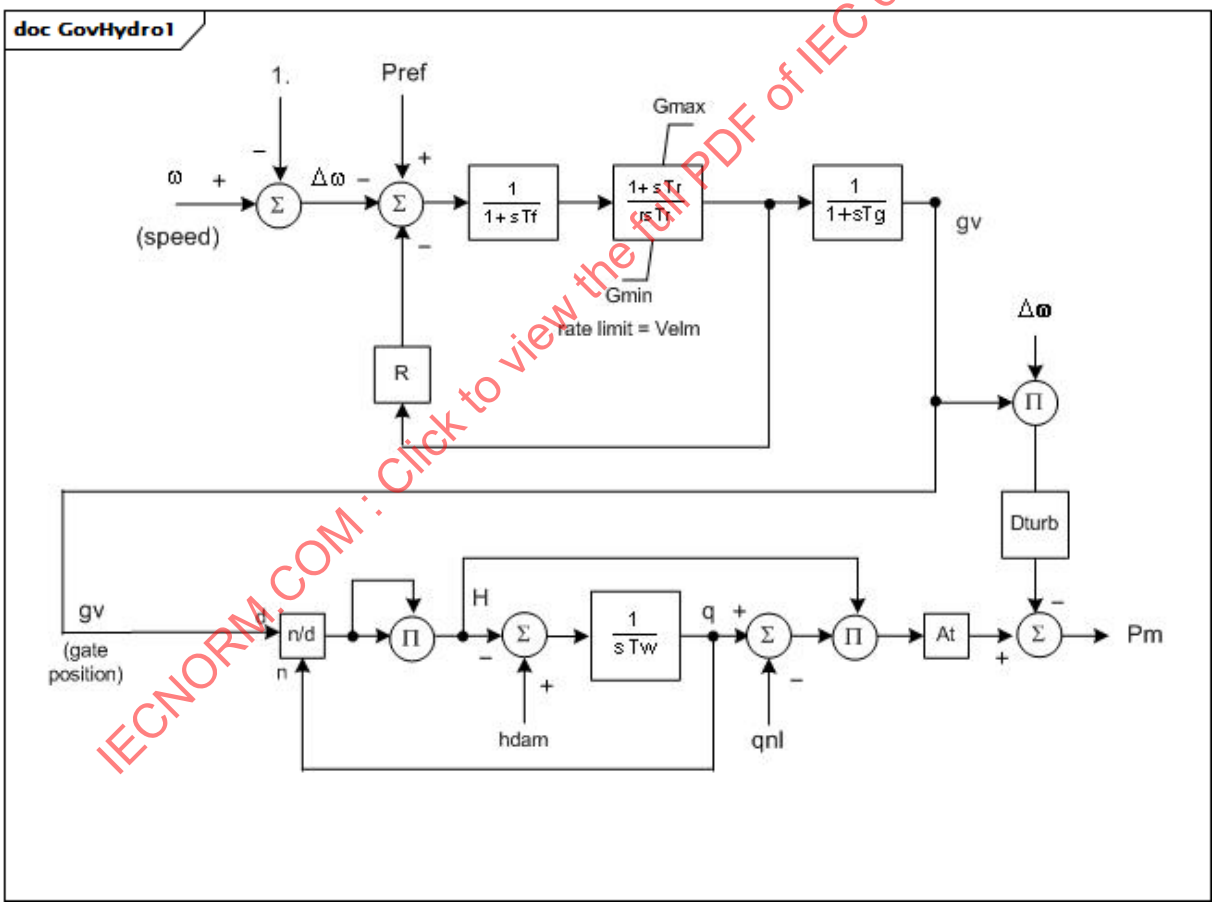
Tableau 52 – Extrémités d'association de TurbineGovernorDynamics::GovGASTWD avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.15 GovHydro1

Régulateur d'hydroturbine de base.



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Anglais	Français
(speed)	(vitesse)
rate limit	limite assignée
(gate position)	(position de la vanne)

Figure 54 – GovHydro1

Figure 54: Ce diagramme décrit le modèle de régulateur de turbine GovHydro1.

Détails sur les paramètres:

1) Les paramètres PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.
2) Les vannes se déplacent sur une plage de 1,0 PU d'une position de fermeture totale à une position d'ouverture totale. La position de la vanne est en principe supérieure à zéro à puissance nulle. Elle est en principe inférieure à 1,0 lorsque la puissance est de 1,0 PU. Gmax et Gmin sont les limites de fonctionnement.
3) Les unités de Dturb sont delta P (PU de mwcap)/vitesse delta (PU).

Le Tableau 53 présente tous les attributs de GovHydro1.

Tableau 53 – Attributs de TurbineGovernorDynamics::GovHydro1

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
rperm	0..1	PU	Statisme permanent (R) (> 0). Valeur classique = 0,04.
rtemp	0..1	PU	Statisme temporaire (r) (> GovHydro1.rperm). Valeur classique = 0,3.
tr	0..1	Seconds	Constante de temps de relaxation (Tr) (> 0). Valeur classique = 5.
tf	0..1	Seconds	Constante de temps de filtrage (Tf) (> 0). Valeur classique = 0,05.
tg	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tg) (> 0). Valeur classique = 0,5.
velm	0..1	Float	Vitesse maximale de la vanne (Vlem) (> 0). Valeur classique = 0,2.
gmax	0..1	PU	Ouverture maximale de la vanne (Gmax) (> 0 et > GovHydro.gmin). Valeur classique = 1.
gmin	0..1	PU	Ouverture minimale de la vanne (Gmin) (>= 0 et < GovHydro1.gmax). Valeur classique = 0.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (> 0). Valeur classique = 1.
at	0..1	PU	Gain de la turbine (At) (> 0). Valeur classique = 1,2.
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb) (>= 0). Valeur classique = 0,5.
qnl	0..1	PU	Débit sans charge à chute nominale (qnl) (>= 0). Valeur classique = 0,08.
hdam	0..1	PU	Chute nominale de la turbine (hdam). Valeur classique = 1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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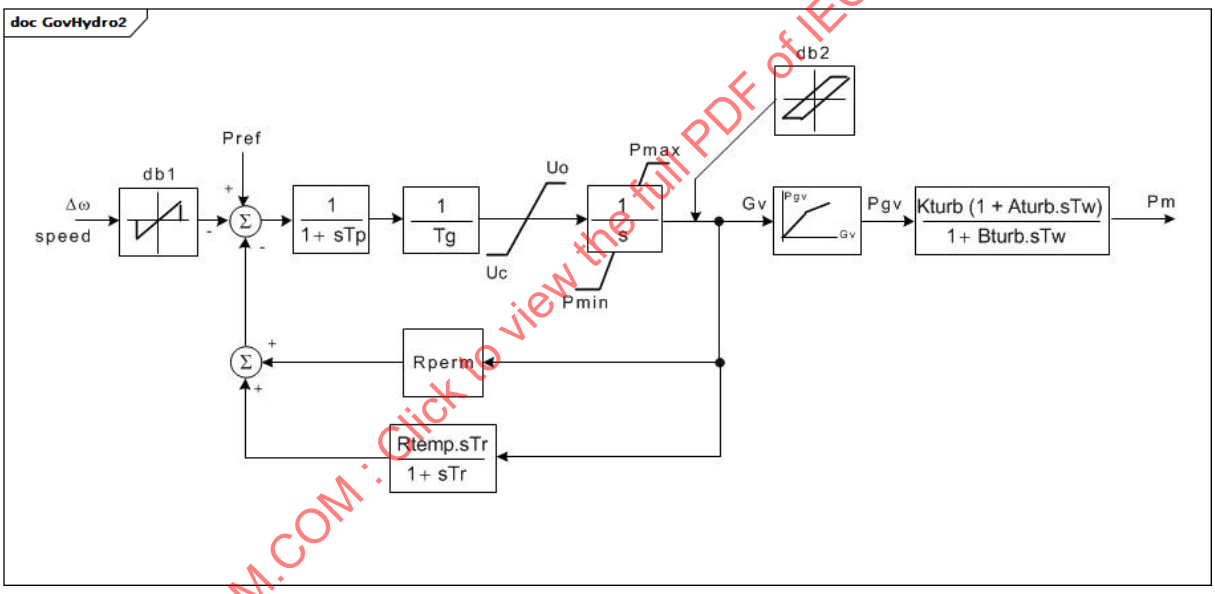
Le Tableau 54 présente toutes les extrémités d'association de GovHydro1 avec d'autres classes.

Tableau 54 – Extrémités d'association de TurbineGovernorDynamics::GovHydro1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.16 GovHydro2

Régulateur d'hydroturbine IEEE avec conduites forcées directes et régulateur à amortisseur hydraulique.



Anglais	Français
speed	vitesse

Figure 55 – GovHydro2

Figure 55: Ce diagramme décrit le modèle de régulateur de turbine GovHydro2.

Détails sur les paramètres:

1) Les paramètres PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.
2) Ce modèle de régulateur de turbine est une approximation raisonnable des performances des centrales hydroélectriques simples pour de petits mouvements des vannes en fonction d'une charge donnée. Toutefois, il représente la variation des effets d'inertie de l'eau en fonction de la charge uniquement si l'utilisateur ajuste correctement les valeurs des paramètres de la turbine au fur et à mesure de la variation de charge. Pour un modèle de turbine idéal, définir Kturb = 1,0, Aturb = -1,0, Bturb = 0,5.

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3) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0.) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

4) Pour des raisons de compatibilité avec les anciennes versions de ce modèle: Kturb = a23, Aturb = a11 – a13 x a21/a23, Bturb = a11.

Le Tableau 55 présente tous les attributs de GovHydro2.

Tableau 55 – Attributs de TurbineGovernorDynamics::GovHydro2

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
tg	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tg) (< 0). Valeur classique = 0,5.
tp	0..1	Seconds	Constante de temps du servodistributeur du pilote (Tp) (>= 0). Valeur classique = 0,03.
uo	0..1	Float	Vitesse maximale d'ouverture de la vanne (Uo). Unité = PU / s. Valeur classique = 0,1.
uc	0..1	Float	Vitesse de fermeture maximale de la vanne (Uc) (< 0). Unité = PU / s. Valeur classique = -0,1.
pmax	0..1	PU	Ouverture maximale de la vanne (Pmax) (> GovHydro2.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne (Pmin) (< GovHydro2.pmax). Valeur classique = 0.
rperm	0..1	PU	Statisme permanent (Rperm). Valeur classique = 0,05.
rtemp	0..1	PU	Statisme temporaire (Rtemp). Valeur classique = 0,5.
tr	0..1	Seconds	Constante de temps de l'amortisseur (Tr) (>= 0). Valeur classique = 12.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (>= 0). Valeur classique = 2.
kturb	0..1	PU	Gain de la turbine (Kturb). Valeur classique = 1.
aturb	0..1	PU	Multiplicateur numérateur de la turbine (Aturb). Valeur classique = -1.
bturb	0..1	PU	Multiplicateur dénominateur de la turbine (Bturb) (> 0). Valeur classique = 0,5.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 56 présente toutes les extrémités d'association de GovHydro2 avec d'autres classes.

Tableau 56 – Extrémités d'association de TurbineGovernorDynamics::GovHydro2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.17 GovHydro3

Régulateur de turbine hydraulique IEEE modifiée.

Ce modèle diffère de celui défini dans le document comprenant les lignes directrices pour la modélisation IEEE en ce sens que les limites de position et de vitesse de la vanne ne permettent pas une "extraction" des signaux en amont.

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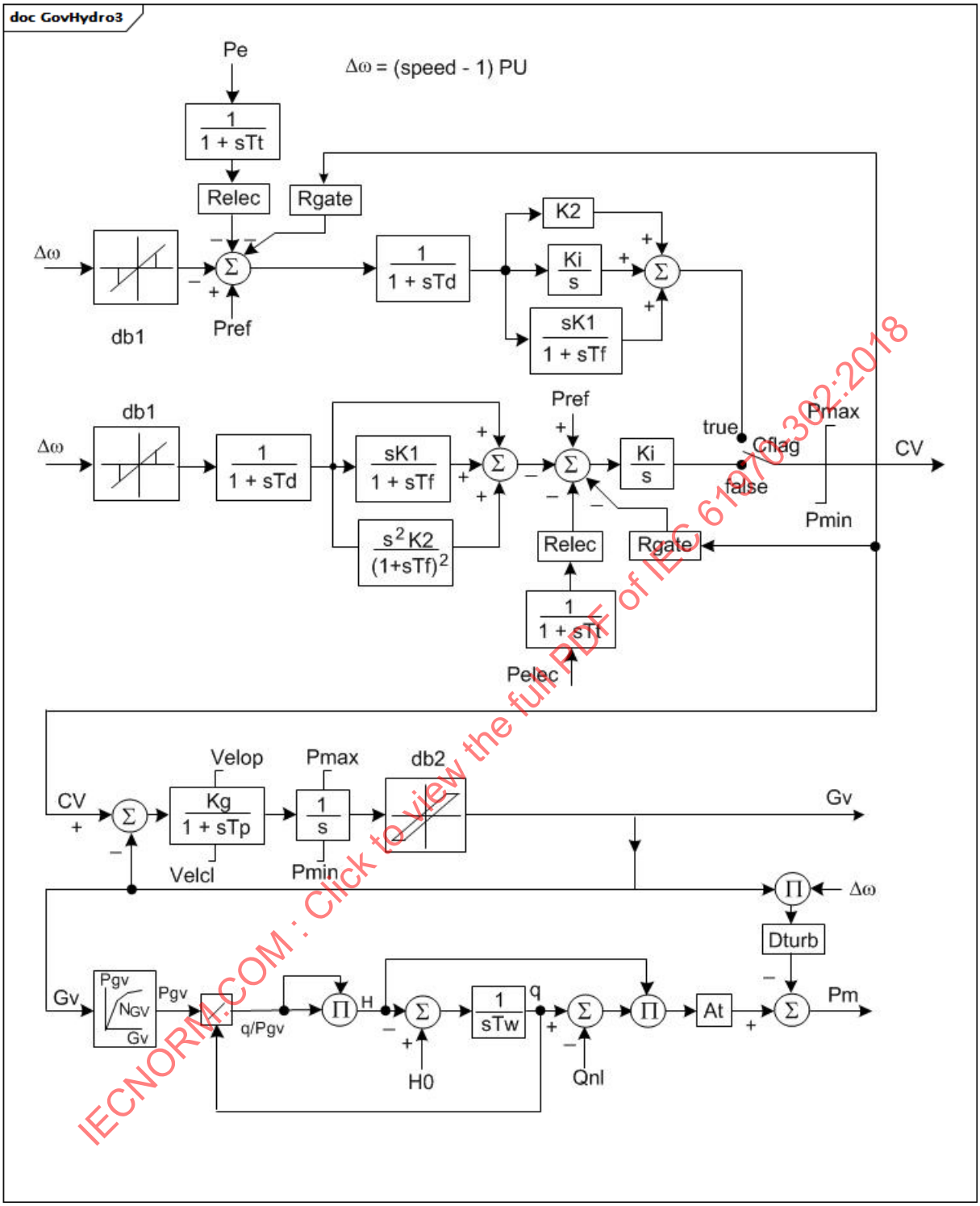

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Anglais	Français
(speed – 1)	(vitesse – 1)

Figure 56 – GovHydro3

Figure 56: Ce diagramme décrit le modèle de régulateur de turbine GovHydro3.

Détails sur les paramètres:

1) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

Le Tableau 57 présente tous les attributs de GovHydro3.

Tableau 57 – Attributs de TurbineGovernorDynamics::GovHydro3

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
pmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Pmax) (> GovHydro3.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Pmin) (< GovHydro3.pmax). Valeur classique = 0.
governorControl	0..1	Boolean	Fanion de commande du régulateur (Cflag). true = commande PID active false = commande par dérivée double active. Valeur classique = true.
rgate	0..1	PU	Statisme en régime établi, PU, pour mode à rebouclage par la sortie du régulateur (Rgate). Valeur classique = 0.
relec	0..1	PU	Statisme en régime établi, PU, pour réaction de puissance électrique (Relec). Valeur classique = 0,05.
td	0..1	Seconds	Constante de temps du filtre d'entrée (Td) (>= 0). Valeur classique = 0,05.
tf	0..1	Seconds	Constante de temps de relaxation (Tf) (>= 0). Valeur classique = 0,1.
tp	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tp) (>= 0). Valeur classique = 0,05.
velop	0..1	Float	Vitesse maximale d'ouverture de la vanne (Velop). Unité = PU / s. Valeur classique = 0,2.
velcl	0..1	Float	Vitesse maximale de fermeture de la vanne (Velcl). Unité = PU / s. Valeur classique = −0,2.
k1	0..1	PU	Gain par dérivation (K1). Valeur classique = 0,01.
k2	0..1	PU	Gain par dérivation double, si Cflag = -1 (K2). Valeur classique = 2,5.
ki	0..1	PU	Gain intégral (Ki). Valeur classique = 0,5.
kg	0..1	PU	Gain de l'asservissement de vanne de puissance (Kg). Valeur classique = 2.
tt	0..1	Seconds	Constante de temps de réaction de puissance (Tt) (>= 0). Valeur classique = 0,2.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (>= 0). Si cette valeur est nulle, le bloc est contourné. Valeur classique = 1.
at	0..1	PU	Gain de la turbine (At) (> 0). Valeur classique = 1,2.
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb). Valeur classique = 0,2.
qnl	0..1	PU	Débit sans charge de la turbine à chute nominale (Qnl). Valeur classique = 0,08.
h0	0..1	PU	Chute nominale de la turbine (H0). Valeur classique = 1.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.

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nom	mult	type	description
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 58 présente toutes les extrémités d'association de GovHydro3 avec d'autres classes.

Tableau 58 – Extrémités d'association de TurbineGovernorDynamics::GovHydro3 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.6.18 GovHydro4

Turbine hydraulique et régulateur. Représente les centrales à conduites forcées directes et régulateurs hydrauliques de type "amortisseur" traditionnels. Ce modèle peut être utilisé pour représenter des turbines simples, Francis/Pelton ou Kaplan.

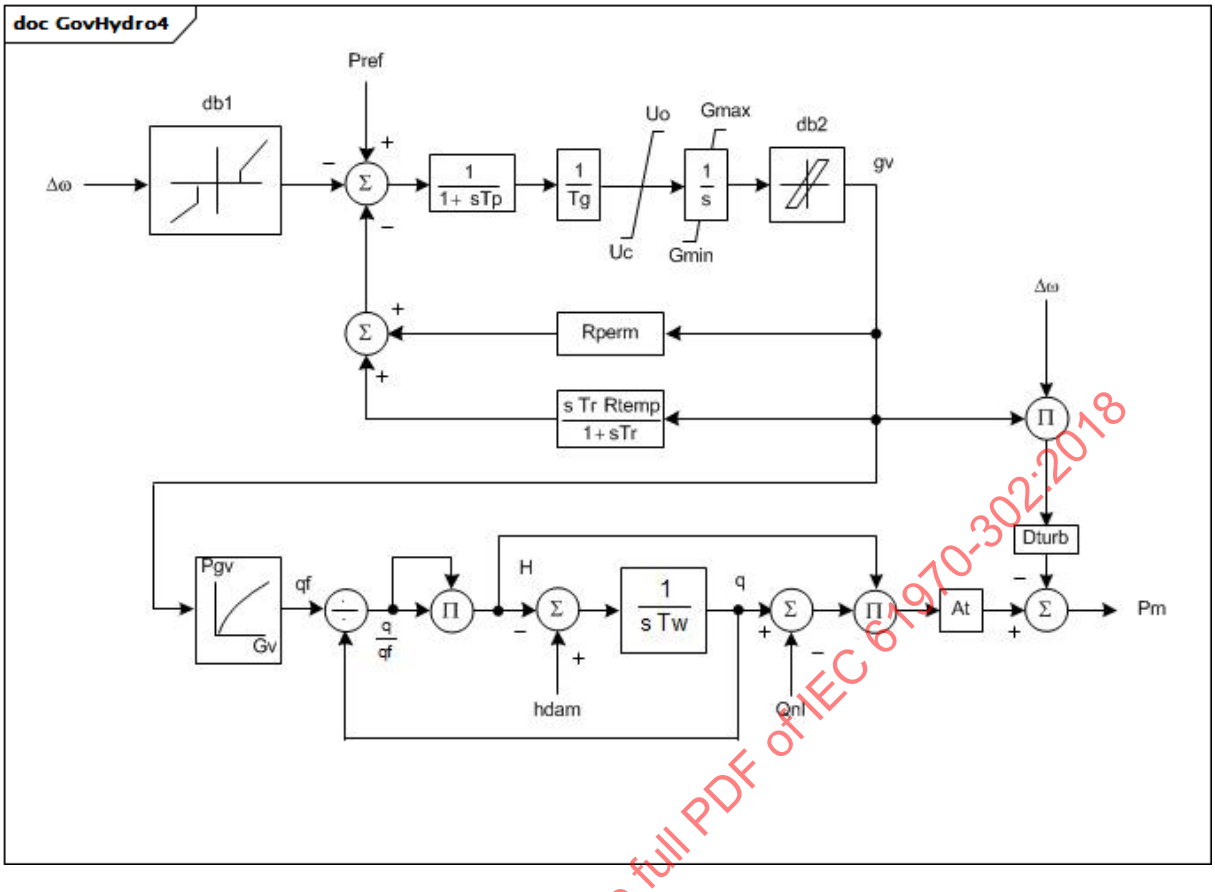

Figure 57 – GovHydro4

Figure 57: Ce diagramme décrit le modèle de régulateur de turbine GovHydro4.

Détails sur les paramètres:

1) Le modèle GovHydro4 peut être utilisé pour représenter trois variantes différentes de modèle normalisé: simple, Francis/Pelton et Kaplan.
2) Les vannes se déplacent sur une plage de 1 à 0 PU d'une position de fermeture totale à une position d'ouverture totale. La position des vannes est supérieure à zéro à puissance nulle. Elle est en principe inférieure à 1 PU lorsque la puissance est de 1 PU, Gmax et Gmin étant les limites de fonctionnement.
3) Les combinaisons suivantes de paramètres sont utilisées par les variantes afin de représenter les caractéristiques de vanne-chute-débit-puissance:
   - Simple: la ligne présentant la chute At et l'interception avec Qnl décrit les caractéristiques de l'ouverture de la vanne à la puissance de la turbine (comme représenté dans le diagramme GovHydro4SimpleHydroTurbine). Cette courbe est proportionnelle à la puissance de la turbine, la constante de proportionnalité étant fonction de la chute disponible. Cette constante est spécifiée par le gain de la turbine, At. Les paramètres Gv0 à Gv5, Pgv0 à Pgv5, et Bgv0 à Bgv5 ne sont pas pris en considération.
   - modèle de turbine Francis/Pelton: Les paramètres (Gv0, Pgv0) à (Gv5, Pgv5) sont utilisés pour décrire les caractéristiques non linéaires de l'ouverture de la vanne à la puissance de la turbine et de l'angle (comme représenté dans le diagramme GovHydro4FrancisPeltonTurbine). Les paramètres Bgv0 à Bgv5 ne sont pas pris en considération.
   - modèle de turbine Kaplan: Les paramètres (Gv0, Pgv0) à (Gv5, Pgv5) et (Gv0, Bv0) à (Gv5, Bgv5) sont utilisés pour décrire les caractéristiques non linéaires de l'ouverture de la vanne à la puissance de la turbine et de l'ouverture de la vanne à l'inclinaison des pales (comme représenté dans le diagramme GovHydro4KaplanTurbine).

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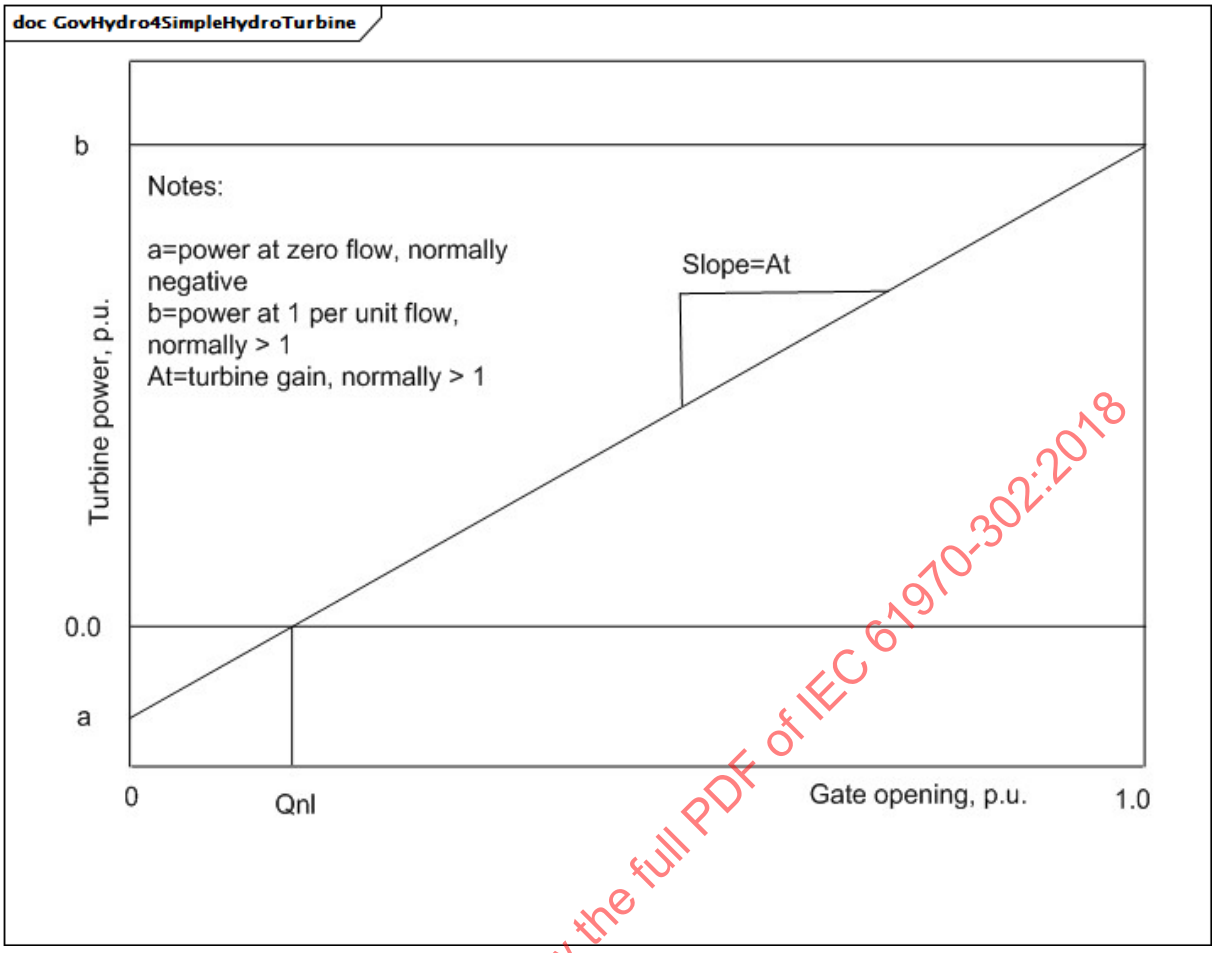

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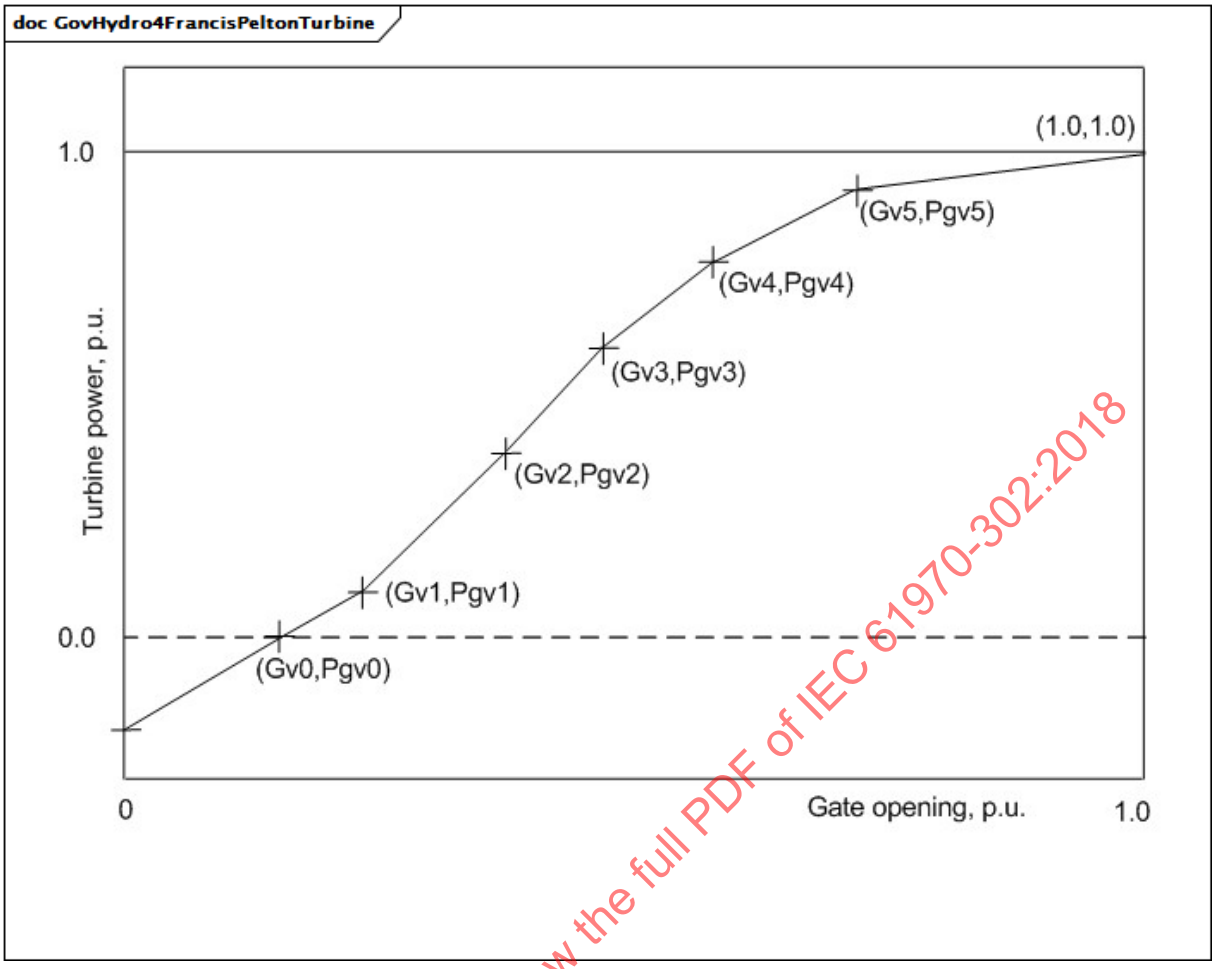
Anglais	Français
a=power at zero flow, normally negative	a = puissance à débit nul, en principe négative
b= power at 1 per unit flow, normally > 1	b= puissance à débit de 1 par unité, en principe > 1
At=turbine gain, normally > 1	At = gain de la turbine, en principe > 1
Slope=At	Pente = At
Gate opening	Ouverture de la vanne
Turbine power	Puissance de la turbine

Figure 58 – GovHydro4SimpleHydroTurbine

Figure 58: Ce diagramme représente les caractéristiques de vanne-chute-débit-puissance pour un modèle général simple.



Anglais	Français
Gate opening	Ouverture de la vanne
Turbine power	Puissance de la turbine

Figure 59 – GovHydro4FrancisPeltonTurbine

Figure 59: Ce diagramme représente les caractéristiques de vanne-chute-débit-puissance pour un modèle de turbine Francis/Pelton.

Détails sur les paramètres:

1) La courbe décrite de (Gv0, Pgv0) à (Gv5, Pgv5) présente la relation du débit de la turbine par rapport à la course de la vanne actionnant le servomoteur.
2) Si Gv0 est supérieur à 0, les deux premiers points de données sont utilisés afin d'extrapoler vers le bas les positions de vanne inférieures à Gv0. Si Gv0 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

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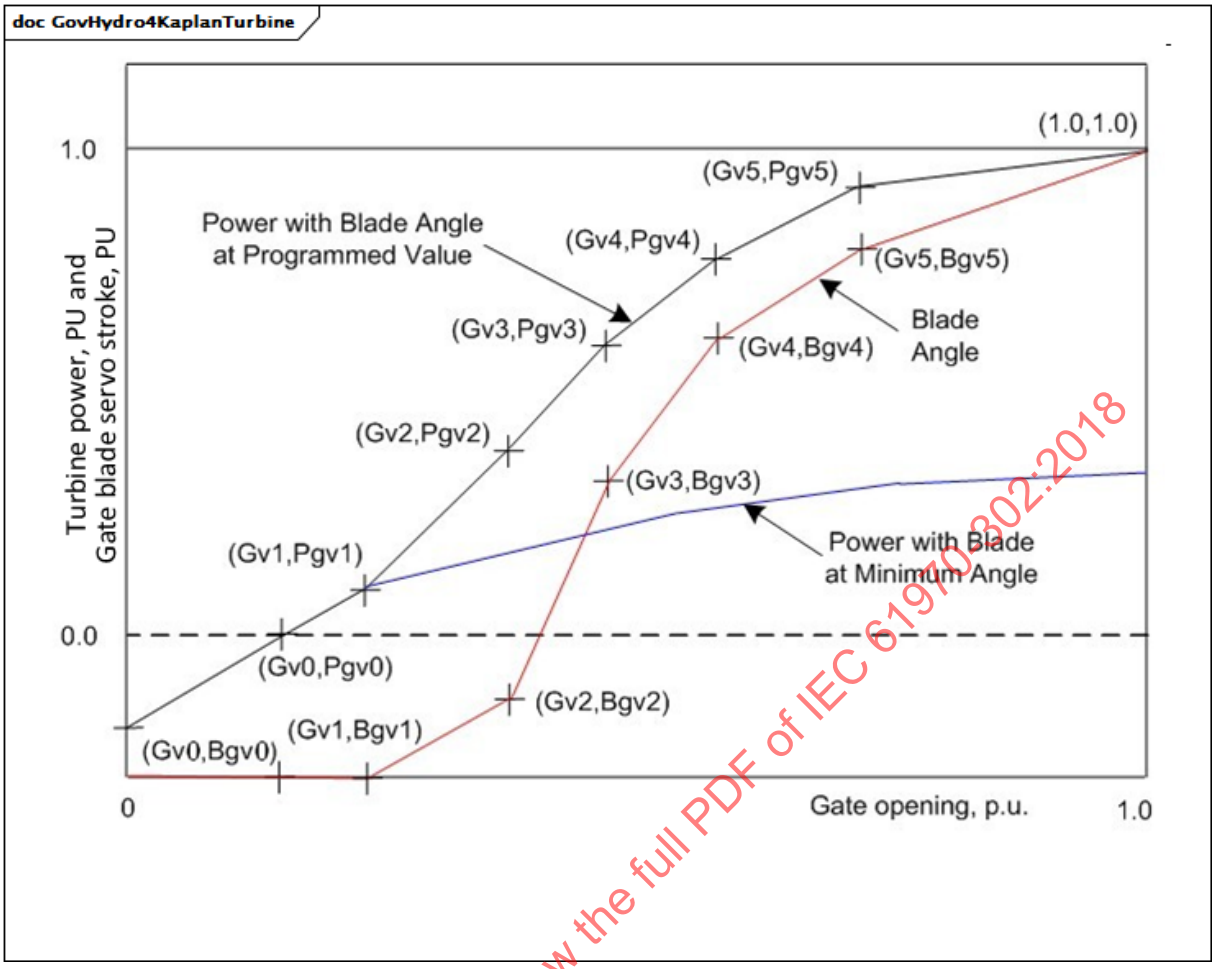

Anglais	Français
Power with Blade Angle at Programmed Value	Puissance avec inclinaison de pale à la valeur programmée
Blade Angle	Inclinaison de pale
Power with Blade at Minimum Angle	Puissance à inclinaison minimale de pale
Gate opening	Ouverture de la vanne
Turbine power, PU and Gate blade servo stroke, PU	Puissance de la turbine, PU, et Course servomoteur des pales de la vanne, PU

Figure 60 – GovHydro4KaplanTurbine

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Figure 60: Ce diagramme représente les caractéristiques non linéaires de l'ouverture de la vanne à la puissance de la turbine et de l'ouverture de la vanne à l'inclinaison des pales pour un modèle de turbine Kaplan.

Détails sur les paramètres:

1) La courbe décrite de (Gv0, Pgv0) à (Gv5, Pgv5) présente la relation du débit de la turbine par rapport à la course de la vanne actionnant le servomoteur.
2) Si Gv0 est supérieur à 0, les deux premiers points de données sont utilisés afin d'extrapoler vers le bas les positions de vanne inférieures à Gv0. Si Gv0 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

Le Tableau 59 présente tous les attributs de GovHydro4.

Tableau 59 – Attributs de TurbineGovernorDynamics::GovHydro4

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
tg	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tg) (> 0). Valeur classique = 0,5.
tp	0..1	Seconds	Constante de temps du servodistributeur du pilote (Tp) (>= 0). Valeur classique = 0,1.
uo	0..1	Float	Vitesse max d'ouverture de la vanne (Uo). Valeur classique = 0,2.
uc	0..1	Float	Vitesse max de fermeture de la vanne (Uc). Valeur classique = 0,2.
gmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Gmax) (> GovHydro4.gmin). Valeur classique = 1.
gmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Gmin) (< GovHydro4.gmax). Valeur classique = 0.
rperm	0..1	Seconds	Statisme permanent (Rperm) (>= 0). Valeur classique = 0,05.
rtemp	0..1	Seconds	Statisme temporaire (Rtemp) (>= 0). Valeur classique = 0,3.
tr	0..1	Seconds	Constante de temps de l'amortisseur (Tr) (>= 0). Valeur classique = 5.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (> 0). Valeur classique = 1.
at	0..1	PU	Gain de la turbine (At). Valeur classique = 1,2.
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb). Unité = delta P (PU de MWbase)/vitesse delta (PU). Valeur classique pour modèle simple = 0,5, pour modèle Francis/Pelton = 1,1 et Kaplan = 1,1.
hdam	0..1	PU	Chute disponible au niveau du barrage (hdam). Valeur classique = 1.
qnl	0..1	PU	Débit sans charge à chute nominale (Qnl). Valeur classique pour modèle simple = 0,08, pour modèle Francis/Pelton = 0,1 et Kaplan = 0.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
gv0	0..1	PU	Point 0 de gain non linéaire, PU gv (Gv0) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,1 et Kaplan = 0,1.
pgv0	0..1	PU	Point 0 de gain non linéaire, puissance PU (Pgv0) (= 0 pour modèle simple). Valeur classique = 0.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1) (= 0 pour modèle simple, > GovHydro4.gv0 pour Francis/Pelton et Kaplan). Valeur classique pour Francis/Pelton = 0,4 et Kaplan = 0,4.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,42 et Kaplan = 0,35.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2) (= 0 pour modèle simple, > GovHydro4.gv1 pour Francis/Pelton et Kaplan). Valeur classique pour Francis/Pelton = 0,5 et Kaplan = 0,5.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,56 et Kaplan = 0,468.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3) (= 0 pour modèle simple, > GovHydro4.gv2 pour Francis/Pelton et Kaplan). Valeur classique pour Francis/Pelton = 0,7 et Kaplan = 0,7.

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nom	mult	type	description
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,8 et Kaplan = 0,796.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4) (= 0 pour modèle simple, > GovHydro4.gv3 pour Francis/Pelton et Kaplan). Valeur classique pour Francis/Pelton = 0,8 et Kaplan = 0,8.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,9 et Kaplan = 0,917.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5) (= 0 pour modèle simple, < 1 et > GovHydro4.gv4 pour Francis/Pelton et Kaplan). Valeur classique pour Francis/Pelton = 0,9 et Kaplan = 0,9.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5) (= 0 pour modèle simple). Valeur classique pour Francis/Pelton = 0,97 et Kaplan = 0,99.
bgv0	0..1	PU	Point 0 de servo de pale Kaplan (Bgv0) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 0.
bgv1	0..1	PU	Point 1 de servo de pale Kaplan (Bgv1) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 0.
bgv2	0..1	PU	Point 2 de servo de pale Kaplan (Bgv2) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 0,1.
bgv3	0..1	PU	Point 3 de servo de pale Kaplan (Bgv3) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 0,667.
bgv4	0..1	PU	Point 4 de servo de pale Kaplan (Bgv4) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 0,9.
bgv5	0..1	PU	Point 5 de servo de pale Kaplan (Bgv5) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 1.
bmax	0..1	Float	Facteur d'ajustement maximal de la pale (Bmax) (= 0 pour modèle simple, = 0 pour Francis/Pelton). Valeur classique pour Kaplan = 1,1276.
tblade	0..1	Seconds	Constante de temps de la servo de pale (Tblade) (>= 0). Valeur classique = 100.
model	0..1	GovHydro4ModelKind	Type de modèle représenté (simple, Francis/Pelton, ou Kaplan)
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 60 présente toutes les extrémités d'association de GovHydro4 avec d'autres classes.

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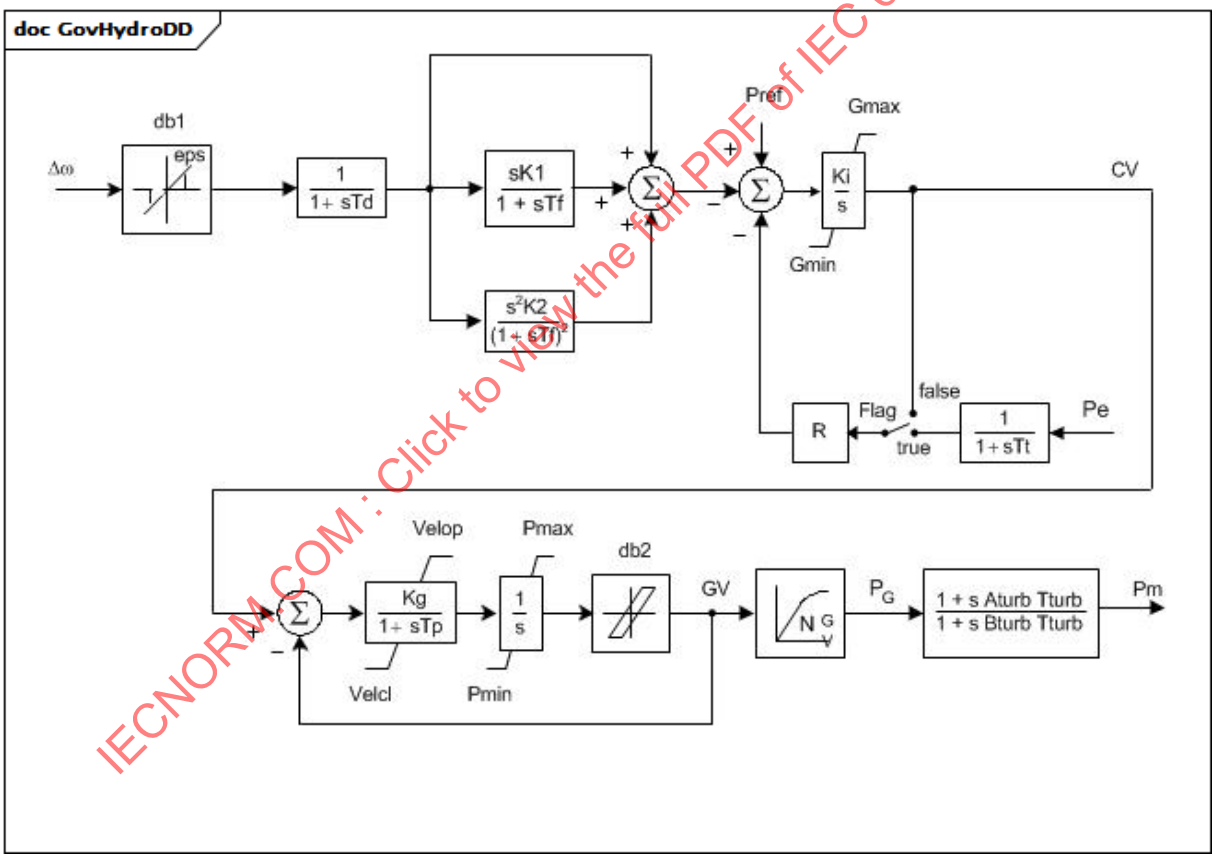
Tableau 60 – Extrémités d'association de TurbineGovernorDynamics::GovHydro4 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.19 GovHydroDD

Régulateur et turbine hydrauliques par dérivée double.



Anglais	Français
Flag	Fanion

Figure 61 – GovHydroDD

Figure 61: Ce diagramme décrit le modèle de régulateur de turbine GovHydroDD.

Détails sur les paramètres:

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1) Si Tf est entré sous la forme d'une valeur nulle, mais que K1 ou K2 n'est pas nul, une petite valeur est attribuée à Tf (4 fois l'intervalle d'intégration). Si Bturb x Tturb est inférieur à 4 fois l'intervalle d'intégration, une valeur nulle est attribuée à Tturb pour contourner le bloc.

2) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

3) S'agissant d'une turbine hydraulique, définir Tturb = Tw (temps au démarrage de l'écoulement de l'eau), et définir Aturb = -1,0 et Bturb = 0,5. S'agissant d'un moteur diesel ou d'une turbine à gaz à deux arbres, définir Aturb = 0,8 et Bturb = 1,0 et Tturb = 1 s. S'agissant d'une petite turbine à vapeur avec une alimentation en vapeur sans resurchauffe ou d'une turbine à gaz monoarbre, définir Aturb = 0,0 et Bturb = 1,0 et Tturb = 0,2 s.

Le Tableau 61 présente tous les attributs de GovHydroDD.

Tableau 61 – Attributs de TurbineGovernorDynamics::GovHydroDD

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
pmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Pmax) (> GovHydroDD.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Pmin) (< GovHydroDD.pmax). Valeur classique = 0.
r	0..1	PU	Statisme en régime établi (R). Valeur classique = 0,05.
td	0..1	Seconds	Constante de temps du filtre d'entrée (Td) (>= 0) Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0.
tf	0..1	Seconds	Constante de temps de relaxation (Tf) (>= 0). Valeur classique = 0,1.
tp	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tp) (>= 0) Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0,35.
velop	0..1	Float	Vitesse maximale d'ouverture de la vanne (Velop). Unité = PU / s. Valeur classique = 0,09.
velcl	0..1	Float	Vitesse maximale de fermeture de la vanne (Velcl). Unité = PU / s. Valeur classique = -0,14.
k1	0..1	PU	Gain par dérivation simple (K1). Valeur classique = 3,6.
k2	0..1	PU	Gain par dérivation double (K2). Valeur classique = 0,2.
ki	0..1	PU	Gain intégral (Ki). Valeur classique = 1.
kg	0..1	PU	Gain de l'asservissement de vanne de puissance (Kg). Valeur classique = 3.
tturb	0..1	Seconds	Constante de temps de la turbine (Tturb) (>= 0) (voir le détail 3 sur les paramètres). Valeur classique = 0,8.
aturb	0..1	PU	Multiplicateur numérateur de la turbine (Aturb) (voir le détail 3 sur les paramètres). Valeur classique = −1.
bturb	0..1	PU	Multiplicateur dénominateur de la turbine (Bturb) (voir le détail 3 sur les paramètres). Valeur classique = 0,5.
tt	0..1	Seconds	Constante de temps de réaction de puissance (Tt) (>= 0). Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0,02.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.

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nom	mult	type	description
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
gmax	0..1	PU	Ouverture maximale de la vanne (Gmax) (> GovHydroDD.gmin). Valeur classique = 0.
gmin	0..1	PU	Ouverture minimale de la vanne (Gmin) (< GovHydroDD.gmax). Valeur classique = 0.
inputSignal	0..1	Boolean	Commutateur de signal d'entrée (Fanion). true = entrée Pe utilisée false = retour reçu de CV. Le fanion dépend en principe de Tt. Si Tt est nul, la valeur false est attribuée au Fanion. Si Tt n'est pas nul, la valeur true est attribuée au Fanion. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 62 présente toutes les extrémités d'association de GovHydroDD avec d'autres classes.

Tableau 62 – Extrémités d'association de TurbineGovernorDynamics::GovHydroDD avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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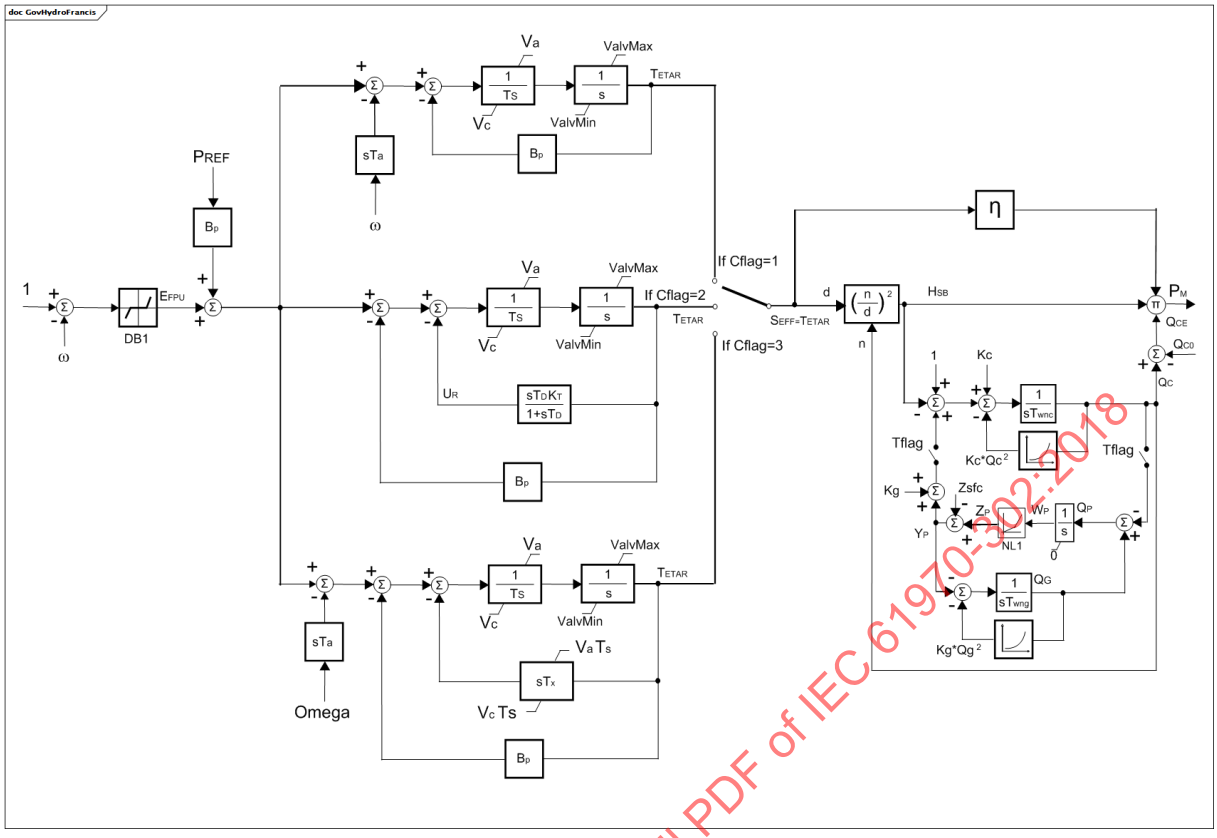
5.3.6.20 GovHydroFrancis

Unité hydraulique détaillée – modèle Francis. Ce modèle peut être utilisé pour représenter trois types de régulateurs.

Un schéma du système hydraulique des modèles d'unités hydrauliques détaillées (tels que les modèles Francis et Pelton) est représenté dans le diagramme DetailedHydroModelHydraulicSystem.



Anglais	Français
If	Si

Figure 62 – GovHydroFrancis

Figure 62: Ce diagramme décrit le modèle de régulateur de turbine GovHydroFrancis.

Détails sur les paramètres:

1) Les paramètres PU des régulateurs reposent sur la capacité en MW de la turbine.
2) La charge hydraulique assignée, Hn, en mètres, et le débit assigné, Qn, en mètres cubes par s, sont les paramètres de conception de la capacité du système hydraulique.
3) Les attributs de chute du système hydraulique (Zsfc, H1, H2) sont exprimés en mètres, mais ils sont exprimés en PU dans le diagramme de bloc sur la base de Hn exprimé en mètres.
4) Les attributs de surface hydraulique (Av0, Av1) sont exprimés en mètres carrés, mais ils sont exprimés en PU dans le diagramme de bloc sur la base de Qn/Hn en mètres carrés par s.
5) omega a des unités de vitesse PU.
6) Les équations de gain non linéaire et de rendement sont représentées dans le diagramme GovHydroFrancisNonLinearGainAndEfficiency.

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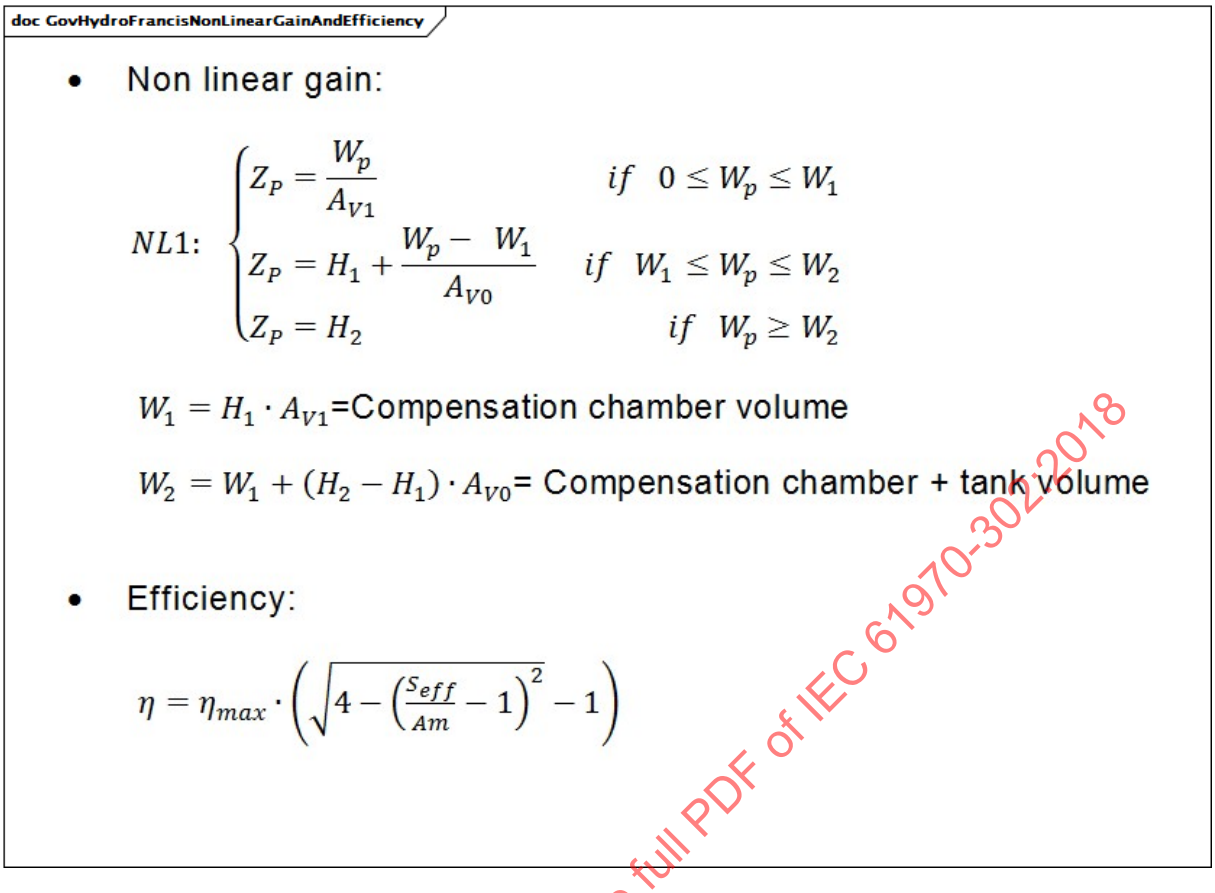

Anglais	Français
Non linear gain	Gain non linéaire
Compensation chamber volume	Volume de la chambre de compensation
Compensation chamber + tank volume	Volume de la chambre de compensation + réservoir
Efficiency	Rendement

Figure 63 – GovHydroFrancisNonLinearGainAndEfficiency

Figure 63: Ce diagramme représente les équations de gain non linéaire et de rendement.

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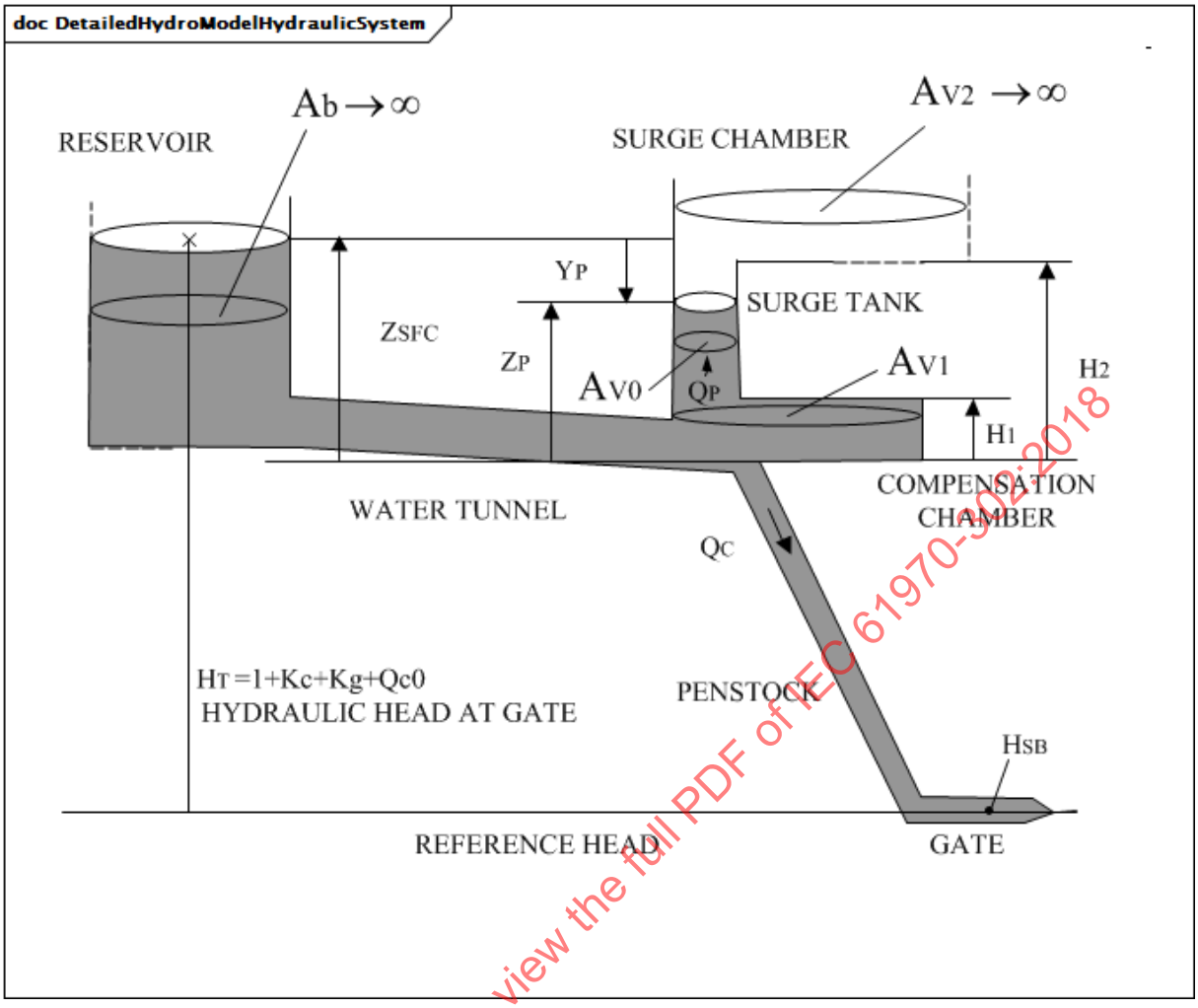

Anglais	Français
SURGE CHAMBER	CHAMBRE D'ÉQUILIBRE
SURGE TANK	CHEMINÉE D'ÉQUILIBRE
WATER TUNNEL	TUNNEL HYDRODYNAMIQUE
COMPENSATION CHAMBER	CHAMBRE DE COMPENSATION
HYDRAULIC HEAD AT GATE	VANNE DE CHARGE HYDRAULIQUE
PENSTOCK	CONDUITE FORCÉE
REFERENCE HEAD	CHUTE DE RÉFÉRENCE
GATE	VANNE

Figure 64 – DetailedHydroModelHydraulicSystem

Figure 64: Ce diagramme représente le modèle hydraulique détaillé d'un système hydraulique.

Le Tableau 63 présente tous les attributs de GovHydroFrancis.

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Tableau 63 – Attributs de TurbineGovernorDynamics::GovHydroFrancis

nom	mult	type	description
am	0..1	PU	Ouverture de la section SEFF à rendement maximal (Am). Valeur classique = 0,7.
av0	0..1	Area	Surface de la cheminée d'équilibre (AV0). Unité = m2. Valeur classique = 30.
av1	0..1	Area	Surface du réservoir de compensation (AV1). Unité = m2. Valeur classique = 700.
bp	0..1	PU	Statisme (Bp). Valeur classique = 0,05.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (DB1). Unité = Hz. Valeur classique = 0.
etamax	0..1	PU	Rendement maximal (EtaMax). Valeur classique = 1,05.
governorControl	0..1	FrancisGovernorControlKind	Fanion de commande du régulateur (Cflag). Valeur classique = mechanicHydrolicTachoAccelerator.
h1	0..1	Length	Chute du niveau d'eau de la chambre de compensation par rapport au niveau de la conduite forcée (H1). Unité = km. Valeur classique = 0,004.
h2	0..1	Length	Chute du niveau d'eau de la cheminée d'équilibre par rapport au niveau de la conduite forcée (H2). Unité = km. Valeur classique = 0,040.
hn	0..1	Length	Charge hydraulique assignée (Hn). Unité = km. Valeur classique = 0,250.
kc	0..1	PU	Coefficient de perte de conduite forcée (en raison du frottement) (Kc). Valeur classique = 0,025.
kg	0..1	PU	Coefficient de perte du tunnel hydrodynamique et de la chambre d'équilibre (en raison du frottement) (Kg). Valeur classique = 0,025.
kt	0..1	PU	Gain de relaxation (Kt). Valeur classique = 0,25.
qc0	0..1	PU	Débit sans charge de la turbine à chute nominale (Qc0). Valeur classique = 0,1.
qn	0..1	VolumeFlowRate	Débit assigné (Qn). Unité = m3/s. Valeur classique = 250.
ta	0..1	Seconds	Gain par dérivation (Ta) (>= 0). Valeur classique = 3.
td	0..1	Seconds	Constante de temps de relaxation (Td) (>= 0). Valeur classique = 6.
ts	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Ts) (>= 0). Valeur classique = 0,5.
twnc	0..1	Seconds	Constante de temps de l'inertie de l'eau (Twnc) (>= 0). Valeur classique = 1.
twng	0..1	Seconds	Constante de temps d'inertie du tunnel hydrodynamique et de la chambre d'équilibre (Twng) (>= 0). Valeur classique = 3.
tx	0..1	Seconds	Gain de la boucle de rétroaction par dérivation (Tx) (>= 0). Valeur classique = 1.
va	0..1	Float	Vitesse maximale d'ouverture de la vanne (Va). Unité = PU / s. Valeur classique = 0,06.
valvmax	0..1	PU	Ouverture maximale de la vanne (ValvMax) (> GovHydroFrancis.valvmin). Valeur classique = 1,1.
valvmin	0..1	PU	Ouverture minimale de la vanne (ValvMin) (< GovHydroFrancis.valvmax). Valeur classique = 0.

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nom	mult	type	description
vc	0..1	Float	Vitesse maximale de fermeture de la vanne (Vc). Unité = PU / s. Valeur classique = -0,06.
waterTunnelSurgeChamberSimulation	0..1	Boolean	Simulation du tunnel hydrodynamique et de la chambre d'équilibre (Tflag). true = permettre la simulation du tunnel hydrodynamique et de la chambre d'équilibre false = interdire la simulation du tunnel hydrodynamique et de la chambre d'équilibre Valeur classique = false.
zsfc	0..1	Length	Chute du niveau d'eau supérieur par rapport au niveau de la conduite forcée (Zsfc). Unité = km. Valeur classique = 0,025.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 64 présente toutes les extrémités d'association de GovHydroFrancis avec d'autres classes.

Tableau 64 – Extrémités d'association de TurbineGovernorDynamics::GovHydroFrancis avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.6.21 GovHydroPelton

Unité hydraulique détaillée – modèle Pelton. Ce modèle peut être utilisé pour représenter la dymanique liée au tunnel hydrodynamique et à la chambre d'équilibre.

Le diagramme DetailedHydroModelHydraulicSystem, situé dans la classe GovHydroFrancis, fournit un schéma du système hydraulique des modèles détaillés d'unités hydrauliques (tels que les modèles Francis et Pelton).

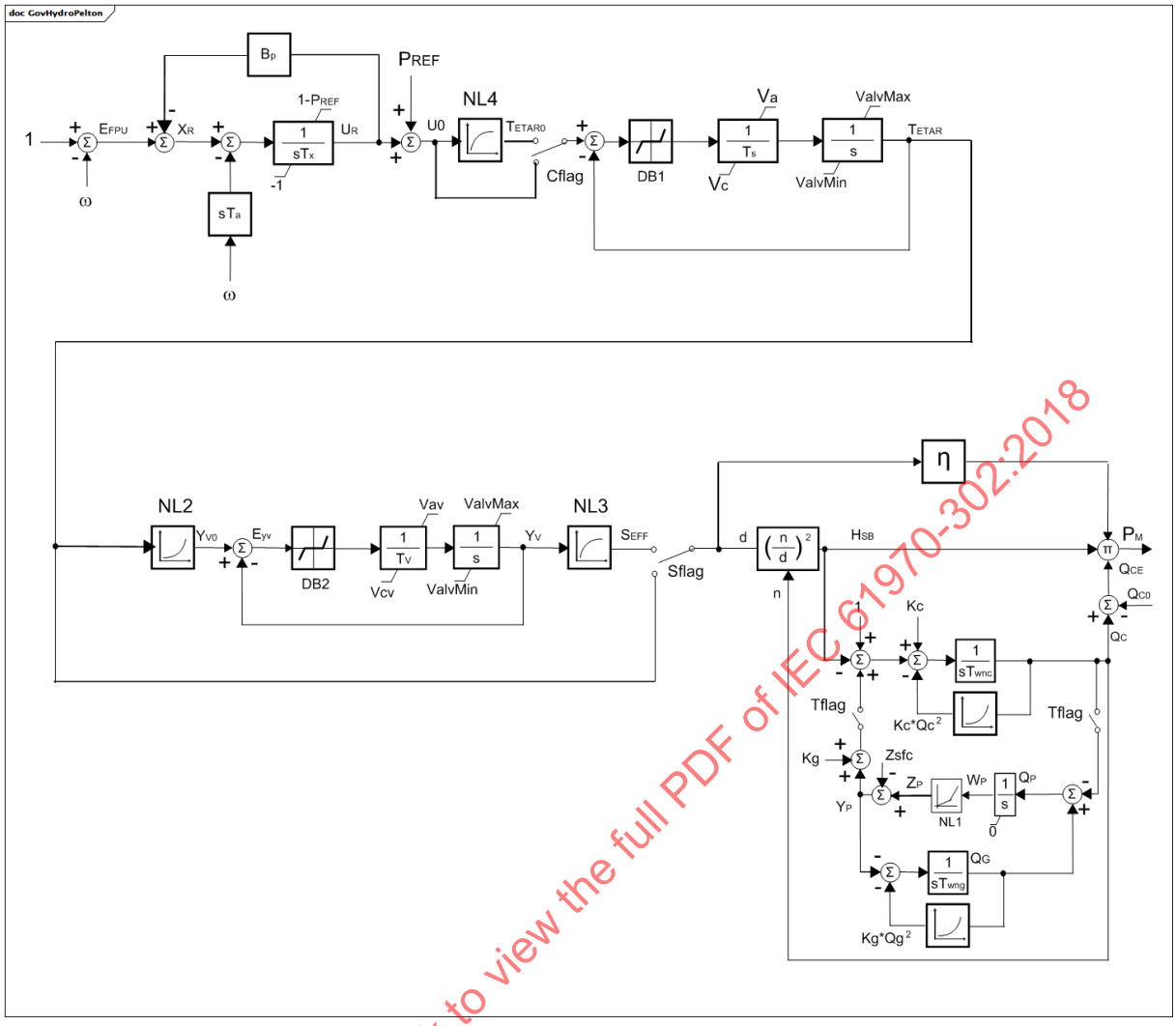

Figure 65 – GovHydroPelton

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Figure 65: Ce diagramme décrit le modèle de régulateur de turbine GovHydroPelton.

Détails sur les paramètres:

1) Les paramètres PU des régulateurs reposent sur la capacité en MW de la turbine.
2) La charge hydraulique assignée, Hn, en mètres, et le débit assigné, Qn, en mètres cubes par s, sont les paramètres de conception de la capacité du système hydraulique.
3) Les attributs de chute du système hydraulique (Zsfc, H1, H2) sont exprimés en mètres, mais ils sont exprimés en PU dans le diagramme de bloc sur la base de Hn exprimé en mètres.
4) Les attributs de surface hydraulique (Av0, Av1) sont exprimés en mètres carrés, mais ils sont exprimés en PU dans le diagramme de bloc sur la base de Qn/Hn en mètres carrés par s.
5) omega a des unités de vitesse PU.
6) Les équations de gain non linéaire et de rendement sont représentées dans le diagramme GovHydroPeltonNonLinearGainAndEfficiency.

doc GovHydroPeltonNonLinearGainAndEfficiency

- Non linear gains:

$$NL1: \begin{cases} Z_p = \dfrac{W_p}{A_{V1}} & if \quad 0 \le W_p \le W_1 \\ Z_p = H_1 + \dfrac{W_p - W_1}{A_{V0}} & if \quad W_1 \le W_p \le W_2 \\ Z_p = H_2 & if \quad W_p \ge W_2 \end{cases}$$

$$NL2: \quad Y_{V0} = (TetaR)^3$$

$$NL3: \quad S_{eff} = -1.1 + \sqrt{1.21 + Y_V \cdot (4.2 - Y_V)}$$

$$NL4: \quad TetaR0 = \left(2.1 - \sqrt{5.62 - (U_0 + 1.1)^2}\right)^{1/3}$$

$W_1 = H_1.A_{V1}$ = Compensation chamber volume
$W_2 = W_1 + (H_2 - H_1).A_{V0}$ = Compensation chamber + tank volume

- Efficiency:

$$\eta = \begin{cases} 1 & if \; S_{eff} \ge 0.3 \\ 0.7 + S_{eff} & if \; 0.13 \le S_{eff} < 0.3 \\ 13.83 \cdot (S_{eff} - 0.07) & if \; 0.07 \le S_{eff} < 0.13 \\ 0 & if \; S_{eff} < 0.07 \end{cases}$$

Anglais	Français
Non linear gains	Gains non linéaires
Compensation chamber volume	Volume de la chambre de compensation
Compensation chamber + tank volume	Volume de la chambre de compensation + réservoir
Efficiency	Rendement

Figure 66 – GovHydroPeltonNonLinearGainAndEfficiency

Figure 66: Ce diagramme représente les équations de gain non linéaire et de rendement.

Le Tableau 65 présente tous les attributs de GovHydroPelton.

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Tableau 65 – Attributs de TurbineGovernorDynamics::GovHydroPelton

nom	mult	type	description
av0	0..1	Area	Surface de la cheminée d'équilibre (AV0). Unité = m2. Valeur classique = 30.
av1	0..1	Area	Surface du réservoir de compensation (AV1). Unité = m2. Valeur classique = 700.
bp	0..1	PU	Statisme (bp). Valeur classique = 0,05.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (DB1). Unité = Hz. Valeur classique = 0.
db2	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle de l'erreur d'ouverture de vanne (DB2). Unité = Hz. Valeur classique = 0,01.
h1	0..1	Length	Chute du niveau d'eau de la chambre de compensation par rapport au niveau de la conduite forcée (H1). Unité = km. Valeur classique = 0,004.
h2	0..1	Length	Chute du niveau d'eau de la cheminée d'équilibre par rapport au niveau de la conduite forcée (H2). Unité = km. Valeur classique = 0,040.
hn	0..1	Length	Charge hydraulique assignée (Hn). Unité = km. Valeur classique = 0,250.
kc	0..1	PU	Coefficient de perte de conduite forcée (en raison du frottement) (Kc). Valeur classique = 0,025.
kg	0..1	PU	Coefficient de perte du tunnel hydrodynamique et de la chambre d'équilibre (en raison du frottement) (Kg). Valeur classique = 0,025.
qc0	0..1	PU	Débit sans charge de la turbine à chute nominale (Qc0). Valeur classique = 0,05.
qn	0..1	VolumeFlowRate	Débit assigné (Qn). Unité = m3/s. Valeur classique = 250.
simplifiedPelton	0..1	Boolean	Simulation du modèle Pelton simplifié (Sflag). true = permettre la simulation du modèle Pelton simplifié false = permettre la simulation du modèle Pelton complet (gain non linéaire). Valeur classique = true.
staticCompensating	0..1	Boolean	Caractéristique de compensation statique (Cflag). Il convient qu'elle soit true si simplifiedPelton = false. true = permettre la caractéristique de compensation statique false = interdire la caractéristique de compensation statique Valeur classique = false.
ta	0..1	Seconds	Gain par dérivation (constante de temps de l'accéléromètre) (Ta) (>= 0). Valeur classique = 3.
ts	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Ts) (>= 0). Valeur classique = 0,15.
tv	0..1	Seconds	Constante de temps de l'intégrateur de servomoteur (Tv) (>= 0). Valeur classique = 0,3.
twnc	0..1	Seconds	Constante de temps de l'inertie de l'eau (Twnc) (>= 0). Valeur classique = 1.
twng	0..1	Seconds	Constante de temps d'inertie du tunnel hydrodynamique et de la chambre d'équilibre (Twng) (>= 0). Valeur classique = 3.
tx	0..1	Seconds	Constante de temps de l'intégrateur électronique (Tx) (>= 0). Valeur classique = 0,5.
va	0..1	Float	Vitesse maximale d'ouverture de la vanne (Va). Unité = PU / s. Valeur classique = 0,06.

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nom	mult	type	description
valvmax	0..1	PU	Ouverture maximale de la vanne (ValvMax) (> GovHydroPelton.valvmin). Valeur classique = 1.
valvmin	0..1	PU	Ouverture minimale de la vanne (ValvMin) (< GovHydroPelton.valvmax). Valeur classique = 0.
vav	0..1	PU	Vitesse maximale d'ouverture de la vanne de servomoteur (Vav). Valeur classique = 0,1.
vc	0..1	Float	Vitesse maximale de fermeture de la vanne (Vc). Unité = PU / s. Valeur classique = -0,06.
vcv	0..1	PU	Vitesse maximale de fermeture de la vanne de servomoteur (Vcv). Valeur classique = -0,1.
waterTunnelSurgeChamberSimulation	0..1	Boolean	Simulation du tunnel hydrodynamique et de la chambre d'équilibre (Tflag). true = permettre la simulation du tunnel hydrodynamique et de la chambre d'équilibre false = interdire la simulation du tunnel hydrodynamique et de la chambre d'équilibre Valeur classique = false.
zsfc	0..1	Length	Chute du niveau d'eau supérieur par rapport au niveau de la conduite forcée (Zsfc). Unité = km. Valeur classique = 0,025.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 66 présente toutes les extrémités d'association de GovHydroPelton avec d'autres classes.

Tableau 66 – Extrémités d'association de TurbineGovernorDynamics::GovHydroPelton avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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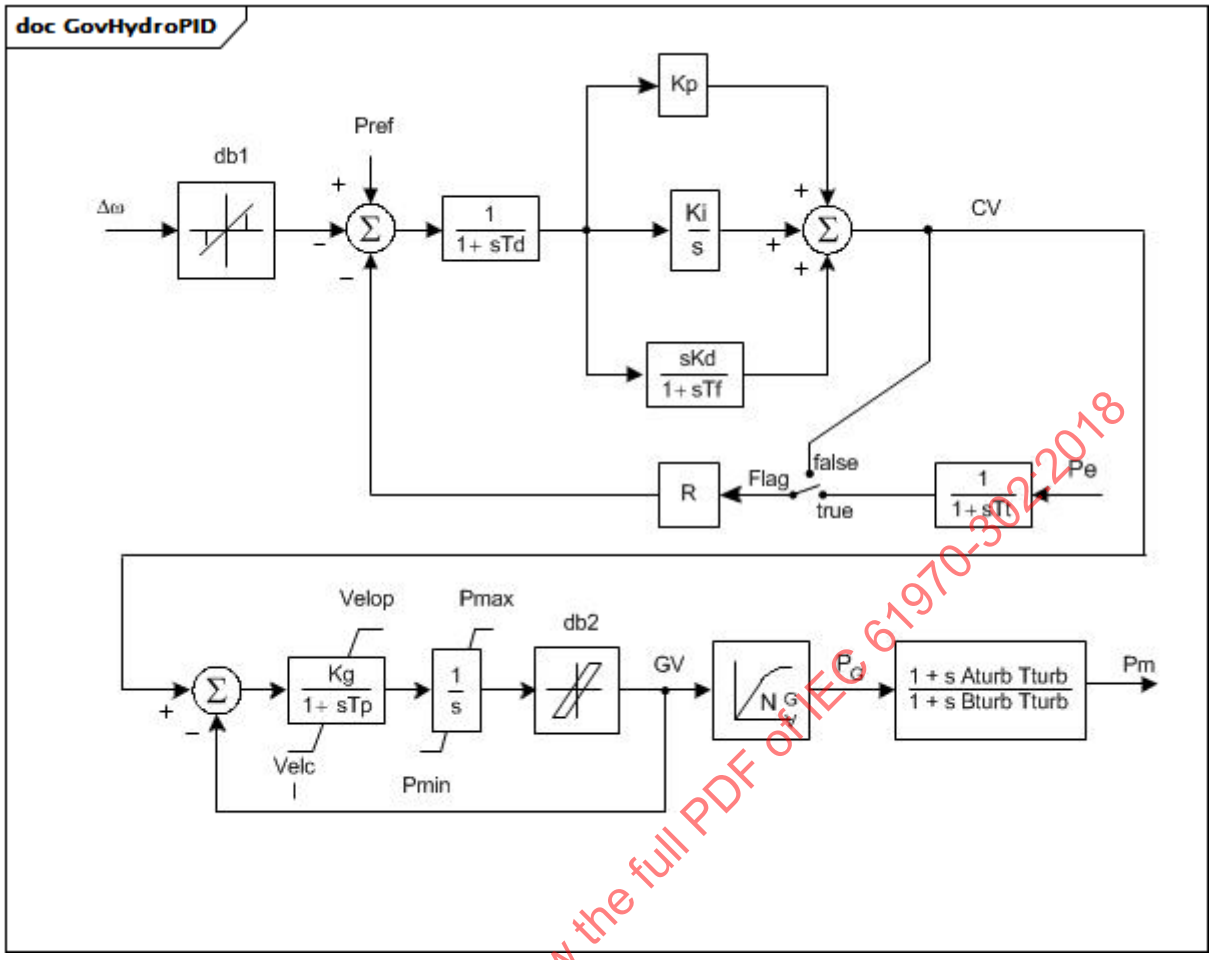
5.3.6.22 GovHydroPID

Régulateur PID et turbine.



Anglais	Français
Flag	Fanion

Figure 67 – GovHydroPID

Figure 67: Ce diagramme décrit le modèle de régulateur de turbine GovHydroPID.

Détails sur les paramètres:

1) Si Tf est nul, mais que Kd ne l'est pas, une petite valeur est attribuée à Tf (4 fois l'intervalle d'intégration).
2) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.
3) S'agissant d'une turbine hydraulique, définir Tturb = Tw (temps au démarrage de l'écoulement de l'eau), et définir Aturb = -1. et Bturb = 0,5. S'agissant d'un moteur diesel ou d'une turbine à gaz à deux arbres, définir Aturb = 0,8 et Bturb = 1 et Tturb = 1 s. S'agissant d'une petite turbine à vapeur avec une alimentation en vapeur sans resurchauffe ou d'une turbine à gaz monoarbre, définir Aturb = 0 et Bturb = 1 et Tturb = 0 s.

Le Tableau 67 présente tous les attributs de GovHydroPID.

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Tableau 67 – Attributs de TurbineGovernorDynamics::GovHydroPID

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
pmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Pmax) (> GovHydroPID.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Pmin) (< GovHydroPID.pmax). Valeur classique = 0.
r	0..1	PU	Statisme en régime établi (R). Valeur classique = 0,05.
td	0..1	Seconds	Constante de temps du filtre d'entrée (Td) (>= 0). Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0.
tf	0..1	Seconds	Constante de temps de relaxation (Tf)) (>= 0). Valeur classique = 0,1.
tp	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tp) (>= 0). Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0,35.
velop	0..1	Float	Vitesse maximale d'ouverture de la vanne (Velop). Unité = PU / s. Valeur classique = 0,09.
velcl	0..1	Float	Vitesse maximale de fermeture de la vanne (Velcl). Unité = PU / s. Valeur classique = -0,14.
kd	0..1	PU	Gain par dérivation (Kd). Valeur classique = 1,11.
kp	0..1	PU	Gain proportionnel (Kp). Valeur classique = 0,1.
ki	0..1	PU	Gain intégral (Ki). Valeur classique = 0,36.
kg	0..1	PU	Gain de l'asservissement de vanne de puissance (Kg). Valeur classique = 2,5.
tturb	0..1	Seconds	Constante de temps de la turbine (Tturb)) (>= 0). Voir le détail 3 sur les paramètres. Valeur classique = 0,8.
aturb	0..1	PU	Multiplicateur numérateur de la turbine (Aturb) (voir le détail 3 sur les paramètres). Valeur classique = -1.
bturb	0..1	PU	Multiplicateur dénominateur de la turbine (Bturb) (voir le détail 3 sur les paramètres). Valeur classique = 0,5.
tt	0..1	Seconds	Constante de temps de réaction de puissance (Tt) (>= 0). Si cette valeur est nulle, le bloc est contourné. Valeur classique = 0,02.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
inputSignal	0..1	Boolean	Commutateur de signal d'entrée (Fanion). true = entrée Pe utilisée false = retour reçu de CV. Le fanion dépend en principe de Tt. Si Tt est nul, la valeur false est attribuée au Fanion. Si Tt n'est pas nul, la valeur true est attribuée au Fanion. Valeur classique = true.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.

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nom	mult	type	description
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 68 présente toutes les extrémités d'association de GovHydroPID avec d'autres classes.

Tableau 68 – Extrémités d'association de TurbineGovernorDynamics::GovHydroPID avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.23 GovHydroPID2

Turbine hydraulique et régulateur. Représente les centrales à conduites forcées directes et les régulateurs électro-hydrauliques "à triple action" (c'est-à-dire, Woodward™).

[NOTE Les régulateurs électroniques Woodward sont des exemples de produits appropriés disponibles dans le commerce. Ces informations sont fournies à des fins de commodité des utilisateurs du présent document et ne constituent pas un entérinement de ces produits de la part de l'IEC.]

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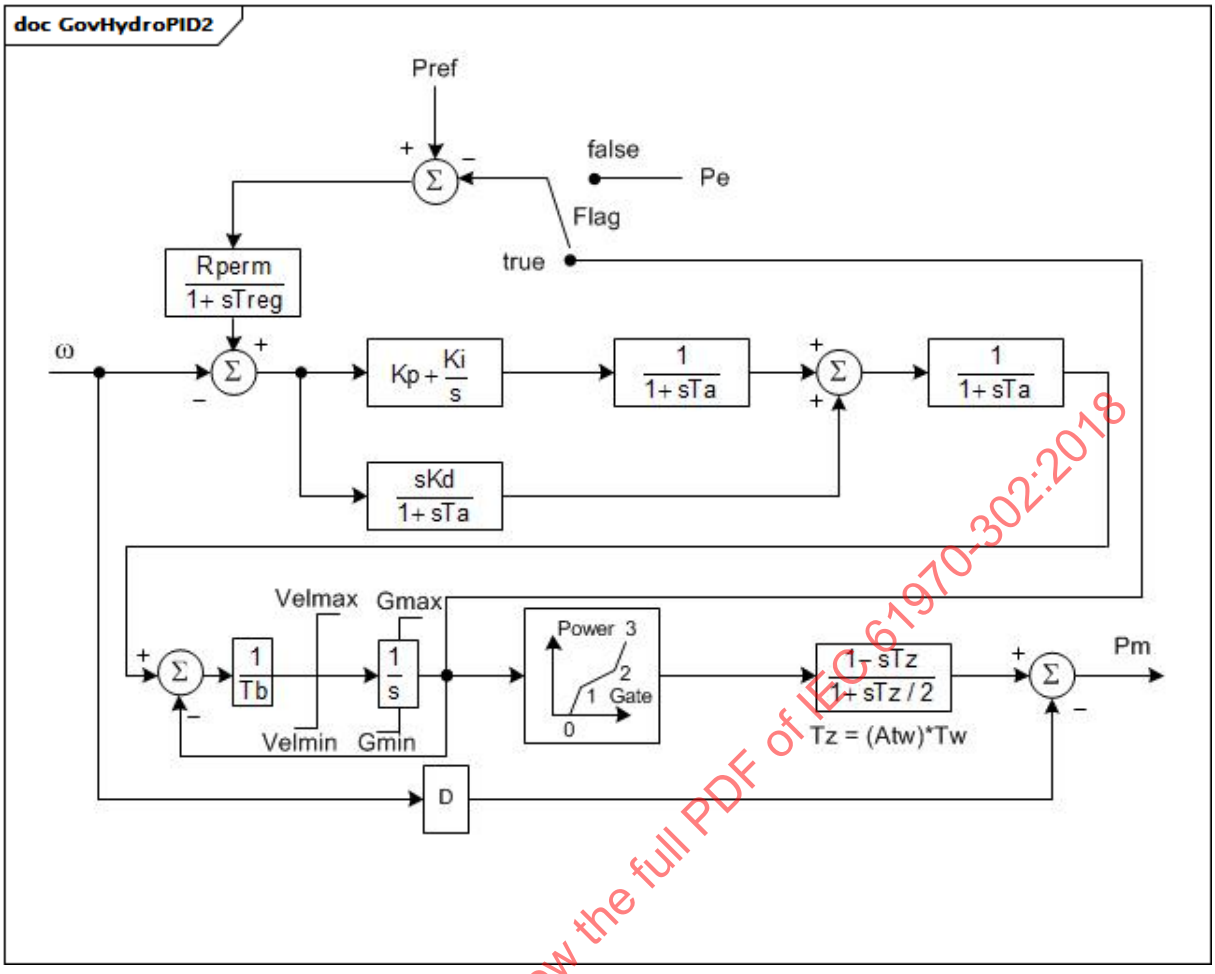

Anglais	Français
Flag	Fanion
Power	Puissance
Gate	Vanne

Figure 68 – GovHydroPID2

Figure 68: Ce diagramme représente le modèle de régulateur de turbine GovHydroPID2.

Détails sur les paramètres:

1) Les vannes se déplacent sur une plage de 1,0 PU d'une position totalement fermée à une position totalement ouverte. La position des vannes est supérieure à zéro à puissance nulle. Elle est en principe inférieure à 1,0 lorsque la puissance est de 1,0 PU.
2) G0, G1, P1, G2, P2 et P3 indiquent la variation de puissance avec la vanne G2 > G1 > G0.
3) Ce modèle utilise un modèle simplifié de conduite forcée de turbine qui ne tient pas compte des effets de l'inertie de l'eau lorsque la vanne est ouverte. Pour que ce modèle corresponde à d'autres modèles grâce au modèle "classique" de conduite forcée de turbine, définir Atw sur l'unité. Pour approximer les effets de l'inertie de l'eau à charge partielle, Atw peut être défini sur l'ouverture de vanne par unité sur laquelle les perturbations sont centrées.

Le Tableau 69 présente tous les attributs de GovHydroPID2.

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Tableau 69 – Attributs de TurbineGovernorDynamics::GovHydroPID2

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
treg	0..1	Seconds	Constante de temps du détecteur de vitesse (Treg) (>= 0). Valeur classique = 0.
rperm	0..1	PU	Statisme permanent (Rperm). Valeur classique = 0.
kp	0..1	PU	Gain proportionnel (Kp). Valeur classique = 0.
ki	0..1	Float	Gain de réinitialisation (Ki). Unité = PU / s. Valeur classique = 0.
kd	0..1	PU	Gain par dérivation (Kd). Valeur classique = 0.
ta	0..1	Seconds	Constante de temps du régulateur (Ta) (>= 0). Valeur classique = 0.
tb	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tb) (> 0).
velmax	0..1	Float	Vitesse maximale d'ouverture de la vanne (Velmax) (< GovHydroPID2.velmin). Unité = PU / s. Valeur classique = 0.
velmin	0..1	Float	Vitesse maximale de fermeture de la vanne (Velmin) (> GovHydroPID2.velmax). Unité = PU / s. Valeur classique = 0.
gmax	0..1	PU	Ouverture maximale de la vanne (Gmax) (> GovHydroPID2.gmin). Valeur classique = 0.
gmin	0..1	PU	Ouverture minimale de la vanne (Gmin) (< GovHydroPID2.gmax). Valeur classique = 0.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (>= 0). Valeur classique = 0.
d	0..1	PU	Facteur d'amortissement de la turbine (D). Unité = delta P/vitesse delta. Valeur classique = 0.
g0	0..1	PU	Ouverture de la vanne à vitesse sans charge (G0). Valeur classique = 0.
g1	0..1	PU	Ouverture de la vanne intermédiaire (G1). Valeur classique = 0.
p1	0..1	PU	Puissance à l'ouverture de la vanne G1 (P1). Valeur classique = 0.
g2	0..1	PU	Ouverture de la vanne intermédiaire (G2). Valeur classique = 0.
p2	0..1	PU	Puissance à l'ouverture de la vanne G2 (P2). Valeur classique = 0.
p3	0..1	PU	Puissance à l'ouverture totale de la vanne (P3). Valeur classique = 0.
atw	0..1	PU	Facteur de multiplication de Tw (Atw). Valeur classique = 0.
feedbackSignal	0..1	Boolean	Fanion du type de signal de retour (Flag). true = utiliser le signal de retour de position de la vanne false = utiliser Pe.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 70 présente toutes les extrémités d'association de GovHydroPID2 avec d'autres classes.

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Tableau 70 – Extrémités d'association de TurbineGovernorDynamics::GovHydroPID2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.24 GovHydroR

Régulateur d'avance/retard de quatrième ordre et turbine hydraulique.

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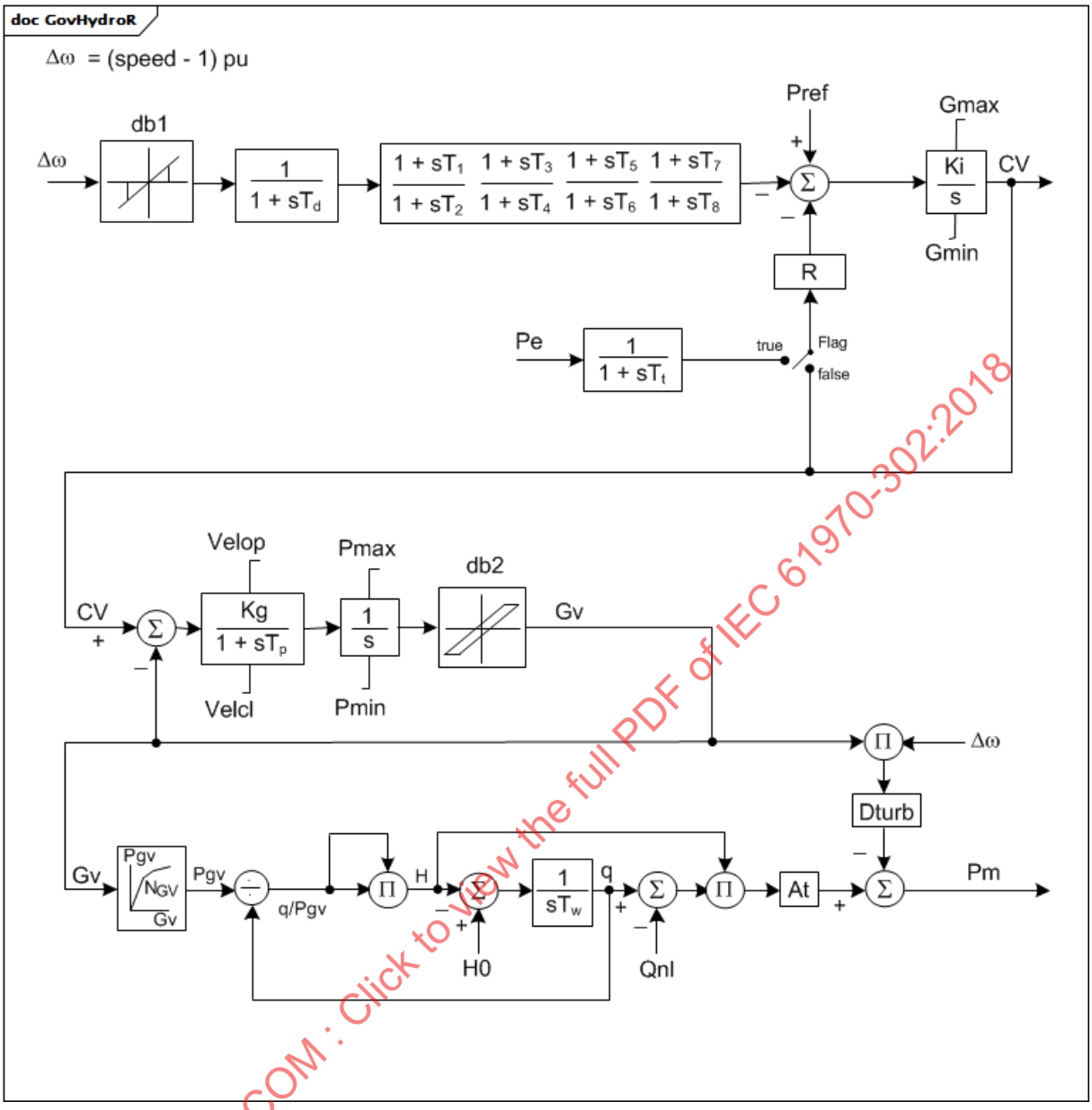

Anglais	Français
(speed – 1)	(vitesse – 1)
Flag	Fanion

Figure 69 – GovHydroR

Figure 69: Ce diagramme décrit le modèle de régulateur de turbine GovHydroR.

Détails sur les paramètres:

1) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

Le Tableau 71 présente tous les attributs de GovHydroR.

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Tableau 71 – Attributs de TurbineGovernorDynamics::GovHydroR

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
pmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Pmax) (> GovHydroR.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Pmin) (< GovHydroR.pmax). Valeur classique = 0.
r	0..1	PU	Statisme en régime établi (R). Valeur classique = 0,05.
td	0..1	Seconds	Constante de temps du filtre d'entrée (Td) (>= 0). Valeur classique = 0,05.
t1	0..1	Seconds	Constante de délai de mise en œuvre 1 (T1) (>= 0). Valeur classique = 1,5.
t2	0..1	Seconds	Constante de temps de réponse 1 (T2) (>= 0). Valeur classique = 0,1.
t3	0..1	Seconds	Constante de délai de mise en œuvre 2 (T3) (>= 0). Valeur classique = 1,5.
t4	0..1	Seconds	Constante de temps de réponse 2 (T4) (>= 0). Valeur classique = 0,1.
t5	0..1	Seconds	Constante de délai de mise en œuvre 3 (T5) (>= 0). Valeur classique = 0.
t6	0..1	Seconds	Constante de temps de réponse 3 (T6) (>= 0). Valeur classique = 0,05.
t7	0..1	Seconds	Constante de délai de mise en œuvre 4 (T7) (>= 0). Valeur classique = 0.
t8	0..1	Seconds	Constante de temps de réponse 4 (T8) (>= 0). Valeur classique = 0,05.
tp	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tp) (>= 0). Valeur classique = 0,05.
velop	0..1	Float	Vitesse maximale d'ouverture de la vanne (Velop). Unité = PU / s. Valeur classique = 0,2.
velcl	0..1	Float	Vitesse maximale de fermeture de la vanne (Velcl). Unité = PU / s. Valeur classique = -0,2.
ki	0..1	PU	Gain intégral (Ki). Valeur classique = 0,5.
kg	0..1	PU	Gain de l'asservissement de vanne de puissance (Kg). Valeur classique = 2.
gmax	0..1	PU	Sortie maximale du régulateur (Gmax) (> GovHydroR.gmin). Valeur classique = 1,05.
gmin	0..1	PU	Sortie minimale du régulateur (Gmin) (< GovHydroR.gmax). Valeur classique = -0,05.
tt	0..1	Seconds	Constante de temps de réaction de puissance (Tt) (>= 0). Valeur classique = 0.
inputSignal	0..1	Boolean	Commutateur de signal d'entrée (Fanion). true = entrée Pe utilisée false = retour reçu de CV. Le fanion dépend en principe de Tt. Si Tt est nul, la valeur false est attribuée au Fanion. Si Tt n'est pas nul, la valeur true est attribuée au Fanion. Valeur classique = true.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (> 0). Valeur classique = 1.
at	0..1	PU	Gain de la turbine (At). Valeur classique = 1,2.
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb). Valeur classique = 0,2.
qnl	0..1	PU	Débit sans charge de la turbine à chute nominale (Qnl). Valeur classique = 0,08.

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nom	mult	type	description
h0	0..1	PU	Chute nominale de la turbine (H0). Valeur classique = 1.
gv1	0..1	PU	Point 1 de gain non linéaire, PU gv (Gv1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de gain non linéaire, puissance PU (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de gain non linéaire, PU gv (Gv2). Valeur classique = 0.
pgv2	0..1	PU	Point 2 de gain non linéaire, puissance PU (Pgv2). Valeur classique = 0.
gv3	0..1	PU	Point 3 de gain non linéaire, PU gv (Gv3). Valeur classique = 0.
pgv3	0..1	PU	Point 3 de gain non linéaire, puissance PU (Pgv3). Valeur classique = 0.
gv4	0..1	PU	Point 4 de gain non linéaire, PU gv (Gv4). Valeur classique = 0.
pgv4	0..1	PU	Point 4 de gain non linéaire, puissance PU (Pgv4). Valeur classique = 0.
gv5	0..1	PU	Point 5 de gain non linéaire, PU gv (Gv5). Valeur classique = 0.
pgv5	0..1	PU	Point 5 de gain non linéaire, puissance PU (Pgv5). Valeur classique = 0.
gv6	0..1	PU	Point 6 de gain non linéaire, PU gv (Gv6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de gain non linéaire, puissance PU (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 72 présente toutes les extrémités d'association de GovHydroR avec d'autres classes.

Tableau 72 – Extrémités d'association de TurbineGovernorDynamics::GovHydroR avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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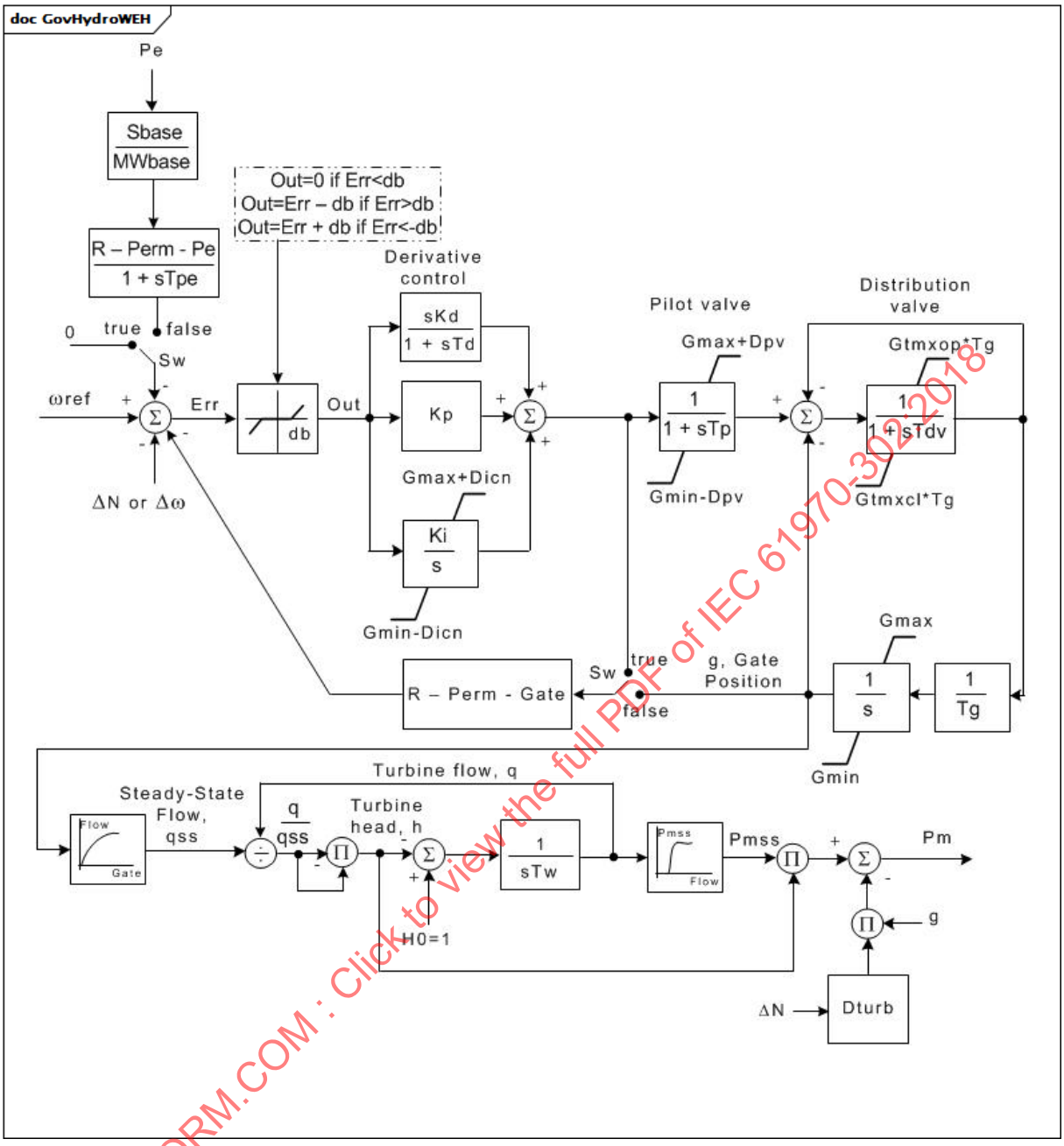
5.3.6.25 GovHydroWEH

Régulateur hydroélectrique Woodward™.

[NOTE Les régulateurs hydroélectriques Woodward sont des exemples de produits appropriés disponibles dans le commerce. Ces informations sont fournies à des fins de commodité des utilisateurs du présent document et ne constituent pas un entérinement de ces produits de la part de l'IEC.]



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Anglais	Français
Derivative control	Commande par dérivée
Pilot valve	Vanne pilote
Distribution valve	Vanne de répartition
Gate Position	Position de la vanne
Gate	Vanne
Steady-State Flow	Débit en régime établi
Turbine flow	Débit de la turbine
Turbine head	Chute de turbine

Figure 70 – GovHydroWEH

Figure 70: Ce diagramme représente le modèle de régulateur de turbine GovHydroWEH.

Détails sur les paramètres:

1) La relation non linéaire entre la position de la vanne et le débit d'eau peut être l'entrée avec 5 points spécifiés par paires d'attributs .gvn et .fln au maximum.
2) La relation non linéaire entre le débit de la turbine et la puissance mécanique (sur les caractéristiques assignées MVA de la machine) peut être l'entrée avec 10 points spécifiés par paires d'attributs .fpn et .pmssn au maximum.

Le Tableau 73 présente tous les attributs de GovHydroWEH.

Tableau 73 – Attributs de TurbineGovernorDynamics::GovHydroWEH

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
rpg	0..1	Float	Statisme permanent pour mode à rebouclage par la sortie du régulateur (R-Perm-Gate).
rpp	0..1	Float	Statisme permanent pour réaction de puissance électrique (R-Perm-Pe).
tpe	0..1	Seconds	Constante de temps du statisme de puissance électrique (Tpe) (>= 0).
kp	0..1	PU	Gain de commande par dérivée (Kp).
ki	0..1	PU	Gain intégral du régulateur par dérivation (Ki).
kd	0..1	PU	Gain par dérivation du régulateur par dérivation (Kd).
td	0..1	Seconds	Constante de temps du régulateur par dérivation (Td) (>= 0). Limite la caractéristique de dérivée au-delà d'une fréquence de rupture afin d'éviter l'amplification du bruit à haute fréquence.
tp	0..1	Seconds	Constante de temps de réponse de la vanne pilote (Tp) (>= 0).
tdv	0..1	Seconds	Constante de temps de réponse de la vanne de répartition (Tdv) (>= 0).
tg	0..1	Seconds	Valeur permettant au régulateur de vanne de répartition de dépasser la limite de vitesse de mouvement de la vanne (Tg) (>= 0).
gtmxop	0..1	PU	Vitesse maximale d'ouverture de la vanne (Gtmxop).
gtmxcl	0..1	PU	Vitesse maximale de fermeture de la vanne (Gtmxcl).
gmax	0..1	PU	Position maximale de la vanne (Gmax) (> GovHydroWEH.gmin).
gmin	0..1	PU	Position minimale de la vanne (Gmin) (< GovHydroWEH.gmax).
dturb	0..1	PU	Facteur d'amortissement de la turbine (Dturb). Unité = delta P (PU de MWbase)/vitesse delta (PU).
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (> 0).
db	0..1	PU	Zone d'insensibilité de vitesse (db).
dpv	0..1	PU	Valeur permettant au régulateur de vanne pilote de dépasser les limites de la vanne (Dpv).
dicn	0..1	PU	Valeur permettant au régulateur intégral de dépasser les limites de la vanne (Dicn).
feedbackSignal	0..1	Boolean	Sélection du signal de retour (Sw). true = sortie PID (si R-Perm-Gate = droop et R-Perm-Pe = 0) false = puissance électrique (si R-Perm-Gate = 0 et R-Perm-Pe = droop) ou false = position de la vanne (si R-Perm-Gate = droop et R-Perm-Pe = 0). Valeur classique = false.
gv1	0..1	PU	Vanne 1 (Gv1). Valeur de position de la vanne pour le point 1 de la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
gv2	0..1	PU	Vanne 2 (Gv2). Valeur de position de la vanne pour le point 2 de la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.

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nom	mult	type	description
gv3	0..1	PU	Vanne 3 (Gv3). Valeur de position de la vanne pour le point 3 de la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
gv4	0..1	PU	Vanne 4 (Gv4). Valeur de position de la vanne pour le point 4 de la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
gv5	0..1	PU	Vanne 5 (Gv5). Valeur de position de la vanne pour le point 5 de la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fl1	0..1	PU	Débit 1 de la vanne (Fl1). Valeur de débit correspondant au point 1 de la position de la vanne, pour la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fl2	0..1	PU	Débit 2 de la vanne (Fl2). Valeur de débit correspondant au point 2 de la position de la vanne, pour la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fl3	0..1	PU	Débit 3 de la vanne (Fl3). Valeur de débit correspondant au point 3 de la position de la vanne, pour la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fl4	0..1	PU	Débit 4 de la vanne (Fl4). Valeur de débit correspondant au point 4 de la position de la vanne, pour la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fl5	0..1	PU	Débit 5 de la vanne (Fl5). Valeur de débit correspondant au point 5 de la position de la vanne, pour la table de conversion représentant le débit d'eau passant par la turbine en fonction de la position de la vanne générant un débit en régime établi.
fp1	0..1	PU	Débit P1 (Fp1). Valeur de débit de la turbine pour le point 1 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp2	0..1	PU	Débit P2 (Fp2). Valeur de débit de la turbine pour le point 2 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp3	0..1	PU	Débit P3 (Fp3). Valeur de débit de la turbine pour le point 3 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp4	0..1	PU	Débit P4 (Fp4). Valeur de débit de la turbine pour le point 4 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp5	0..1	PU	Débit P5 (Fp5). Valeur de débit de la turbine pour le point 5 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp6	0..1	PU	Débit P6 (Fp6). Valeur de débit de la turbine pour le point 6 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp7	0..1	PU	Débit P7 (Fp7). Valeur de débit de la turbine pour le point 7 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp8	0..1	PU	Débit P8 (Fp8). Valeur de débit de la turbine pour le point 8 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.

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nom	mult	type	description
fp9	0..1	PU	Débit P9 (Fp9). Valeur de débit de la turbine pour le point 9 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
fp10	0..1	PU	Débit P10 (Fp10). Valeur de débit de la turbine pour le point 10 de la table de conversion représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss1	0..1	PU	Débit P1 Pmss (Pmss1). Sortie de puissance mécanique pour le point 1 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss2	0..1	PU	Débit P2 Pmss (Pmss2). Sortie de puissance mécanique pour le point 2 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss3	0..1	PU	Débit P3 Pmss (Pmss3). Sortie de puissance mécanique pour le point 3 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss4	0..1	PU	Débit P4 Pmss (Pmss4). Sortie de puissance mécanique pour le point 4 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss5	0..1	PU	Débit P5 Pmss (Pmss5). Sortie de puissance mécanique pour le point 5 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss6	0..1	PU	Débit P6 Pmss (Pmss6). Sortie de puissance mécanique pour le point 6 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss7	0..1	PU	Débit P7 Pmss (Pmss7). Sortie de puissance mécanique pour le point 7 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss8	0..1	PU	Débit P8 Pmss (Pmss8). Sortie de puissance mécanique pour le point 8 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss9	0..1	PU	Débit P9 Pmss (Pmss9). Sortie de puissance mécanique pour le point 9 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
pmss10	0..1	PU	Débit P10 Pmss (Pmss10). Sortie de puissance mécanique pour le point 10 de débit de la turbine de la table de conversion, représentant la puissance mécanique PU d'une caractéristique assignée MVA de la machine en fonction du débit de la turbine.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 74 présente toutes les extrémités d'association de GovHydroWEH avec d'autres classes.

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Tableau 74 – Extrémités d'association de TurbineGovernorDynamics::GovHydroWEH avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachine Dynamics	0..1	AsynchronousMachine Dynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineD ynamics	0..1	SynchronousMachineD ynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerD ynamics	0..1	TurbineLoadControllerD ynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.26 GovHydroWPID

Régulateur hydraulique PID Woodward™.

[NOTE Les régulateurs hydrauliques PID Woodward sont des exemples de produits appropriés disponibles dans le commerce. Ces informations sont fournies à des fins de commodité des utilisateurs du présent document et ne constituent pas un entérinement de ces produits de la part de l'IEC.]

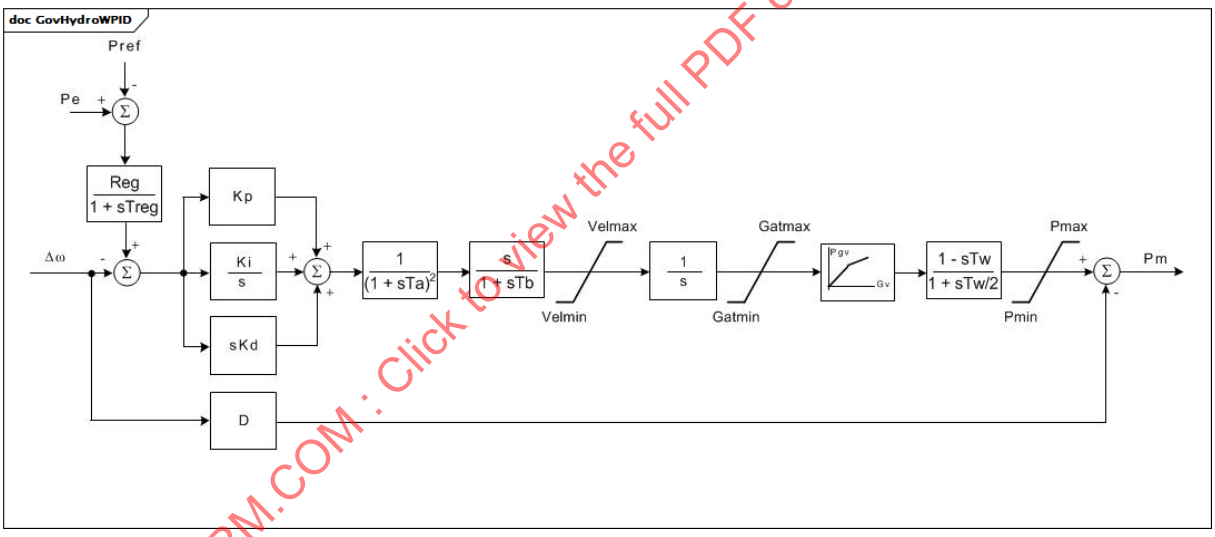

Figure 71 – GovHydroWPID

Figure 71: Ce diagramme décrit le modèle de régulateur de turbine GovHydroWPID.

Détails sur les paramètres:

1) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Le point (0,0 , 0,0) peut être pris par hypothèse. Dans ce modèle, Gv3 = 1,0 et il n'est pas admis que la sortie dépasse 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe hydraulique par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

Le Tableau 75 présente tous les attributs de GovHydroWPID.

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Tableau 75 – Attributs de TurbineGovernorDynamics::GovHydroWPID

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
treg	0..1	Seconds	Constante de temps du détecteur de vitesse (Treg) (>= 0).
reg	0..1	PU	Statisme permanent (Reg).
kp	0..1	PU	Gain proportionnel (Kp). Valeur classique = 0,1.
ki	0..1	PU	Gain de réinitialisation (Ki). Valeur classique = 0,36.
kd	0..1	PU	Gain par dérivation (Kd). Valeur classique = 1,11.
ta	0..1	Seconds	Constante de temps du régulateur (Ta) (>= 0). Valeur classique = 0.
tb	0..1	Seconds	Constante de temps de l'asservissement de vanne de puissance (Tb) (>= 0). Valeur classique = 0.
velmax	0..1	PU	Vitesse maximale d'ouverture de la vanne (Velmax) (> GovHydroWPID.velmin). Unité = PU / s. Valeur classique = 0.
velmin	0..1	PU	Vitesse maximale de fermeture de la vanne (Velmin) (< GovHydroWPID.velmax). Unité = PU / s. Valeur classique = 0.
gatmax	0..1	PU	Limite d'ouverture maximale de la vanne (Gatmax) (> GovHydroWPID.gatmin).
gatmin	0..1	PU	Limite d'ouverture minimale de la vanne (Gatmin) (< GovHydroWPID.gatmax).
tw	0..1	Seconds	Constante de temps de l'inertie de l'eau (Tw) (>= 0). Valeur classique = 0.
pmax	0..1	PU	Sortie de puissance maximale (Pmax) (> GovHydroWPID.pmin).
pmin	0..1	PU	Sortie de puissance minimale (Pmin) (< GovHydroWPID.pmax).
d	0..1	PU	Facteur d'amortissement de la turbine (D). Unité = delta P / vitesse delta.
gv3	0..1	PU	Position de vanne 3 (Gv3) (= 1,0).
gv1	0..1	PU	Position de vanne 1 (Gv1).
pgv1	0..1	PU	Sortie à Gv1 PU de MWbase (Pgv1).
gv2	0..1	PU	Position de vanne 2 (Gv2).
pgv2	0..1	PU	Sortie à Gv2 PU de MWbase (Pgv2).
pgv3	0..1	PU	Sortie à Gv3 PU de MWbase (Pgv3).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 76 présente toutes les extrémités d'association de GovHydroWPID avec d'autres classes.

Tableau 76 – Extrémités d'association de TurbineGovernorDynamics::GovHydroWPID avec d'autres classes

Mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.27 GovSteam0

Régulateur de turbine à vapeur simplifié.

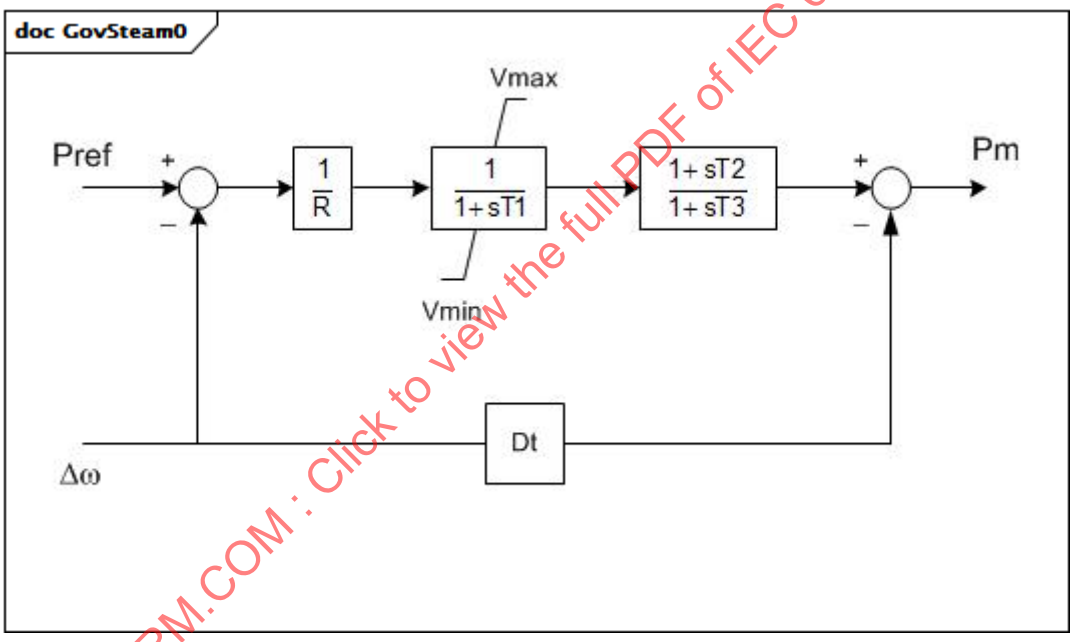

Figure 72 – GovSteam0

Figure 72: Ce diagramme décrit le modèle de régulateur de turbine GovSteam0.

Détails sur les paramètres:

1) Pour représenter une turbine sans resurchauffe, définir T2 = 0 et T3 sur environ 0,5 s. Pour la turbine à resurchauffe, définir T2 = T3 x (partie de turbine HP).

Le Tableau 77 présente tous les attributs de GovSteam0.

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Tableau 77 – Attributs de TurbineGovernorDynamics::GovSteam0

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
r	0..1	PU	Statisme permanent (R). Valeur classique = 0,05.
t1	0..1	Seconds	Constante de temps du coffre de vapeur (T1) (> 0). Valeur classique = 0,5.
vmax	0..1	PU	Position maximale de la vanne, PU de mwcap (Vmax) (> GovSteam0.vmin). Valeur classique = 1.
vmin	0..1	PU	Position minimale de la vanne, PU de mwcap (Vmin) (< GovSteam0.vmax). Valeur classique = 0.
t2	0..1	Seconds	Constante de temps du numérateur du bloc T2/T3 (T2) (>= 0). Valeur classique = 3.
t3	0..1	Seconds	Constante de temps du resurchauffeur (T3) (> 0). Valeur classique = 10.
dt	0..1	PU	Facteur d'amortissement de la turbine (Dt). Unité = delta P / vitesse delta. Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 78 présente toutes les extrémités d'association de GovSteam0 avec d'autres classes.

Tableau 78 – Extrémités d'association de TurbineGovernorDynamics::GovSteam0 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.6.28 GovSteam1

Régulateur de turbine à vapeur reposant sur GovSteamIEEE1 (avec une zone d'insensibilité facultative et un gain de vanne non linéaire ajouté).

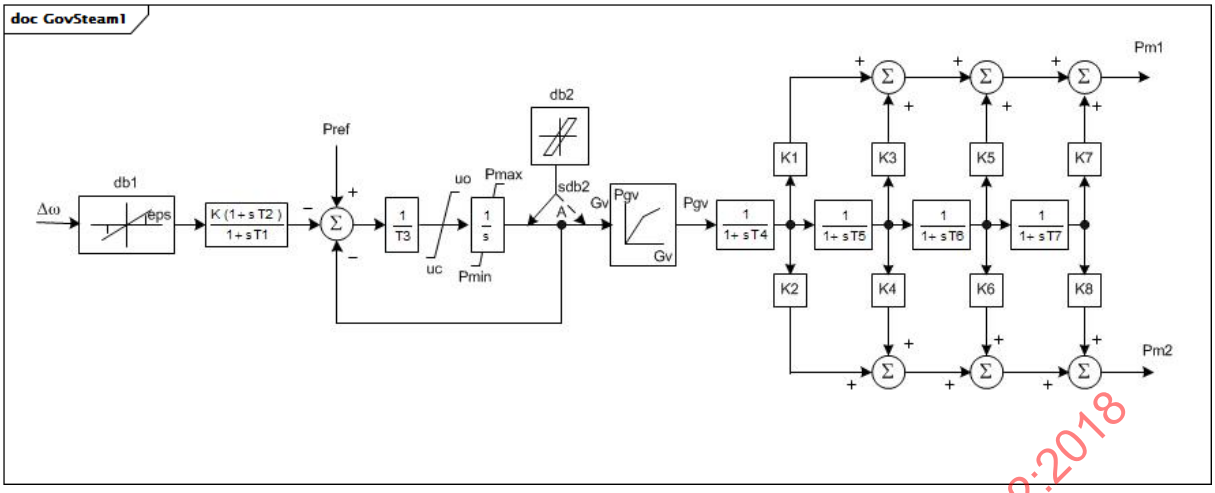

Figure 73 – GovSteam1

Figure 73: Ce diagramme décrit le modèle de régulateur de turbine GovSteam1.

Détails sur les paramètres:

1) Les paramètres PU reposent sur MWbase, qui est en principe la capacité en MW de la turbine.
2) Pour une turbine à simple ligne d'arbres, les paramètres K2, K4, K6 et K8 sont ignorés. Pour une turbine à deux lignes d'arbres, deux générateurs sont connectés à ce modèle de régulateur de turbine.
3) Chaque générateur doit être représenté dans le flux de puissance par des données relatives à sa base MVA. Les valeurs de K1, K3, K5 et K7 doivent être spécifiées pour décrire le développement proportionnel de la puissance sur le premier arbre de turbine. K2, K4, K6 et K8 doivent décrire le deuxième arbre de turbine. En principe, K1 + K3 + K5 + K7 = 1,0 et K2 + K4 + K6 + K8 = 1,0 (si le deuxième générateur est présent).
4) La répartition de puissance entre les deux arbres est proportionnelle aux valeurs des bases MVA des deux générateurs. Par conséquent, dans les conditions initiales de flux de puissance, il convient que les deux générateurs soient chargés sur la même fraction de chacune des bases MVA.
5) La zone d'insensibilité de vitesse d'entrée intentionnelle est conforme à la relation représentée dans le diagramme GovSteamIEEE1InputSpeedDeadband.
6) La zone d'insensibilité non intentionnelle peut être utilisée pour représenter l'hystérésis de jeu dans les composants de commande par la relation représentée dans le diagramme GovSteamIEEE1BacklashHysteresis.
7) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.

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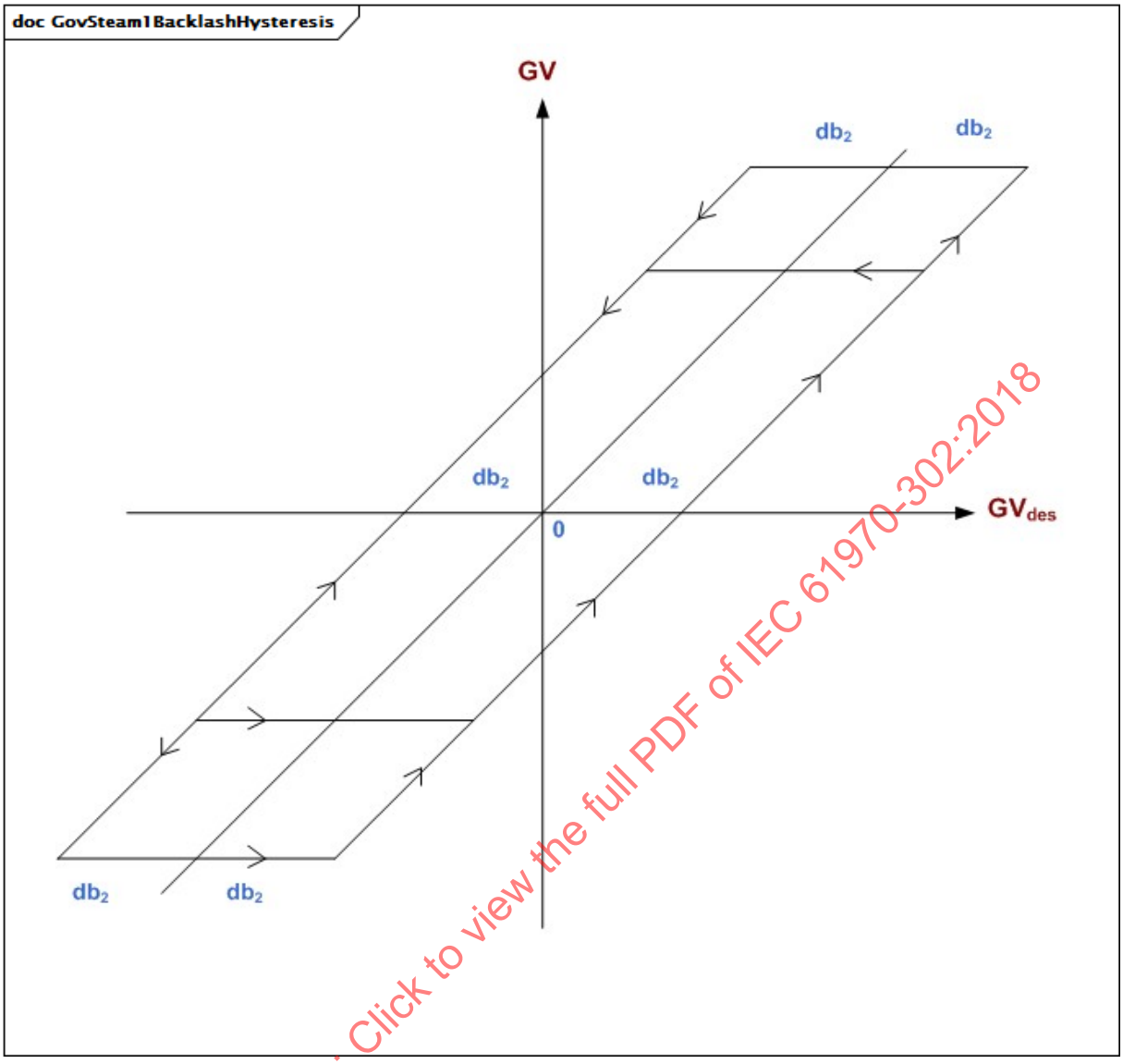

Figure 74 – GovSteam1BacklashHysteresis

Figure 74: Ce diagramme représente l'hystérésis de jeu.

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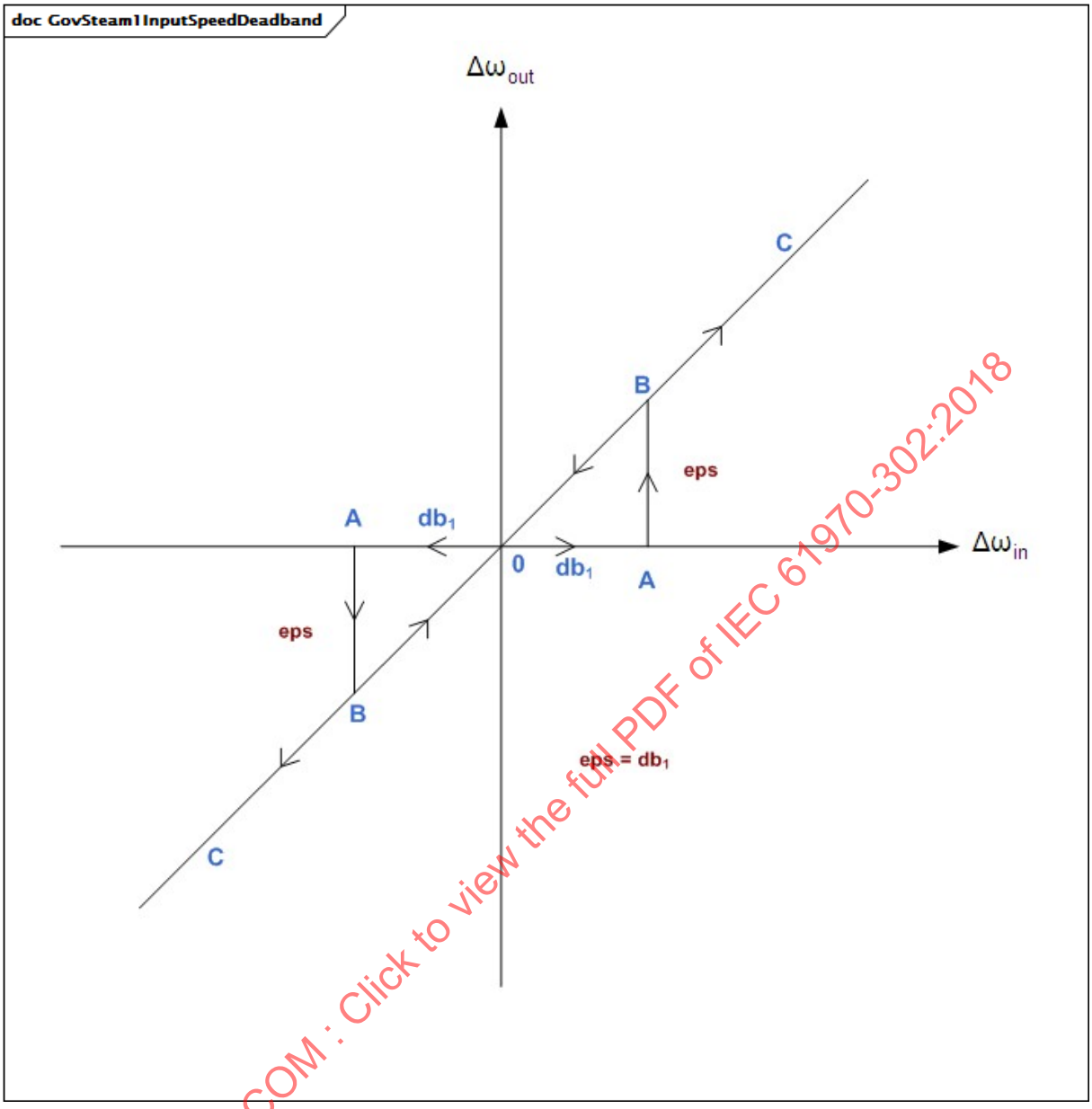

Figure 75 – GovSteam1InputSpeedDeadband

Figure 75: Ce diagramme représente la zone d'insensibilité de vitesse d'entrée.

Le Tableau 79 présente tous les attributs de GovSteam1.

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Tableau 79 – Attributs de TurbineGovernorDynamics::GovSteam1

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
k	0..1	PU	Gain du régulateur (réciproque du statisme) (K) (> 0). Valeur classique = 25.
t1	0..1	Seconds	Constante de temps de réponse du régulateur (T1) (>= 0). Valeur classique = 0.
t2	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T2) (>= 0). Valeur classique = 0.
t3	0..1	Seconds	Constante de temps du positionneur de vanne (T3) (> 0). Valeur classique = 0,1.
uo	0..1	Float	Vitesse d'ouverture maximale de la vanne (Uo) (> 0). Unité = PU / s. Valeur classique = 1.
uc	0..1	Float	Vitesse de fermeture maximale de la vanne (Uc) (< 0). Unité = PU / s. Valeur classique = -10.
pmax	0..1	PU	Ouverture maximale de la vanne (Pmax) (> GovSteam1.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne (Pmin) (>= 0 et < GovSteam1.pmax). Valeur classique = 0.
t4	0..1	Seconds	Constante de temps de la tuyauterie d'amenée d'air/du coffre de vapeur (T4) (>= 0). Valeur classique = 0,3.
k1	0..1	Float	Fraction de la puissance de l'arbre haute pression après le premier passage de la chaudière (K1). Valeur classique = 0,2.
k2	0..1	Float	Fraction de la puissance de l'arbre basse pression après le premier passage de la chaudière (K2). Valeur classique = 0.
t5	0..1	Seconds	Constante de temps du deuxième passage de la chaudière (T5) (>= 0). Valeur classique = 5.
k3	0..1	Float	Fraction de la puissance de l'arbre haute pression après le deuxième passage de la chaudière (K3). Valeur classique = 0,3.
k4	0..1	Float	Fraction de la puissance de l'arbre basse pression après le deuxième passage de la chaudière (K4). Valeur classique = 0.
t6	0..1	Seconds	Constante de temps du troisième passage de la chaudière (T6) (>= 0). Valeur classique = 0,5.
k5	0..1	Float	Fraction de la puissance de l'arbre haute pression après le troisième passage de la chaudière (K5). Valeur classique = 0,5.
k6	0..1	Float	Fraction de la puissance de l'arbre basse pression après le troisième passage de la chaudière (K6). Valeur classique = 0.
t7	0..1	Seconds	Constante de temps du quatrième passage de la chaudière (T7) (>= 0). Valeur classique = 0.
k7	0..1	Float	Fraction de la puissance de l'arbre haute pression après le quatrième passage de la chaudière (K7). Valeur classique = 0.
k8	0..1	Float	Fraction de la puissance de l'arbre basse pression après le quatrième passage de la chaudière (K8). Valeur classique = 0.
db1	0..1	Frequency	Largeur de zone d'insensibilité intentionnelle (db1). Unité = Hz. Valeur classique = 0.
eps	0..1	Frequency	Hystérésis db intentionnelle (eps). Unité = Hz. Valeur classique = 0.
sdb1	0..1	Boolean	Indicateur de zone d'insensibilité intentionnelle. true = la zone d'insensibilité intentionnelle est appliquée false = la zone d'insensibilité intentionnelle n'est pas appliquée Valeur classique = true.
sdb2	0..1	Boolean	Emplacement de la zone d'insensibilité non intentionnelle. true = la zone d'insensibilité intentionnelle est appliquée avant le point "A" false = la zone d'insensibilité intentionnelle est appliquée après le point "A" Valeur classique = true.
db2	0..1	ActivePower	Zone d'insensibilité non intentionnelle (db2). Unité = MW. Valeur classique = 0.

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nom	mult	type	description
valve	0..1	Boolean	Caractéristique de vanne non linéaire. true = la caractéristique de vanne non linéaire est utilisée false = la caractéristique de vanne non linéaire n'est pas utilisée. Valeur classique = true.
gv1	0..1	PU	Point 1 de la position de vanne de gain non linéaire (GV1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de la valeur de puissance de gain non linéaire (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de la position de vanne de gain non linéaire (GV2). Valeur classique = 0,4.
pgv2	0..1	PU	Point 2 de la valeur de puissance de gain non linéaire (Pgv2). Valeur classique = 0,75.
gv3	0..1	PU	Point 3 de la position de vanne de gain non linéaire (GV3). Valeur classique = 0,5.
pgv3	0..1	PU	Point 3 de la valeur de puissance de gain non linéaire (Pgv3). Valeur classique = 0,91.
gv4	0..1	PU	Point 4 de la position de vanne de gain non linéaire (GV4). Valeur classique = 0,6.
pgv4	0..1	PU	Point 4 de la valeur de puissance de gain non linéaire (Pgv4). Valeur classique = 0,98.
gv5	0..1	PU	Point 5 de la position de vanne de gain non linéaire (GV5). Valeur classique = 1.
pgv5	0..1	PU	Point 5 de la valeur de puissance de gain non linéaire (Pgv5). Valeur classique = 1.
gv6	0..1	PU	Point 6 de la position de vanne de gain non linéaire (GV6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de la valeur de puissance de gain non linéaire (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 80 présente toutes les extrémités d'association de GovSteam1 avec d'autres classes.

Tableau 80 – Extrémités d'association de TurbineGovernorDynamics::GovSteam1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.29 GovSteam2

Régulateur simplifié.

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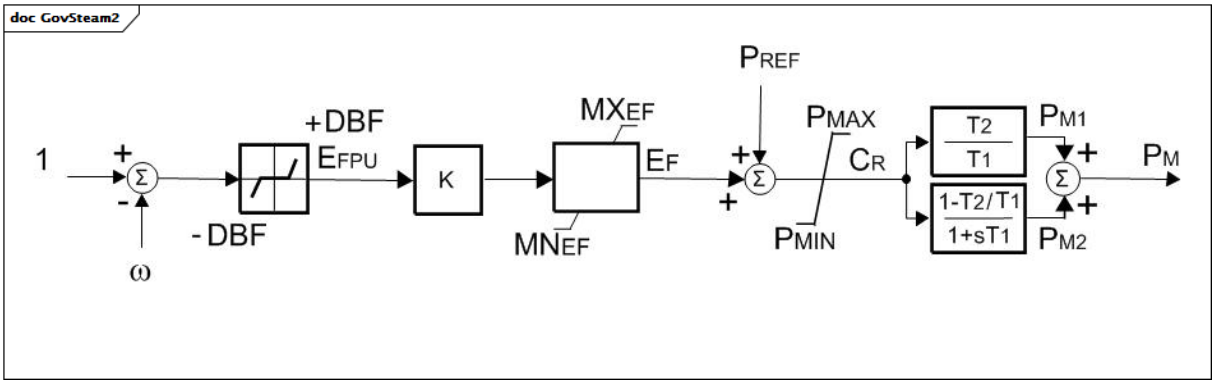

Figure 76 – GovSteam2

Figure 76: Ce diagramme décrit le modèle de régulateur de turbine GovSteam2.

Détails sur les paramètres:

1) Les paramètres PU reposent sur la capacité en MW de la turbine.
2) Ce modèle peut être utilisé pour les centrales thermiques et hydroélectriques.
3) omega a des unités de vitesse par unité.

Le Tableau 81 présente tous les attributs de GovSteam2.

Tableau 81 – Attributs de TurbineGovernorDynamics::GovSteam2

nom	mult	type	description
k	0..1	Float	Gain du régulateur (réciproque du statisme) (K). Valeur classique = 20.
dbf	0..1	PU	Zone d'insensibilité de fréquence (DBF). Valeur classique = 0.
t1	0..1	Seconds	Constante de temps de réponse du régulateur (T1) (> 0). Valeur classique = 0,45.
t2	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T2) (>= 0). Valeur classique = 0.
pmax	0..1	PU	Débit de combustible maximal (PMAX) (> GovSteam2.pmin). Valeur classique = 1.
pmin	0..1	PU	Débit de combustible minimal (PMIN) (< GovSteam2.pmax). Valeur classique = 0.
mxef	0..1	PU	Valeur de l'erreur positive maximale du débit de combustible (MXEF). Valeur classique = 1.
mnef	0..1	PU	Valeur de l'erreur négative maximale du débit de combustible (MNEF). Valeur classique = -1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 82 présente toutes les extrémités d'association de GovSteam2 avec d'autres classes.

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Tableau 82 – Extrémités d'association de TurbineGovernorDynamics::GovSteam2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.30 GovSteamBB

Modèle européen de régulateur.

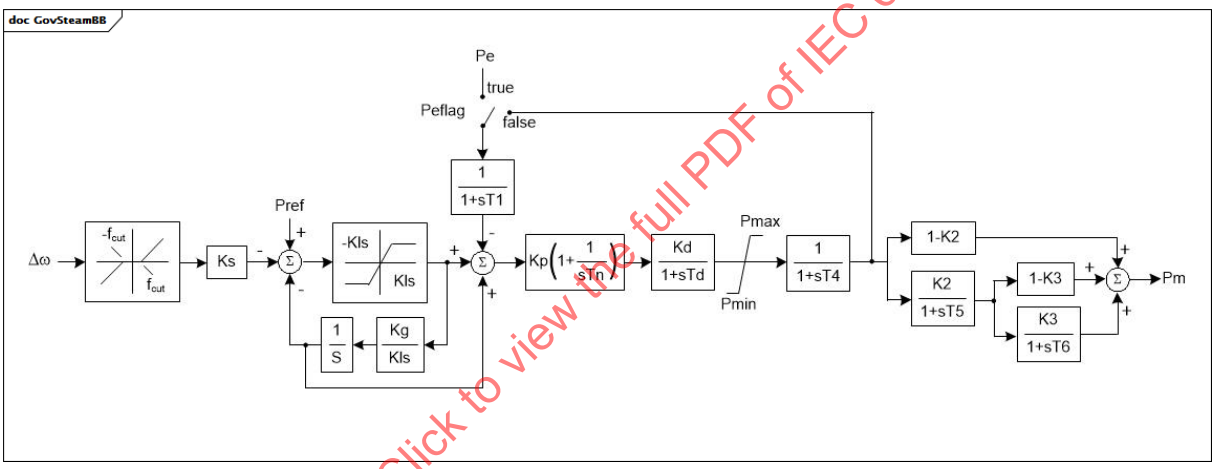

Figure 77 – GovSteamBB

Figure 77: Ce diagramme décrit le modèle de régulateur de turbine GovSteamBB.

Le Tableau 83 présente tous les attributs de GovSteamBB.

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Tableau 83 – Attributs de TurbineGovernorDynamics::GovSteamBB

nom	mult	type	description
fcut	0..1	PU	Zone d'insensibilité de fréquence (fcut) (>= 0). Valeur classique = 0,002.
ks	0..1	PU	Gain (Ks). Valeur classique = 21,0.
kls	0..1	PU	Gain (Kls) (> 0). Valeur classique = 0,1.
kg	0..1	PU	Gain (Kg). Valeur classique = 1,0.
t1	0..1	Seconds	Constante de temps (T1). Valeur classique = 0,05.
kp	0..1	PU	Gain (Kp). Valeur classique = 1,0.
tn	0..1	Seconds	Constante de temps (Tn) (> 0). Valeur classique = 1,0.
kd	0..1	PU	Gain (Kd). Valeur classique = 1,0.
td	0..1	Seconds	Constante de temps (Td) (> 0). Valeur classique = 1,0.
pmax	0..1	PU	Limite supérieure de puissance (Pmax) (> GovSteamBB.pmin). Valeur classique = 1,0.
pmin	0..1	PU	Limite inférieure de puissance (Pmin) (< GovSteamBB.pmax). Valeur classique = 0.
t4	0..1	Seconds	Constante de temps (T4). Valeur classique = 0,15.
k2	0..1	PU	Gain (K2). Valeur classique = 0,75.
t5	0..1	Seconds	Constante de temps (T5). Valeur classique = 12,0.
k3	0..1	PU	Gain (K3). Valeur classique = 0,5.
t6	0..1	Seconds	Constante de temps (T6). Valeur classique = 0,75.
peflag	0..1	Boolean	Sélection de l'entrée de puissance électrique (Peflag). true = entrée de puissance électrique false = signal de retour Valeur classique = false.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 84 présente toutes les extrémités d'association de GovSteamBB avec d'autres classes.

Tableau 84 – Extrémités d'association de TurbineGovernorDynamics::GovSteamBB avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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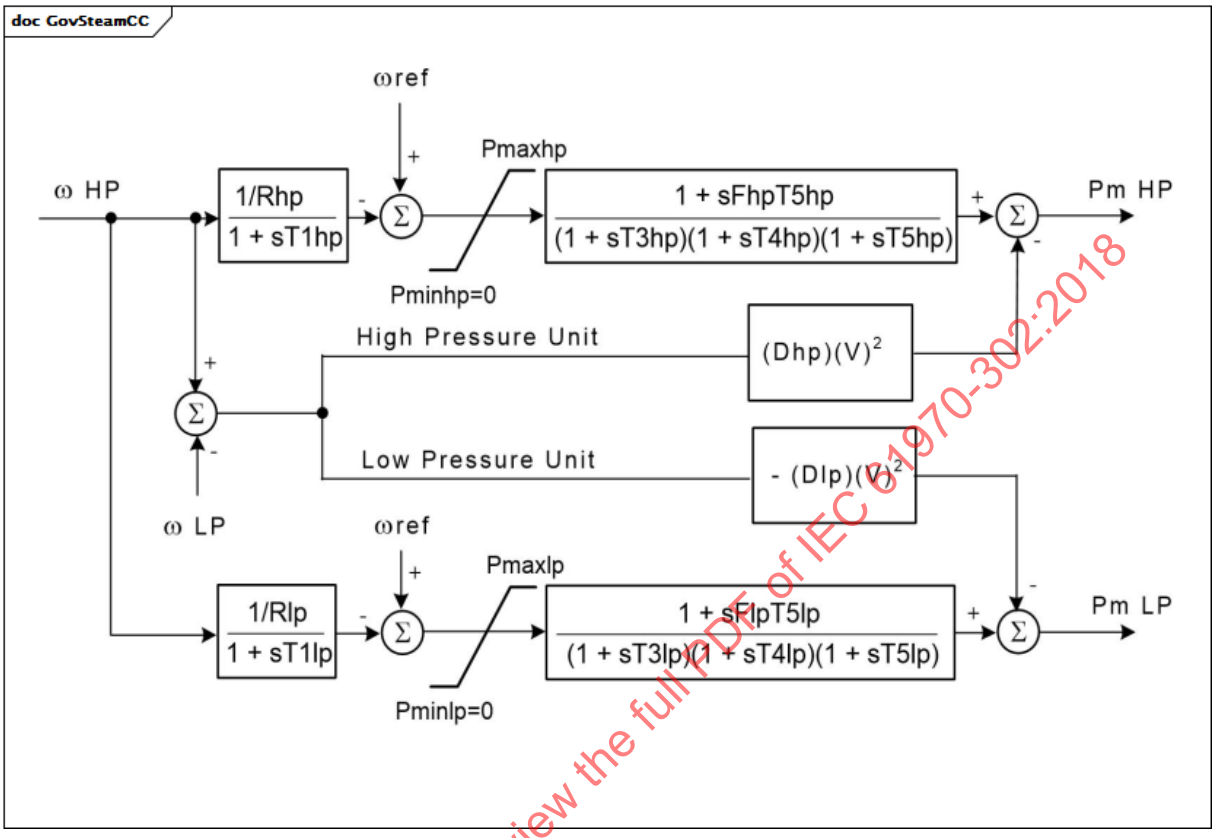
5.3.6.31 GovSteamCC

Régulateur de turbine à deux lignes d'arbres. À la différence des unités à simple ligne d'arbres, celles à deux lignes d'arbres ne se situent pas sur le même arbre.



Anglais	Français
High Pressure Unit	Unité haute pression
Low Pressure Unit	Unité basse pression

Figure 78 – GovSteamCC

Figure 78: Ce diagramme décrit le modèle de régulateur de turbine GovSteamCC.

Détails sur les paramètres:

1) Les deux générateurs doivent être présents et en service.
2) Chaque générateur doit être représenté dans le flux de puissance par des données établies relatives à sa base MVA. La répartition de la puissance entre les deux turbines est déterminée par les valeurs de MWbase des deux générateurs, par les valeurs de Fhp et Flp.
3) Les valeurs de référence de la vitesse du rotor (omegaref) sont les valeurs de référence respectives des unités, chaque unité ayant son arbre distinct et chaque arbre étant équipé de son propre générateur et de sa propre excitatrice.
4) V est la tension aux bornes.
5) Fhp et Flp peuvent être utilisés pour indiquer la présence de deux étages de resurchauffe pour une seule turbine. S'il n'y a qu'un seul étage de resurchauffe, entre les turbines HP et BP, il convient que Fhp et Flp soient respectivement une unité et zéro, et il convient que T5lp soit défini sur la constante de temps du resurchauffeur.

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6) Dhp et Dlp donnent une approximation grossière de l'amortissement des variations de vitesse entre machines dues aux effets électromagnétiques. Si les générateurs sont représentés par le modèle de rotor rond avec des valeurs de constantes de temps subtransitoire correctes, cet amortissement est représenté précisément dans les couples électriques du générateur, et il convient d'attribuer une valeur nulle à Dhp et Dlp.

7) Si l'une des constantes de temps est nulle, elle est ignorée.

Le Tableau 85 présente tous les attributs de GovSteamCC.

Tableau 85 – Attributs de TurbineGovernorDynamics::GovSteamCC

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
pmaxhp	0..1	PU	Position de la valeur HP maximale (Pmaxhp). Valeur classique = 1.
rhp	0..1	PU	Statisme du régulateur HP (Rhp) (> 0). Valeur classique = 0,05.
t1hp	0..1	Seconds	Constante de temps du régulateur HP (T1hp) (>= 0). Valeur classique = 0,1.
t3hp	0..1	Seconds	Constante de temps de la turbine HP (T3hp) (>= 0). Valeur classique = 0,1.
t4hp	0..1	Seconds	Constante de temps de la turbine HP (T4hp) (>= 0). Valeur classique = 0,1.
t5hp	0..1	Seconds	Constante de temps du resurchauffeur HP (T5hp) (>= 0). Valeur classique = 10.
fhp	0..1	PU	Fraction de puissance HP à l'avant du resurchauffeur (Fhp). Valeur classique = 0,3.
dhp	0..1	PU	Facteur d'amortissement HP (Dhp). Valeur classique = 0.
pmaxlp	0..1	PU	Position de la valeur BP maximale (Pmaxlp). Valeur classique = 1.
rlp	0..1	PU	Statisme du régulateur BP (Rlp) (> 0). Valeur classique = 0,05.
t1lp	0..1	Seconds	Constante de temps du régulateur BP (T1lp) (>= 0). Valeur classique = 0,1.
t3lp	0..1	Seconds	Constante de temps de la turbine BP (T3lp) (>= 0) Valeur classique = 0,1.
t4lp	0..1	Seconds	Constante de temps de la turbine BP (T4lp) (>= 0). Valeur classique = 0,1.
t5lp	0..1	Seconds	Constante de temps du resurchauffeur BP (T5lp) (>= 0) Valeur classique = 10.
flp	0..1	PU	Fraction de puissance BP à l'avant du resurchauffeur (Flp). Valeur classique = 0,7.
dlp	0..1	PU	Facteur d'amortissement BP (Dlp). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 86 présente toutes les extrémités d'association de GovSteamCC avec d'autres classes.

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Tableau 86 – Extrémités d'association de TurbineGovernorDynamics::GovSteamCC avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	LowPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: CrossCompoundTurbineGovernorDyanmics
0..1	HighPressureSynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: CrossCompoundTurbineGovernorDyanmics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.32 GovSteamEU

Chaudière simplifiée et turbine à vapeur avec régulateur PID.

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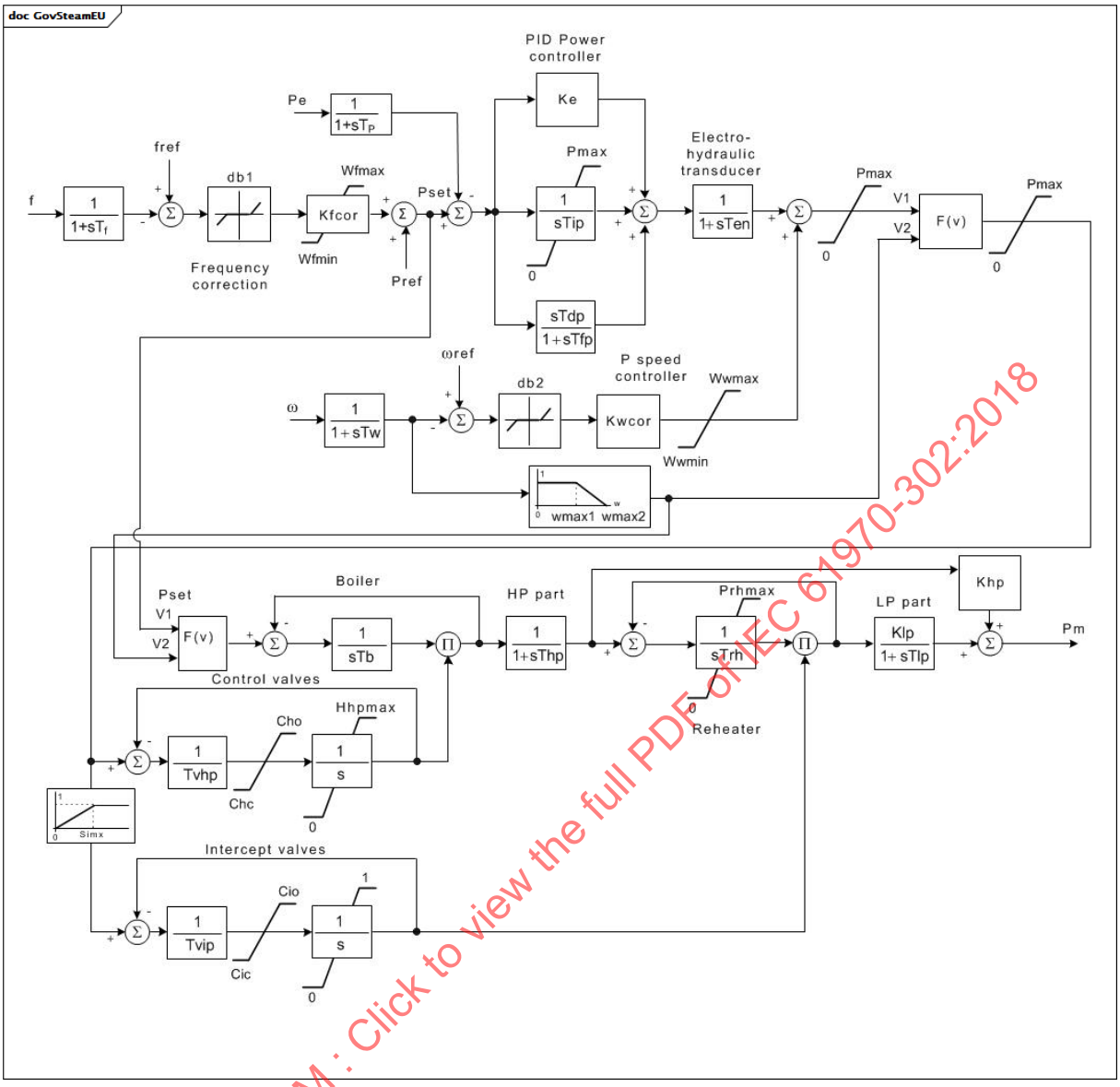

Anglais	Français
PID Power controller	Régulateur de puissance PID
Electro-hydraulic transducer	Transducteur électrohydraulique
Frequency correction	Correction de fréquence
P speed controller	Régulateur de vitesse P
Boiler	Chaudière
HP part	Partie HP
LP part	Partie BP
Control valves	Vannes de commande
Reheater	Resurchauffeur
Intercept valves	Vannes d'interception

Figure 79 – GovSteamEU

Figure 79: Ce diagramme décrit le modèle de régulateur de turbine GovSteamEU.

Détails sur les paramètres:

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1) Les paramètres PU reposent sur la capacité en MW de la turbine MWbase.
2) Pour représenter une turbine sans resurchauffe, définir Trh = 0 et Tlp sur environ 0,5 s.
3) F(v) est une sélection de valeur minimale.
4) La fréquence (f) est la fréquence (nodale) locale.

Le Tableau 87 présente tous les attributs de GovSteamEU.

Tableau 87 – Attributs de TurbineGovernorDynamics::GovSteamEU

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
tp	0..1	Seconds	Constante de temps du transducteur de puissance (Tp) (>= 0). Valeur classique = 0,07.
ke	0..1	PU	Gain du régulateur de puissance (Ke). Valeur classique = 0,65.
tip	0..1	Seconds	Constante de temps intégrale du régulateur de puissance (Tip) (>= 0). Valeur classique = 2.
tdp	0..1	Seconds	Constante de temps de dérivation du régulateur de puissance (Tdp) (>= 0). Valeur classique = 0.
tfp	0..1	Seconds	Constante de temps du régulateur de puissance (Tfp) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du transducteur de fréquence (Tf) (>= 0). Valeur classique = 0.
kfcor	0..1	PU	Gain du correcteur de fréquence (Kfcor). Valeur classique = 20.
db1	0..1	PU	Zone d'insensibilité du correcteur de fréquence (db1). Valeur classique = 0.
wfmax	0..1	PU	Limite supérieure de correction de fréquence (Wfmax) (> GovSteamEU.wfmin). Valeur classique = 0,05.
wfmin	0..1	PU	Limite inférieure de correction de fréquence (Wfmin) (< GovSteamEU.wfmax). Valeur classique = -0,05.
pmax	0..1	PU	Puissance active maximale de la turbine (Pmax). Valeur classique = 1.
ten	0..1	Seconds	Transducteur électrohydraulique (Ten) (>= 0). Valeur classique = 0,1.
tw	0..1	Seconds	Constante de temps du transducteur de vitesse (Tw) (>= 0). Valeur classique = 0,02.
kwcor	0..1	PU	Gain du régulateur de vitesse (Kwcor). Valeur classique = 20.
db2	0..1	PU	Zone d'insensibilité du régulateur de vitesse (db2). Valeur classique = 0,0004.
wwmax	0..1	PU	Limite supérieure du régulateur de vitesse (Wwmax) (> GovSteamEU.wwmin). Valeur classique = 0,1.
wwmin	0..1	PU	Limite inférieure pour la correction de fréquence du régulateur de vitesse (Wwmin) (< GovSteamEU.wwmax). Valeur classique = -1.
wmax1	0..1	PU	Limite inférieure de commande de vitesse d'urgence (wmax1). Valeur classique = 1,025.
wmax2	0..1	PU	Limite supérieure de commande de vitesse d'urgence (wmax2). Valeur classique = 1,05.
tvhp	0..1	Seconds	Constante de temps des asservissements de vannes de commande (Tvhp) (>= 0). Valeur classique = 0,1.
cho	0..1	Float	Limite de vitesse d'ouverture des vannes de commande (Cho). Unité = PU / s. Valeur classique = 0,17.
chc	0..1	Float	Limite de vitesse de fermeture des vannes de commande (Chc). Unité = PU / s. Valeur classique = −3,3.
hhpmax	0..1	PU	Position maximale de la vanne de commande (Hhpmax). Valeur classique = 1.
tvip	0..1	Seconds	Constante de temps des asservissements de vannes d'interception (Tvip) (>= 0). Valeur classique = 0,15.
cio	0..1	PU	Limite de vitesse d'ouverture des vannes d'interception (Cio). Valeur classique = 0,123.
cic	0..1	PU	Limite de vitesse de fermeture des vannes d'interception (Cic). Valeur classique = -2,2.

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nom	mult	type	description
simx	0..1	PU	Limite de transfert des vannes d'interception (Simx). Valeur classique = 0,425.
thp	0..1	Seconds	Constante de temps haute pression (HP) de la turbine (Thp) (>= 0). Valeur classique = 0,31.
trh	0..1	Seconds	Constante de temps du resurchauffeur de la turbine (Trh) (>= 0). Valeur classique = 8.
tlp	0..1	Seconds	Constante de temps basse pression (BP) de la turbine (Tlp) (>= 0). Valeur classique = 0,45.
prhmax	0..1	PU	Limite maximale de basse pression (Prhmax). Valeur classique = 1,4.
khp	0..1	PU	Fraction de la sortie totale de la turbine générée par la partie HP (Khp). Valeur classique = 0,277.
klp	0..1	PU	Fraction de la sortie totale de la turbine générée par la partie BP (Klp). Valeur classique = 0,723.
tb	0..1	Seconds	Constante de temps de la chaudière (Tb) (>= 0). Valeur classique = 100.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 88 présente toutes les extrémités d'association de GovSteamEU avec d'autres classes.

Tableau 88 – Extrémités d'association de TurbineGovernorDynamics::GovSteamEU avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.33 GovSteamFV2

Régulateur de turbine à vapeur avec constantes de temps du resurchauffeur et modélisation des effets de fermeture rapide de la vanne afin de réduire la puissance mécanique.

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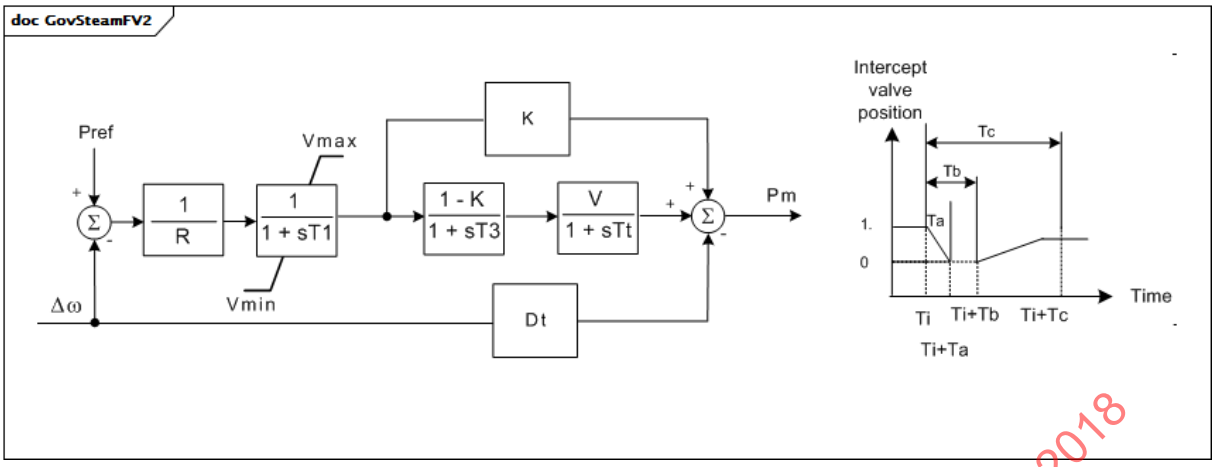

Anglais	Français
Intercept valve position	Position de la vanne d'interception
Time	Temps

Figure 80 – GovSteamFV2

Figure 80: Ce diagramme décrit le modèle de régulateur de turbine GovSteamFV2.

Détails sur les paramètres:

1) La position de la vanne est déterminée par la courbe de temps. La position de la vanne est 1 ou 0.
2) Ti (Temps initial de début de vannage rapide) est un paramètre défini par l'utilisateur au moment de la simulation. Il n'est pas échangé. Ti est pris par hypothèse comme étant de 0,1 s. Il est utilisé pour examiner l'effet du vannage rapide.

Le Tableau 89 présente tous les attributs de GovSteamFV2.

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Tableau 89 – Attributs de TurbineGovernorDynamics::GovSteamFV2

nom	mult	type	description
dt	0..1	PU	(Dt).
k	0..1	PU	Fraction de la puissance de la turbine développée par des tranches de turbine qui ne sont pas concernées par le vannage rapide (K).
mwbase	0..1	ActivePower	Base utilisée à la place de la base machine dans le modèle d'équipement, le cas échéant (MWbase) (> 0). Unité = MW.
r	0..1	PU	(R).
t1	0..1	Seconds	Constante de temps du régulateur (T1) (>= 0).
t3	0..1	Seconds	Constante de temps du resurchauffeur (T3) (>= 0).
ta	0..1	Seconds	Temps postérieur au temps initial pour la fermeture de la vanne (Ta) (>= 0).
tb	0..1	Seconds	Temps postérieur au temps initial pour le début d'ouverture de la vanne (Tb) (>= 0).
tc	0..1	Seconds	Temps postérieur au temps initial pour l'ouverture totale de la vanne (Tc) (>= 0).
tt	0..1	Seconds	Constante de temps avec laquelle la puissance diminue par suite de la fermeture de la vanne d'interception (Tt) (>= 0).
vmax	0..1	PU	(Vmax) (> GovSteamFV2.vmin).
vmin	0..1	PU	(Vmin) (< GovSteamFV2.vmax).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 90 présente toutes les extrémités d'association de GovSteamFV2 avec d'autres classes.

Tableau 90 – Extrémités d'association de TurbineGovernorDynamics::GovSteamFV2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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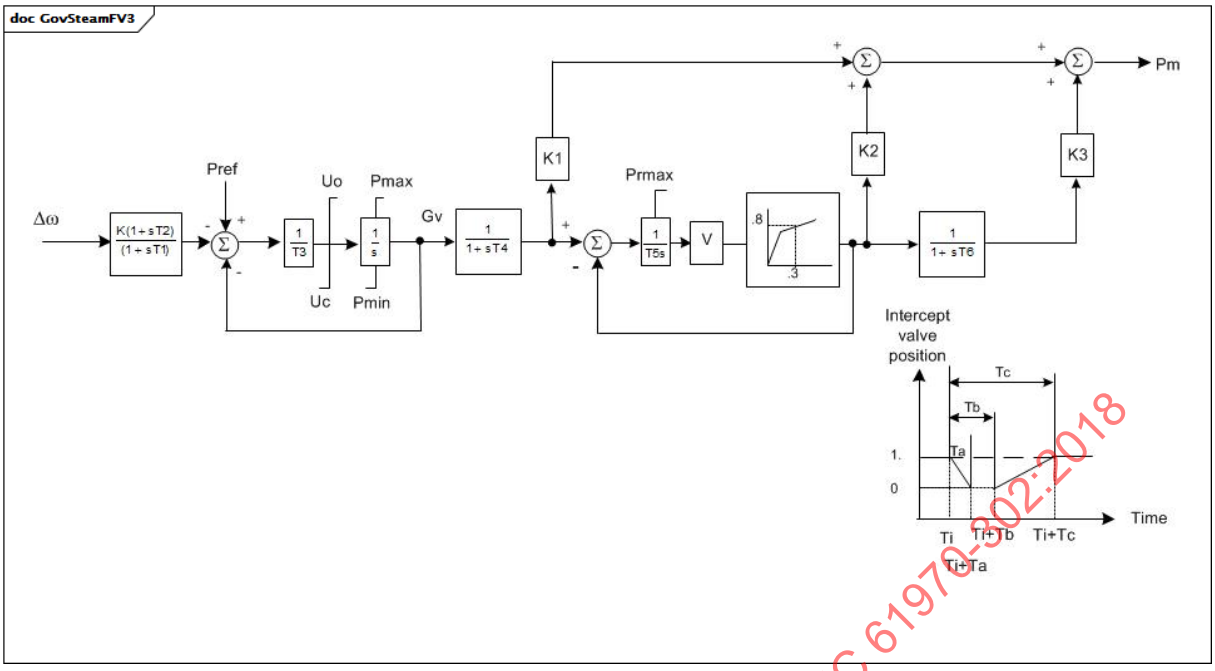
5.3.6.34 GovSteamFV3

Régulateur simplifié de turbine à vapeur GovSteamIEEE1 avec limite Prmax et vannage rapide.



Anglais	Français
Intercept valve position	Position de la vanne d'interception
Time	Temps

Figure 81 – GovSteamFV3

Figure 81: Ce diagramme décrit le modèle de régulateur de turbine GovSteamFV3.

Détails sur les paramètres:

1) Les gains K1, K2 et K3 décrivent la répartition de sortie de puissance entre les étages de turbine. En principe, K1 + K2 + K3 = 1.
2) Les temps Ta, Tb et Tc sont indiqués en fonction du temps d'initiation.
3) La valeur Prmax est une limite de pression dans le resurchauffeur. En principe, il convient que cette valeur soit environ de 1,10 PU.
4) Le gain non linéaire entre la position de la vanne et la puissance peut être l'entrée avec 6 points au maximum. Les points (0,0 , 0,0) et (1,0 , 1,0) peuvent être pris par hypothèse. Il n'est pas admis que la sortie dépasse 0,0 et 1,0. Toutefois, si Pmax > 1,0, l'entrée et la sortie sont mises à l'échelle par Pmax. Si Gv1 est un nombre négatif ou nul, la courbe par défaut (entre (0,0 , 0,0) et (1,0 , 1,0)) est utilisée.
5) Ti (Temps initial de début de vannage rapide) est un paramètre défini par l'utilisateur au moment de la simulation. Il n'est pas échangé. Ti est pris par hypothèse comme étant de 0,1 s. Il est utilisé pour examiner l'effet du vannage rapide.

Le Tableau 91 présente tous les attributs de GovSteamFV3.

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Tableau 91 – Attributs de TurbineGovernorDynamics::GovSteamFV3

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
k	0..1	PU	Gain du régulateur (réciproque du statisme) (K). Valeur classique = 20.
t1	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (T1) (>= 0). Valeur classique = 0.
t2	0..1	Seconds	Constante de temps de réponse du régulateur (T2) (>= 0). Valeur classique = 0.
t3	0..1	Seconds	Constante de temps du positionneur de vanne (T3) (>= 0). Valeur classique = 0.
uo	0..1	Float	Vitesse d'ouverture maximale de la vanne (Uo). Unité = PU / s. Valeur classique = 0,1.
uc	0..1	Float	Vitesse de fermeture maximale de la vanne (Uc). Unité = PU / s. Valeur classique = -1.
pmax	0..1	PU	Ouverture maximale de la vanne, PU de MWbase (Pmax) (> GovSteamFV3.pmin). Valeur classique = 1.
pmin	0..1	PU	Ouverture minimale de la vanne, PU de MWbase (Pmin) (< GovSteamFV3.pmax). Valeur classique = 0.
t4	0..1	Seconds	Constante de temps de la tuyauterie d'amenée d'air/du coffre de vapeur (T4) (>= 0). Valeur classique = 0,2.
k1	0..1	PU	Fraction de la puissance de la turbine développée après le premier passage de la chaudière (K1). Valeur classique = 0,2.
t5	0..1	Seconds	Constante de temps du deuxième passage de la chaudière (c'est-à-dire le resurchauffeur) (T5) (> 0 si le vannage rapide est utilisé; dans les autres cas, >= 0). Valeur classique = 0,5.
k2	0..1	PU	Fraction de la puissance de la turbine développée après le deuxième passage de la chaudière (K2). Valeur classique = 0,2.
t6	0..1	Seconds	Constante de temps du point convergence ou du troisième passage de la chaudière (T6) (>= 0). Valeur classique = 10.
k3	0..1	PU	Fraction de la puissance de la turbine HP développée après le point convergence ou le troisième passage de la chaudière (K3). Valeur classique = 0,6.
ta	0..1	Seconds	Temps de fermeture de la vanne d'interception (IV) (Ta) (>= 0). Valeur classique = 0,97.
tb	0..1	Seconds	Durée de réouverture d'IV (Tb) (>= 0). Valeur classique = 0,98.
tc	0..1	Seconds	Durée de réouverture totale d'IV (Tc) (>= 0). Valeur classique = 0,99.
prmax	0..1	PU	Pression maximale dans le resurchauffeur (Prmax). Valeur classique = 1.
gv1	0..1	PU	Point 1 de la position de vanne de gain non linéaire (GV1). Valeur classique = 0.
pgv1	0..1	PU	Point 1 de la valeur de puissance de gain non linéaire (Pgv1). Valeur classique = 0.
gv2	0..1	PU	Point 2 de la position de vanne de gain non linéaire (GV2). Valeur classique = 0,4.
pgv2	0..1	PU	Point 2 de la valeur de puissance de gain non linéaire (Pgv2). Valeur classique = 0,75.
gv3	0..1	PU	Point 3 de la position de vanne de gain non linéaire (GV3). Valeur classique = 0,5.
pgv3	0..1	PU	Point 3 de la valeur de puissance de gain non linéaire (Pgv3). Valeur classique = 0,91.
gv4	0..1	PU	Point 4 de la position de vanne de gain non linéaire (GV4). Valeur classique = 0,6.
pgv4	0..1	PU	Point 4 de la valeur de puissance de gain non linéaire (Pgv4). Valeur classique = 0,98.
gv5	0..1	PU	Point 5 de la position de vanne de gain non linéaire (GV5). Valeur classique = 1.

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nom	mult	type	description
pgv5	0..1	PU	Point 5 de la valeur de puissance de gain non linéaire (Pgv5). Valeur classique = 1.
gv6	0..1	PU	Point 6 de la position de vanne de gain non linéaire (GV6). Valeur classique = 0.
pgv6	0..1	PU	Point 6 de la valeur de puissance de gain non linéaire (Pgv6). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 92 présente toutes les extrémités d'association de GovSteamFV3 avec d'autres classes.

Tableau 92 – Extrémités d'association de TurbineGovernorDynamics::GovSteamFV3 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.35 GovSteamFV4

Régulateur électrohydraulique détaillé pour l'appareil à vapeur.

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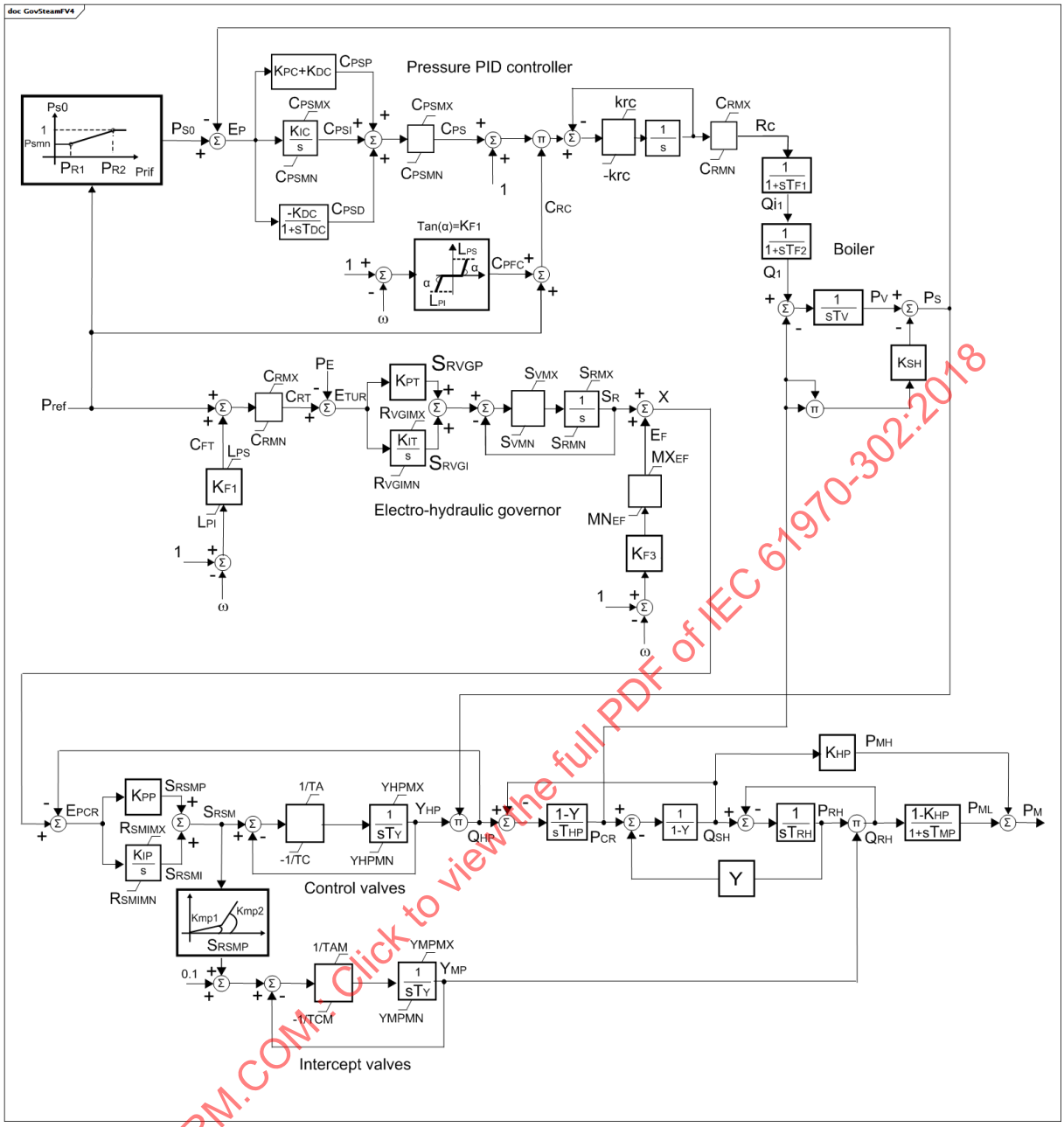

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Anglais	Français
Pressure PID Controller	Régulateur PID de pression
Boiler	Chaudière
Electro-hydraulic governor	Régulateur électrohydraulique
Control valves	Vannes de commande
Intercept valves	Vannes d'interception

Figure 82 – GovSteamFV4

Figure 82: Ce diagramme décrit le modèle de régulateur de turbine GovSteamFV4.

Détails sur les paramètres:

1) Les paramètres PU reposent sur la capacité en MW de la turbine.

2) Ce modèle peut être utilisé pour les appareils à vapeur en commande coordonnée, n'appartenant pas à une centrale électrique à cycle combiné.

3) omega a des unités de vitesse par unité.

Le Tableau 93 présente tous les attributs de GovSteamFV4.

Tableau 93 – Attributs de TurbineGovernorDynamics::GovSteamFV4

nom	mult	type	description
kf1	0..1	PU	Ecart de fréquence (réciproque du statisme) (Kf1). Valeur classique = 20.
kf3	0..1	PU	Commande de fréquence (réciproque du statisme) (Kf3). Valeur classique = 20.
lps	0..1	PU	Erreur de puissance positive maximale (Lps). Valeur classique = 0,03.
lpi	0..1	PU	Erreur de puissance négative maximale (Lpi). Valeur classique = -0,15.
mxef	0..1	PU	Limite supérieure de correction de fréquence (MXEF). Valeur classique = 0,05.
mnef	0..1	PU	Limite inférieure de correction de fréquence (MNEF). Valeur classique = -0,05.
crmx	0..1	PU	Valeur maximale du point de consigne du régulateur (Crmx). Valeur classique = 1,2.
crmn	0..1	PU	Valeur minimale du point de consigne du régulateur (Crmn). Valeur classique = 0.
kpt	0..1	PU	Gain proportionnel du régulateur électrohydraulique (Kpt). Valeur classique = 0,3.
kit	0..1	PU	Gain intégral du régulateur électrohydraulique (Kit). Valeur classique = 0,04.
rvgmx	0..1	PU	Valeur maximale du régulateur intégral (Rvgmx). Valeur classique = 1,2.
rvgmn	0..1	PU	Valeur minimale du régulateur intégral (Rvgmn). Valeur classique = 0.
svmx	0..1	Float	Vitesse maximale d'ouverture de la vanne du régulateur (Svmx). Valeur classique = 0,0333.
svmn	0..1	Float	Vitesse maximale de fermeture de la vanne du régulateur (Svmn). Valeur classique = -0,0333.
srmx	0..1	PU	Ouverture maximale de la vanne (Srmx). Valeur classique = 1,1.
srmn	0..1	PU	Ouverture minimale de la vanne (Srmn). Valeur classique = 0.
kpp	0..1	PU	Gain proportionnel du régulateur de retour de pression (Kpp). Valeur classique = 1.
kip	0..1	PU	Gain intégral du régulateur de retour de pression (Kip). Valeur classique = 0,5.
rsmimx	0..1	PU	Valeur maximale du régulateur intégral (Rsmimx). Valeur classique = 1,1.
rsmimn	0..1	PU	Valeur minimale du régulateur intégral (Rsmimn). Valeur classique = 0.
kmp1	0..1	PU	Premier coefficient de gain de la caractéristique de vannes d'interception (Kmp1). Valeur classique = 0,5.
kmp2	0..1	PU	Deuxième coefficient de gain de la caractéristique de vannes d'interception (Kmp2). Valeur classique = 3,5.
srsmp	0..1	PU	Point de discontinuité de caractéristique des vannes d'interception (Srsmp). Valeur classique = 0,43.
ta	0..1	Seconds	Temps de vitesse d'ouverture des vannes de commande (Ta) (>= 0). Valeur classique = 0,8.
tc	0..1	Seconds	Temps de vitesse de fermeture des vannes de commande (Tc) (>= 0). Valeur classique = 0,5.
ty	0..1	Seconds	Constante de temps des asservissements de vannes de commande (Ty) (>= 0). Valeur classique = 0,1.
yhpmx	0..1	PU	Position maximale de la vanne de commande (Yhpmx). Valeur classique = 1,1.
yhpmn	0..1	PU	Position minimale de la vanne de commande (Yhpmn). Valeur classique = 0.
tam	0..1	Seconds	Temps de vitesse d'ouverture des vannes d'interception (Tam) (>= 0). Valeur classique = 0,8.

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nom	mult	type	description
tcm	0..1	Seconds	Temps de vitesse de fermeture des vannes d'interception (Tcm) (>= 0). Valeur classique = 0,5.
ympmx	0..1	PU	Position maximale de la vanne d'interception (Ympmx). Valeur classique = 1,1.
ympmn	0..1	PU	Position minimale de la vanne d'interception (Ympmn). Valeur classique = 0.
y	0..1	PU	Coefficient des équations linéarisées de la turbine (formule de Stodola) (Y). Valeur classique = 0,13.
thp	0..1	Seconds	Constante de temps haute pression (HP) de la turbine (Thp) (>= 0). Valeur classique = 0,15.
trh	0..1	Seconds	Constante de temps du resurchauffeur de la turbine (Trh) (>= 0). Valeur classique = 10.
tmp	0..1	Seconds	Constante de temps basse pression (BP) de la turbine (Tmp) (>= 0). Valeur classique = 0,4.
khp	0..1	PU	Fraction de la sortie totale de la turbine générée par la partie HP (Khp). Valeur classique = 0,35.
pr1	0..1	PU	Première valeur de la caractéristique statique du point de consigne de pression (Pr1). Valeur classique = 0,2.
pr2	0..1	PU	Deuxième valeur de la caractéristique statique du point de consigne de pression, correspondant à Ps0 = 1.0 PU (Pr2). Valeur classique = 0,75.
psmn	0..1	PU	Valeur minimale de la caractéristique statique du point de consigne de pression (Psmn). Valeur classique = 1.
kpc	0..1	PU	Gain proportionnel du régulateur de pression (Kpc). Valeur classique = 0,5.
kic	0..1	PU	Gain intégral du régulateur de pression (Kic). Valeur classique = 0,0033.
kdc	0..1	PU	Gain par dérivation du régulateur de pression (Kdc). Valeur classique = 1.
tdc	0..1	Seconds	Constante de temps par dérivation du régulateur de pression (Tdc) (>= 0). Valeur classique = 90.
cpsmx	0..1	PU	Valeur maximale de la sortie du régulateur de pression (Cpsmx). Valeur classique = 1.
cpsmn	0..1	PU	Valeur minimale de la sortie du régulateur de pression (Cpsmn). Valeur classique = -1.
krc	0..1	PU	Variation maximale du débit de combustible (Krc). Valeur classique = 0,05.
tf1	0..1	Seconds	Constante de temps de la régulation de combustible (Tf1) (>= 0). Valeur classique = 10.
tf2	0..1	Seconds	Constante de temps de la régulation du coffre de vapeur (Tf2) (>= 0). Valeur classique = 10.
tv	0..1	Seconds	Constante de temps de la chaudière (Tv) (>= 0). Valeur classique = 60.
ksh	0..1	PU	Perte de pression due au frottement de l'écoulement dans les tubes de chaudière (Ksh). Valeur classique = 0,08.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 94 présente toutes les extrémités d'association de GovSteamFV4 avec d'autres classes.

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Tableau 94 – Extrémités d'association de TurbineGovernorDynamics::GovSteamFV4 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.6.36 GovSteamSGO

Régulateur simplifié de turbine à vapeur.

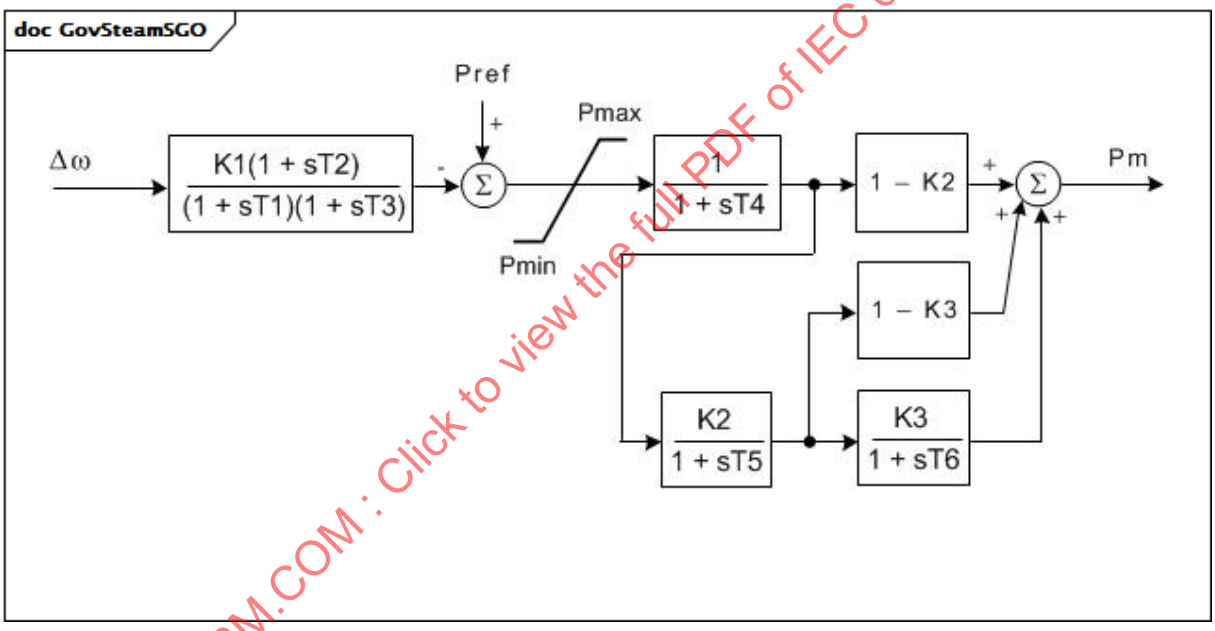

Figure 83 – GovSteamSGO

Figure 83: Ce diagramme décrit le modèle de régulateur de turbine GovSteamSGO.

Le Tableau 95 présente tous les attributs de GovSteamSGO.

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Tableau 95 – Attributs de TurbineGovernorDynamics::GovSteamSGO

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
t1	0..1	Seconds	Retard du régulateur (T1) (>= 0).
t2	0..1	Seconds	Compensation du délai de mise en œuvre du régulateur (T2) (>= 0).
t3	0..1	Seconds	Retard du régulateur (T3) (> 0).
t4	0..1	Seconds	Retard dû aux volumes d'entrée de vapeur associés au coffre de vapeur et à la tuyauterie d'amenée d'air (T4) (>= 0).
t5	0..1	Seconds	Retard du resurchauffeur, y compris les connexions chaudes et froides (T5) (>= 0).
t6	0..1	Seconds	Retard dû à la turbine IP-LP, aux tuyaux de raccordement et aux capots d'extrémité BP (T6) (>= 0).
k1	0..1	PU	Régulation unique / PU (K1).
k2	0..1	PU	Fraction (K2).
k3	0..1	PU	Fraction (K3).
pmax	0..1	PU	Limite de puissance supérieure (Pmax) (> GovSteamSGO.pmin).
pmin	0..1	Seconds	Limite de puissance inférieure (Pmin) (>= 0 et < GovSteamSGO.pmax).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 96 présente toutes les extrémités d'association de GovSteamSGO avec d'autres classes.

Tableau 96 – Extrémités d'association de TurbineGovernorDynamics::GovSteamSGO avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
0..*	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: TurbineGovernorDynamics
1..1	TurbineLoadControllerDynamics	0..1	TurbineLoadControllerDynamics	hérité de: TurbineGovernorDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.6.37 Énumération DroopSignalFeedbackKind

Source de retour du signal de statisme du régulateur.

Le Tableau 97 présente tous les libellés de DroopSignalFeedbackKind.

Tableau 97 – Libellés de TurbineGovernorDynamics::DroopSignalFeedbackKind

libellé	valeur	description
electricalPower		Retour de puissance électrique (raccordement indiqué par 1 dans les diagrammes de bloc des modèles (GovCT1, GovCT2, par exemple)).
none		Pas de retour de signal de statisme, le régulateur est isochrone.
fuelValveStroke		Retour de course de vanne à combustible (course vraie) (raccordement indiqué par 2 dans les diagrammes de bloc des modèles (GovCT1, GovCT2, par exemple)).
governorOutput		Mode à rebouclage par la sortie du régulateur (course demandée) (raccordement indiqué par 3 dans les diagrammes de bloc des modèles (GovCT1, GovCT2, par exemple)).

5.3.6.38 Énumération FrancisGovernorControlKind

Fanion de commande du régulateur pour le modèle hydraulique Francis.

Le Tableau 98 présente tous les libellés de FrancisGovernorControlKind.

Tableau 98 – Libellés de TurbineGovernorDynamics::FrancisGovernorControlKind

libellé	valeur	description
mechanicHydrolicTachoAccelerator		Régulateur mécanico-hydraulique avec tachyaccéléromètre (Cflag = 1).
mechanicHydraulicTransientFeedback		Régulateur mécanico-hydraulique avec retour transitoire (Cflag = 2).
electromechanicalElectrohydraulic		Régulateur électromécanique et électro-hydraulique (Cflag = 3).

5.3.6.39 Énumération GovHydro4ModelKind

Types possibles de modèles GovHydro4.

Le Tableau 99 présente tous les libellés de GovHydro4ModelKind.

Tableau 99 – Libellés de TurbineGovernorDynamics::GovHydro4ModelKind

libellé	valeur	description
simple		
francisPelton		
kaplan		

5.3.7 Paquetage TurbineLoadControllerDynamics

5.3.7.1 Généralités

Un régulateur de puissance de turbine maintient la puissance de la turbine à une valeur définie par ajustement continu de la référence vitesse-puissance du régulateur de turbine.

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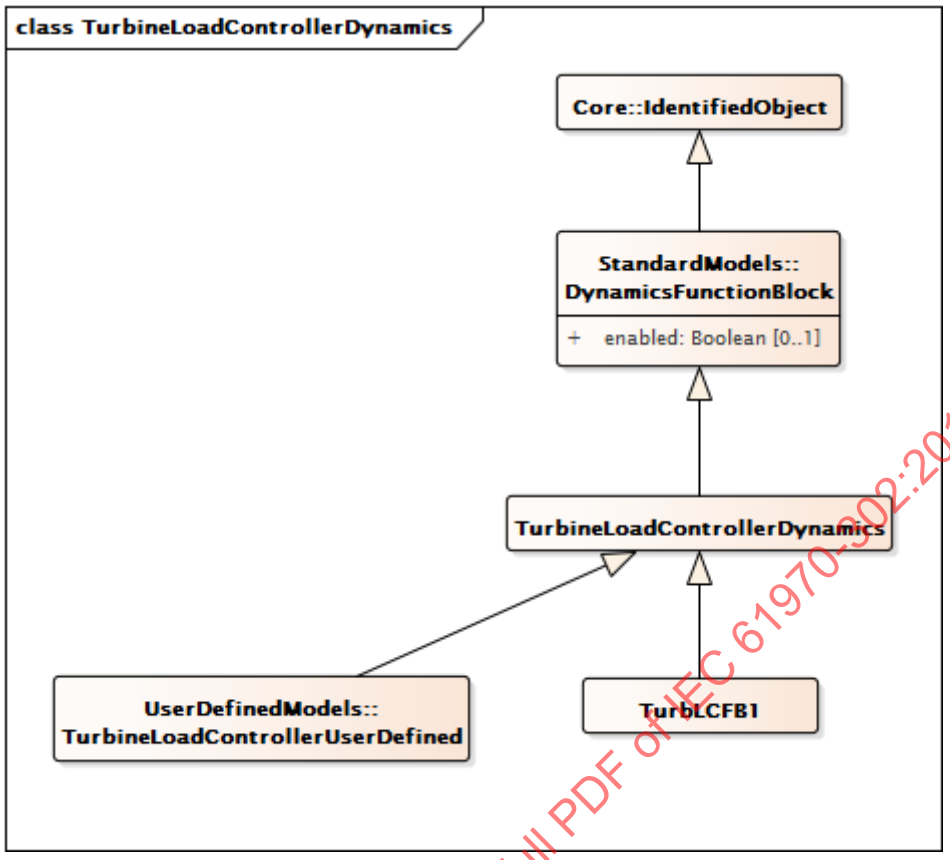

Figure 84 – Diagramme de classe TurbineLoadControllerDynamics::TurbineLoadControllerDynamics

Figure 84: Ce diagramme représente les classes de régulateur de puissance de turbine du modèle normalisé dynamique et leur héritage de la classe TurbineLoadControllerDynamics.

5.3.7.2 TurbineLoadControllerDynamics

Bloc fonctionnel du régulateur de puissance de turbine dont le comportement est décrit en référence au modèle normalisé ou en établissant un modèle défini par l'utilisateur.

Le Tableau 100 présente tous les attributs de TurbineLoadControllerDynamics.

Tableau 100 – Attributs de TurbineLoadControllerDynamics::TurbineLoadControllerDynamics

nom	mult	type	description
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 101 présente toutes les extrémités d'association de TurbineLoadControllerDynamics avec d'autres classes.

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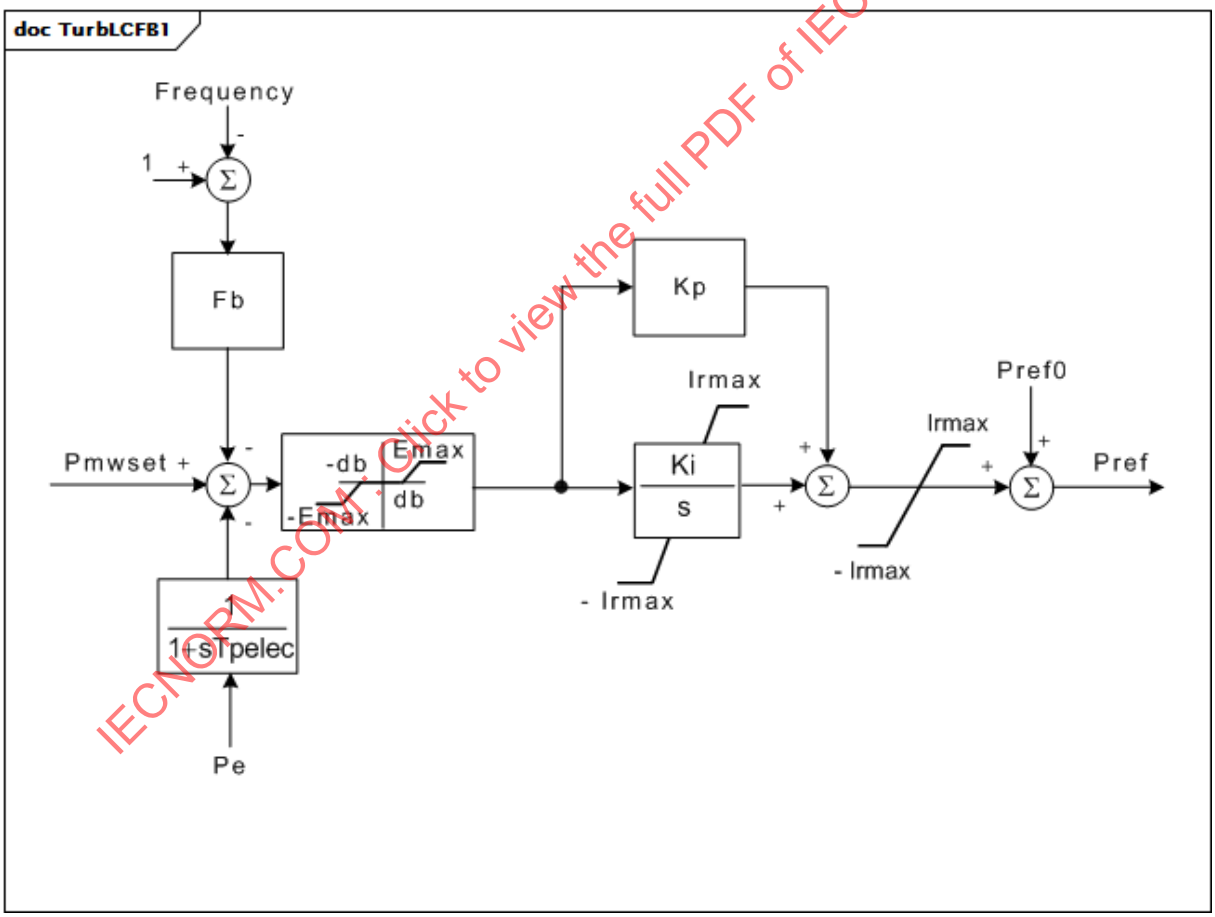
Tableau 101 – Extrémités d'association de TurbineLoadControllerDynamics::TurbineLoadControllerDynamics avec d'autres classes

mult à partir de	Nom	mult vers	type	description
0..1	TurbineGovernorDynamics	1..1	TurbineGovernorDynamics	Régulateur de turbine commandé par ce régulateur de puissance de turbine.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.7.3 TurbLCFB1

Modèle de régulateur de puissance de turbine développé dans le WECC. Ce modèle représente un régulateur de puissance de turbine de surveillance qui maintient la puissance de la turbine à une valeur définie, par ajustement continu de la référence vitesse-puissance du régulateur de turbine. Ce modèle est destiné à représenter les régulateurs "à circulation externe" à réinitialisation lente qui gèrent le fonctionnement du régulateur de turbine.



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Anglais	Français
Frequency	Fréquence

Figure 85 – TurbLCFB1

Figure 85: Ce diagramme décrit le modèle de régulateur de puissance de turbine TurbLCFB1.

Détails sur les paramètres:

1) La référence de puissance de cette boucle de commande de puissance de surveillance est accessible par le paramètre Pmwset. Une valeur est automatiquement attribuée à Pmwset lors de l'initialisation du modèle. Cette valeur remplace toutes les autres valeurs entrées avant l'initialisation.
2) Le régulateur applique un écart à la vitesse-puissance du régulateur de turbine, Pref. Cette référence est initialisée de manière normale par le modèle de régulateur de turbine.
3) La sortie du régulateur est limitée à plus ou moins Irmax. Pour éviter que le régulateur n'ajuste la puissance de la turbine de manière excessive, il convient que Irmax ne dépasse pas environ la moitié du statisme du régulateur ou environ 0,025 PU.
4) La limite d'erreur, Emax, est destinée à définir un taux maximal de variation de la puissance de la turbine. Si la limite de variation de puissance est souhaitée, il convient de définir Emax de telle sorte que Emax = (taux max, PU / s) x (statisme du régulateur en PU) / Ki. Noter que le statisme du régulateur utilisé dans ce calcul doit être exprimé en PU en fonction de la puissance de base, MWbase, de la turbine. Noter également que le statisme des mêmes modèles de régulateur (GovSteamIEEE1, par exemple) est spécifié par un gain dont la valeur est égale à la réciproque du statisme. Par exemple, dans GovSteamIEEE1, le statisme est spécifié par le gain, K, dont la valeur classique est 1 / 0,04 = 25.
5) Ce modèle reconnaît les deux alternatives permettant de spécifier la référence de puissance du régulateur de turbine. Dans les modèles tels que GovCT1 et GovHydro1, la référence est un point de consigne de vitesse. Dans d'autres modèles (GovSteamIEEE1, par exemple), la référence est une valeur de charge PU. En règle générale, les références sont les suivantes: 1) référence de vitesse (1 + (puissance initiale ou position de la vanne) x (statisme)), 2) référence de puissance (0 + (puissance initiale ou position de la vanne)). Les paramètres de TurbLCFB1 doivent toujours être définis sur la base de la référence de vitesse du régulateur.

Le Tableau 102 présente tous les attributs de TurbLCFB1.

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Tableau 102 – Attributs de TurbineLoadControllerDynamics::TurbLCFB1

nom	mult	type	description
mwbase	0..1	ActivePower	Base des valeurs de puissance (MWbase) (> 0). Unité = MW.
speedReferenceGovernor	0..1	Boolean	Type de référence de régulateur de turbine (Type). true = régulateur de référence de vitesse false = régulateur de référence de puissance. Valeur classique = true.
db	0..1	PU	Zone d'insensibilité du régulateur (db). Valeur classique = 0.
emax	0..1	PU	Erreur de commande maximale (Emax) (voir le détail 4 sur les paramètres). Valeur classique = 0,02.
fb	0..1	PU	Gain d'écart de fréquence (Fb). Valeur classique = 0.
kp	0..1	PU	Gain proportionnel (Kp). Valeur classique = 0.
ki	0..1	PU	Gain intégral (Ki). Valeur classique = 0.
fbf	0..1	Boolean	Fanion d'écart de fréquence (Fb). true = activer l'écart de fréquence false = désactiver l'écart de fréquence. Valeur classique = false.
pbf	0..1	Boolean	Fanion du régulateur de puissance (Pbf). true = activer le régulateur de puissance false = désactiver le régulateur de puissance. Valeur classique = false.
tpelec	0..1	Seconds	Constante de temps du transducteur de puissance (Tpelec) (>= 0). Valeur classique = 0.
irmax	0..1	PU	Vitesse maximale de la turbine/écart de référence de charge (Irmax) (voir le détail 3 sur les paramètres). Valeur classique = 0.
pmwset	0..1	ActivePower	Point de consigne du régulateur de puissance (Pmwset) (voir le détail 1 sur les paramètres). Unité = MW. Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 103 présente toutes les extrémités d'association de TurbLCFB1 avec d'autres classes.

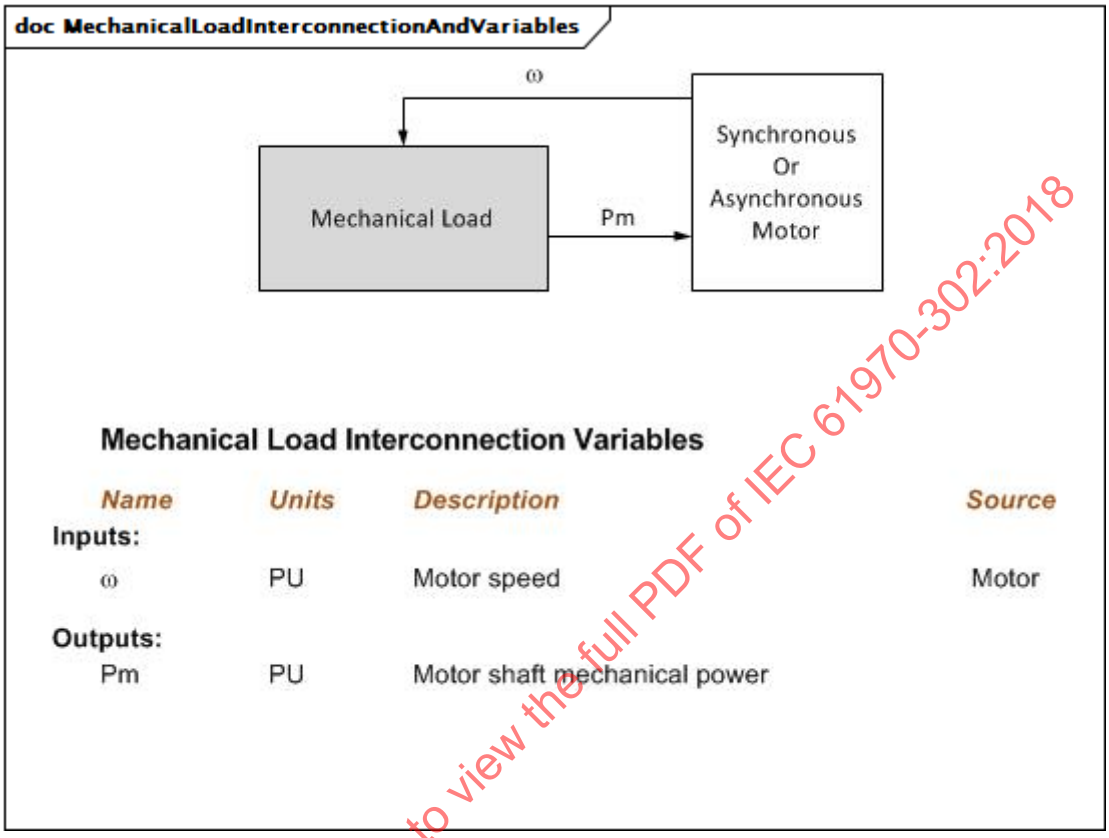
Tableau 103 – Extrémités d'association de TurbineLoadControllerDynamics::TurbLCFB1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	TurbineGovernorDynamics	1..1	TurbineGovernorDynamics	hérité de: TurbineLoadControllerDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.8 Paquetage MechanicalLoadDynamics

5.3.8.1 Généralités

Une charge mécanique représente la variation du couple ou de la puissance de l'arbre d'un moteur en fonction de la vitesse de l'arbre.



Anglais	Français
Mechanical Load	Charge mécanique
Synchronous or Asynchronous Motor	Moteur synchrone ou asynchrone
Mechanical Load Interconnection Variables	Variables d'interconnexion de la charge mécanique
Name	Nom
Units	Unités
Inputs	Entrées
Outputs	Sorties
Motor speed	Vitesse du moteur
Motor shaft mechanical power	Puissance mécanique de l'arbre du moteur
Motor	Moteur

Figure 86 – MechanicalLoadInterconnectionAndVariables

Figure 86: Ce diagramme représente les entrées et sorties d'une charge mécanique.

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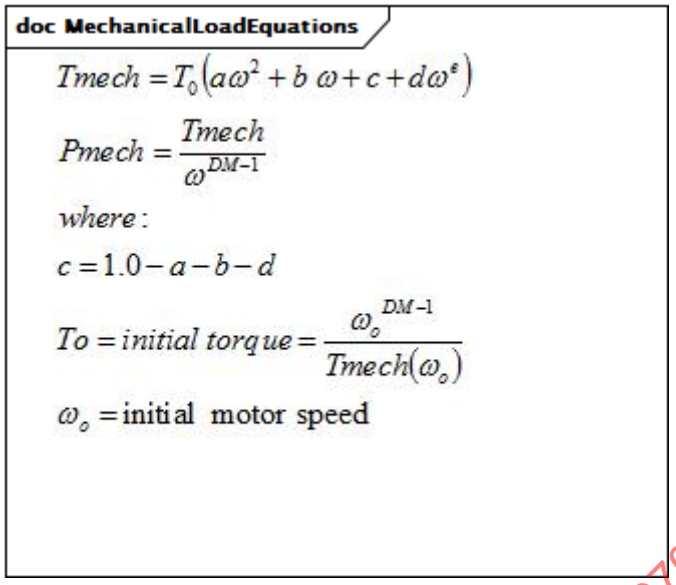

Anglais	Français
where	où
initial torque	couple initial
initial motor speed	vitesse initiale du moteur

Figure 87 – MechanicalLoadEquations

Figure 87: Ce diagramme représente les équations pour une charge mécanique.

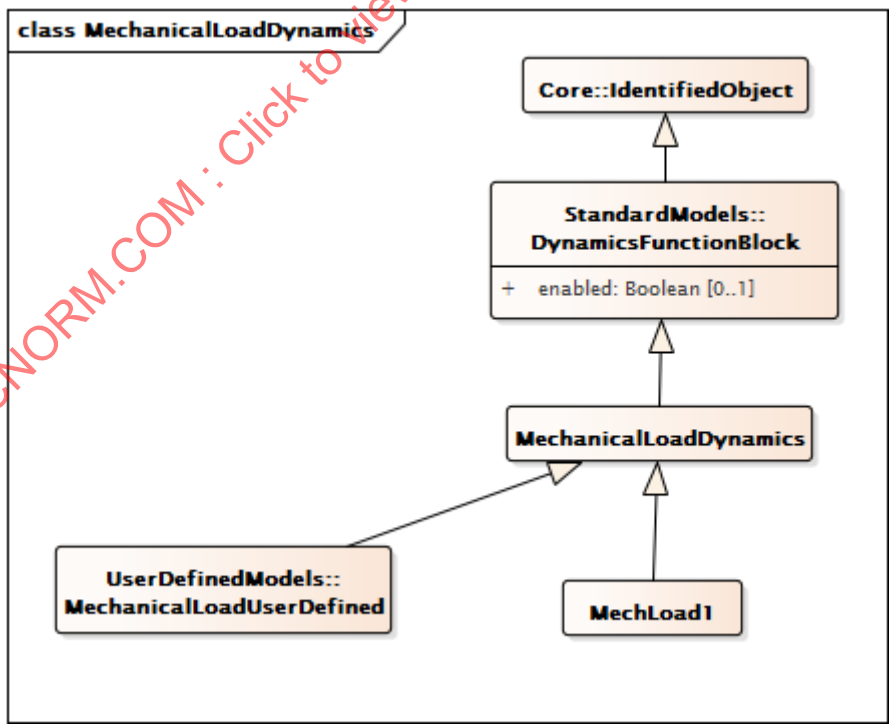

Figure 88 – Diagramme de classe MechanicalLoadDynamics::MechanicalLoadDynamics

Figure 88: Ce diagramme représente les classes de charge mécanique du modèle normalisé dynamique et leur héritage de la classe MechanicalLoadDynamics.

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5.3.8.2 MechanicalLoadDynamics

Bloc fonctionnel de charge mécanique dont le comportement est décrit en référence au modèle normalisé ou en établissant un modèle défini par l'utilisateur.

Le Tableau 104 présente tous les attributs de MechanicalLoadDynamics.

Tableau 104 – Attributs de MechanicalLoadDynamics::MechanicalLoadDynamics

nom	mult	type	description
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 105 présente toutes les extrémités d'association de MechanicalLoadDynamics avec d'autres classes.

Tableau 105 – Extrémités d'association de MechanicalLoadDynamics::MechanicalLoadDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	Modèle de machine synchrone auquel ce modèle de charge mécanique est associé. MechanicalLoadDynamics doit avoir une association avec SynchronousMachineDynamics ou AsynchronousMachineDyanmics.
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	Modèle de machine asynchrone auquel ce modèle de charge mécanique est associé. MechanicalLoadDynamics doit avoir une association avec SynchronousMachineDynamics ou AsynchronousMachineDyanmics.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.8.3 MechLoad1

Modèle de charge mécanique de type 1.

Le Tableau 106 présente tous les attributs de MechLoad1.

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Tableau 106 – Attributs de MechanicalLoadDynamics::MechLoad1

nom	mult	type	description
a	0..1	Float	Coefficient au carré de la vitesse (a).
b	0..1	Float	Coefficient de vitesse (b).
d	0..1	Float	Vitesse au coefficient d'exposant (d).
e	0..1	Float	Exposant (e).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 107 présente toutes les extrémités d'association de MechLoad1 avec d'autres classes.

Tableau 107 – Extrémités d'association de MechanicalLoadDynamics::MechLoad1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	0..1	SynchronousMachineDynamics	hérité de: MechanicalLoadDynamics
0..1	AsynchronousMachineDynamics	0..1	AsynchronousMachineDynamics	hérité de: MechanicalLoadDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9 Paquetage ExcitationSystemDynamics

5.3.9.1 Généralités

Le modèle de système d'excitation fournit la tension de champ (Efd) d'un modèle de machine synchrone. Il est lié à un générateur spécifique (machine synchrone).

La représentation de toutes les limites utilisées par les modèles (sans comprendre les modèles normalisés IEEE) doit être conforme à la représentation définie dans l'Annexe E de l'IEEE 421.5-2005, sauf spécification autre dans la documentation du modèle.

Les paramètres sont différents pour chaque modèle de système d'excitation; le même nom de paramètre peut avoir une signification différente dans différents modèles.

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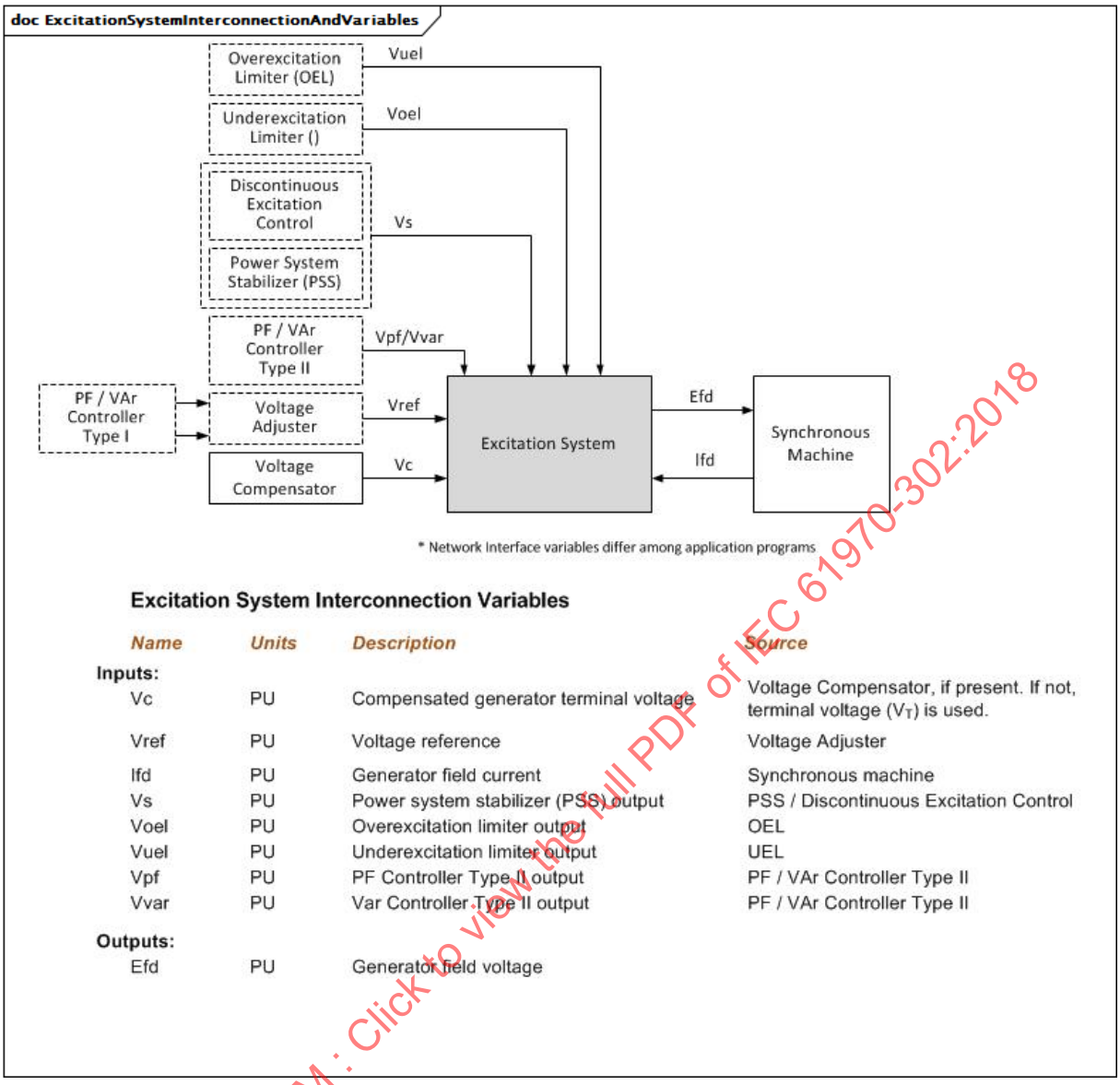

Excitation System Interconnection Variables

Name	Units	Description	Source
Inputs:			
Vc	PU	Compensated generator terminal voltage	Voltage Compensator, if present. If not, terminal voltage (V_T) is used.
Vref	PU	Voltage reference	Voltage Adjuster
Ifd	PU	Generator field current	Synchronous machine
Vs	PU	Power system stabilizer (PSS) output	PSS / Discontinuous Excitation Control
Voel	PU	Overexcitation limiter output	OEL
Vuel	PU	Underexcitation limiter output	UEL
Vpf	PU	PF Controller Type II output	PF / VAr Controller Type II
Vvar	PU	Var Controller Type II output	PF / VAr Controller Type II
Outputs:			
Efd	PU	Generator field voltage	

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Anglais	Français
Overexcitation Limiter	Limiteur de surexcitation
Underexcitation Limiter	Limiteur de sous-excitation
Discontinuous Excitation Control	Commande d'excitation discontinue
Power System Stabilizer	Stabilisateur de système de puissance
PF/Var Controller Type II	Régulateur de facteur de puissance/régulateur VAr de Type II
PF/Var Controller Type I	Régulateur de facteur de puissance/régulateur VAr de Type I
Voltage Adjuster	Dispositif d'ajustage de tension
Voltage Compensator	Compensateur de variation de tension
Excitation System	Système d'excitation
Synchronous Machine	Machine synchrone
Network interface variables differ among application programs	Les variables d'interface de réseau diffèrent selon les programmes d'application
Excitation System Interconnection Variables	Variables d'interconnexion du système d'excitation

Anglais	Français
Name	Nom
Units	Unités
Inputs	Entrées
Outputs	Sorties
Compensated generator terminal voltage	Tension compensée aux bornes du générateur
Voltage reference	Référence de tension
Generator field current	Courant de champ du générateur
Overexcitation Limiter output	Sortie du limiteur de surexcitation
Underexcitation Limiter output	Sortie du limiteur de sous-excitation
PF Controller Type II output	Sortie du régulateur de facteur de puissance de Type II
Var Controller Type II output	Sortie du régulateur VAr de Type II
Generator field voltage	Tension de champ du générateur
Voltage Compensator, if present. If not, terminal voltage (Vr) is used	Compensateur de variation de tension, s'il est présent. Sinon, la tension aux bornes (Vr) est utilisée
PSS/Discontinuous Excitation Control	PSS/ Commande d'excitation discontinue
Power system stabilizer (PSS) output	Sortie du stabilisateur de système de puissance (PSS)

Figure 89 – ExcitationSystemInterconnectionAndVariables

Figure 89: Ce diagramme représente les entrées et sorties d'un modèle de système d'excitation.

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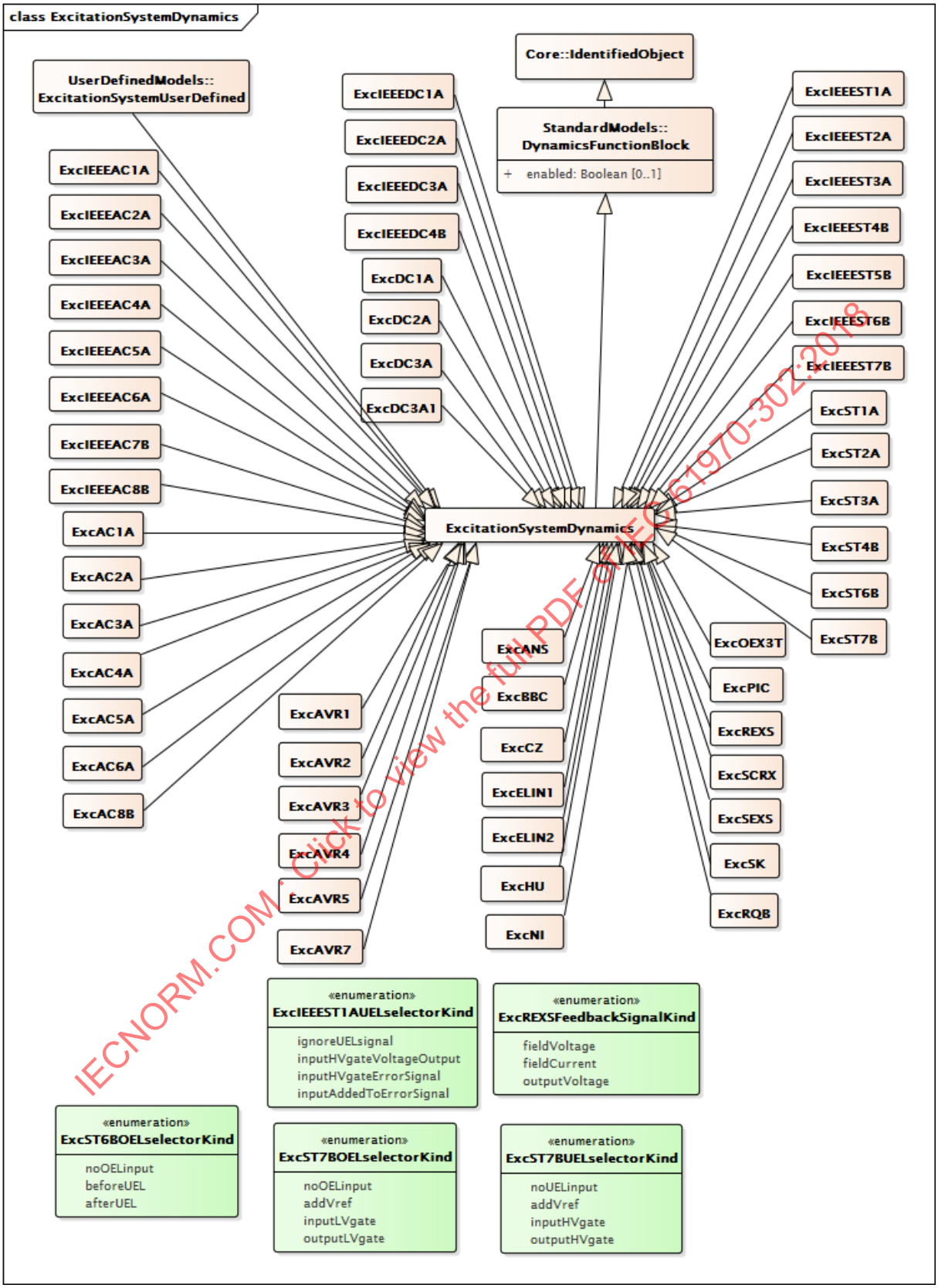

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Figure 90 – Diagramme de classe ExcitationSystemDynamics::ExcitationSystemDynamics

Figure 90: Ce diagramme représente les classes de système d'excitation du modèle normalisé dynamique et leur héritage de la classe ExcitationSystemDynamics.

5.3.9.2 ExcitationSystemDynamics

Bloc fonctionnel de système d'excitation dont le comportement est décrit en référence au modèle normalisé ou en établissant un modèle défini par l'utilisateur.

Le Tableau 108 présente tous les attributs d'ExcitationSystemDynamics.

Tableau 108 – Attributs d'ExcitationSystemDynamics::ExcitationSystemDynamics

nom	mult	type	description
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 109 présente toutes les extrémités d'association d'ExcitationSystemDynamics avec d'autres classes.

Tableau 109 – Extrémités d'association d'ExcitationSystemDynamics::ExcitationSystemDynamics avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	Modèle de machine synchrone auquel ce modèle de système d'excitation est associé.
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	Modèle de stabilisateur de système de puissance associé à ce modèle de système d'excitation.
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	Facteur de puissance ou modèle de contrôleur VAr de type 1 associé à ce modèle de système d'excitation.
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	Modèle de limiteur de surexcitation associé à ce modèle de système d'excitation.
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	Modèle de commande d'excitation discontinue associé à ce modèle de système d'excitation.
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	Facteur de puissance ou modèle de contrôleur VAr de type II associé à ce modèle de système d'excitation.
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	Modèle de limiteur de sous-excitation associé à ce modèle de système d'excitation.
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	Modèle de compensateur de variation de tension associé à ce modèle de système d'excitation.
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.3 ExcIEEEAC1A

Modèle de type AC1A de la norme IEEE 421.5-2005. Le modèle représente les systèmes d'excitation de redresseur d'alternateur à contrôleur de champ appelés type AC1A. Ces systèmes d'excitation sont composés d'une excitatrice principale d'alternateur avec redresseurs non commandés.

Référence: IEEE 421.5-2005, 6.1.

Le Tableau 110 présente tous les attributs d'ExcIEEEAC1A.

Tableau 110 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC1A

nom	mult	type	description
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 400.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,02.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 14,5.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = −14,5.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,8.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,03.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,2.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 0,38.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 4,18.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 0,1.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 3,14.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 0,03.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (VRMAX) (> 0). Valeur classique = 6,03.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (VRMIN) (< 0). Valeur classique = -5,43.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 111 présente toutes les extrémités d'association d'ExcIEEEAC1A avec d'autres classes.

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Tableau 111 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC1A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.4 ExcIEEEAC2A

Modèle de type AC2A de la norme IEEE 421.5-2005. Le modèle représente un système d'excitation de redresseur d'alternateur à contrôleur de champ à réponse initiale élevée. L'excitatrice principale d'alternateur est utilisée avec des redresseurs non commandés. Le modèle de type AC2A s'apparente à celui de type AC1A, hormis pour l'inclusion de la constante de temps de l'excitatrice et des éléments de limitation du courant de champ de l'excitatrice.

Référence: IEEE 421.5-2005, 6.2.

Le Tableau 112 présente tous les attributs d'ExcIEEEAC2A.

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Tableau 112 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC2A

nom	mult	type	description
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 400.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,02.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 8.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = -8.
kb	0..1	PU	Gain du régulateur de deuxième étage (KB) (> 0). Valeur classique = 25.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (VRMAX) (> 0). Valeur classique = 105.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (VRMIN) (< 0). Valeur classique = -95.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,6.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (VFEMAX) (> 0). Valeur classique = 4,4.
kh	0..1	PU	Gain de la boucle de rétroaction du courant de champ de l'excitatrice (KH) (>= 0). Valeur classique = 1.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,03.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,28.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 0,35.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE) (>= 0). Valeur classique = 1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 4,4.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 0,037.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 3,3.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 0,012.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 113 présente toutes les extrémités d'association d'ExcIEEEAC2A avec d'autres classes.

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Tableau 113 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC2A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.5 ExcIEEEAC3A

Modèle de type AC3A de la norme IEEE 421.5-2005. Le modèle représente les systèmes d'excitation de redresseur d'alternateur à contrôleur de champ appelés type AC3A. Ces systèmes d'excitation incluent une excitatrice principale d'alternateur avec redresseurs non commandés. L'excitatrice utilise l'auto-excitation, la puissance du régulateur de tension étant déduite de la tension de sortie de l'excitatrice. Par conséquent, ce système présente une non-linéarité supplémentaire, simulée à l'aide d'un multiplicateur dont les entrées sont le signal de commande du régulateur de tension, Va, et la tension de sortie de l'excitatrice Efd, fois KR. Ce modèle s'applique aux systèmes d'excitation utilisant des régulateurs de tension statique.

Référence: IEEE 421.5-2005, 6.3.

Le Tableau 114 présente tous les attributs d'ExcIEEEAC3A.

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Tableau 114 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC3A

nom	mult	type	description
efdn	0..1	PU	Valeur d'Efd à laquelle le gain de la boucle de rétroaction change (EFDN) (> 0). Valeur classique = 2,36.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 45,62.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,104.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 0,499.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,143.
kn	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KN) (>= 0). Valeur classique = 0,05.
kr	0..1	PU	Constante associée au régulateur et alimentation du champ stator (KR) (> 0). Valeur classique = 3,77.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 1,143.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 0,1.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,013.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 1,17.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 1.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 1.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = −0,95.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 6,24.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 4,68.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (VEMIN) (<= 0). Valeur classique = 0,1.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (VFEMAX) (>= 0). Valeur classique = 16.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 115 présente toutes les extrémités d'association d'ExcIEEEAC3A avec d'autres classes.

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Tableau 115 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC3A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.6 ExcIEEEAC4A

Modèle de type AC4A de la norme IEEE 421.5-2005. Le modèle représente un système d'excitation de redresseur commandé alimenté par alternateur, assez différent d'autres systèmes de type à courant alternatif. Ce système d'excitation à réponse initiale élevée utilise un pont à thyristor complet dans le circuit de sortie de l'excitatrice. Le régulateur de tension commande le déclenchement des ponts à thyristor. L'alternateur d'excitation utilise un régulateur de tension indépendant pour maintenir sa tension de sortie à une valeur constante. Ces effets ne sont pas modélisés. Toutefois, les effets de charge transitoire sur l'alternateur d'excitation sont inclus.

Référence: IEEE 421.5-2005, 6.4.

Le Tableau 116 présente tous les attributs d'ExcIEEEAC4A.

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Tableau 116 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC4A

nom	mult	type	description
vimax	0..1	PU	Limite d'entrée maximale du régulateur de tension (VIMAX) (> 0). Valeur classique = 10.
vimin	0..1	PU	Limite d'entrée minimale du régulateur de tension (VIMIN (< 0). Valeur classique = -10.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 1.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 10.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 200.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,015.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 5,64.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -4,53.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 117 présente toutes les extrémités d'association d'ExcIEEEAC4A avec d'autres classes.

Tableau 117 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC4A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.7 ExcIEEEAC5A

Modèle de type AC5A de la norme IEEE 421.5-2005. Le modèle représente un modèle simplifié de système d'excitation sans balais. Le régulateur est alimenté à partir d'une source (telles qu'un générateur à aimants permanents), sur laquelle les perturbations du système n'ont aucun impact. À l'inverse des autres modèles en courant alternatif, ce modèle utilise les données de saturation de l'excitatrice chargée plutôt qu'en circuit ouvert de la même manière que pour les modèles en courant continu. Le modèle étant largement mis en œuvre par le secteur industriel, il est parfois utilisé pour représenter d'autres types de systèmes lorsque les données détaillées leur étant destinées ne sont pas disponibles ou que des modèles simplifiés sont exigés.

Référence: IEEE 421.5-2005, 6.5.

Le Tableau 118 présente tous les attributs d'ExcIEEEAC5A.

Tableau 118 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC5A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 400.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,02.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 7,3.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -7,3.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,8.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,03.
tf1	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF1) (> 0). Valeur classique = 1.
tf2	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF2) (>= 0). Valeur classique = 1.
tf3	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF3) (>= 0). Valeur classique = 1.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD1) (> 0). Valeur classique = 5,6.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD1 (SE[EFD1]) (>= 0). Valeur classique = 0,86.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD2) (> 0). Valeur classique = 4,2.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD2 (SE[EFD2]) (>= 0). Valeur classique = 0,5.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 119 présente toutes les extrémités d'association d'ExcIEEEAC5A avec d'autres classes.

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Tableau 119 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC5A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.8 ExcIEEEAC6A

Modèle de type AC6A de la norme IEEE 421.5-2005. Le modèle représente des systèmes d'excitation de redresseur d'alternateur à contrôleur de champ équipés de régulateurs de tension électroniques alimentés par le système. La sortie maximale du régulateur, VR, est une fonction de la tension aux bornes, VT. Le limiteur de courant de champ inclus dans le modèle AC6A d'origine est toujours présent dans la mise à jour de 2005.

Référence: IEEE 421.5-2005, 6.6.

Le Tableau 120 présente tous les attributs d'ExcIEEEAC6A.

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Tableau 120 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC6A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 536.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (>= 0). Valeur classique = 0,086.
tk	0..1	Seconds	Constante de temps du régulateur de tension (TK) (>= 0). Valeur classique = 0,18.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 9.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 3.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 75.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = -75.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 44.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -36.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 1.
kh	0..1	PU	Gain du limiteur de courant de champ de l'excitatrice (KH) (>= 0). Valeur classique = 92.
tj	0..1	Seconds	Constante de temps du limiteur de courant de champ de l'excitatrice (TJ) (>= 0). Valeur classique = 0,02.
th	0..1	Seconds	Constante de temps du limiteur de courant de champ de l'excitatrice (TH) (> 0). Valeur classique = 0,08.
vfelim	0..1	PU	Référence de limite de courant de champ de l'excitatrice (VFELIM) (> 0). Valeur classique = 19.
vhmax	0..1	PU	Référence du signal du limiteur de courant de champ maximal (VHMAX) (> 0). Valeur classique = 75.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,173.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 1,91.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1,6.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 7,4.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 0,214.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 5,55.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 0,044.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 121 présente toutes les extrémités d'association d'ExcIEEEAC6A avec d'autres classes.

Tableau 121 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC6A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.9 ExcIEEEAC7B

Modèle de type AC7B de la norme IEEE 421.5-2005. Le modèle représente les systèmes d'excitation composés d'un alternateur en courant alternatif à redresseurs stationnaires ou tournants pour satisfaire aux exigences de champ en courant continu. Il s'agit d'une mise à niveau vers les derniers systèmes d'excitation en courant alternatif, qui remplacent uniquement les commandes, mais conservent l'alternateur en courant alternatif et le pont redresseur à diode.

Référence: IEEE 421.5-2005, 6.7.

Noter, cependant, que dans l'IEEE 421.5-2005, le bloc [1 / sTE] est présenté sous la forme [1 / (1 + sTE)], qui est incorrecte.

Le Tableau 122 présente tous les attributs d'ExcIEEEAC7B.

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Tableau 122 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC7B

nom	mult	type	description
kpr	0..1	PU	Gain proportionnel du régulateur de tension (KPR) (> 0 si ExcIEEEAC7B.kir = 0). Valeur classique = 4,24.
kir	0..1	PU	Gain intégral du régulateur de tension (KIR) (>= 0). Valeur classique = 4,24.
kdr	0..1	PU	Gain par dérivation du régulateur de tension (KDR) (>= 0). Valeur classique = 0.
tdr	0..1	Seconds	Constante de temps de réponse (TDR) (>= 0). Valeur classique = 0.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 5,79.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -5,79.
kpa	0..1	PU	Gain proportionnel du régulateur de tension (KPA) (> 0 si ExcIEEEAC7B.kia = 0). Valeur classique = 65,36.
kia	0..1	PU	Gain intégral du régulateur de tension (KIA) (>= 0). Valeur classique = 59,69.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 1.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = −0,95.
kp	0..1	PU	Coefficient de gain potentiel du circuit (KP) (> 0). Valeur classique = 4,96.
kl	0..1	PU	Paramètre de limite inférieure de tension de champ de l'excitatrice (KL). Valeur classique = 10.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 1,1.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (VFEMAX). Valeur classique = 6,9.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (VEMIN) (<= 0). Valeur classique = 0.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,18.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 0,02.
kf1	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF1) (>= 0). Valeur classique = 0,212.
kf2	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF2) (>= 0). Valeur classique = 0.
kf3	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF3) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 6,3.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 0,44.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 3,02.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 0,075.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 123 présente toutes les extrémités d'association d'ExcIEEEAC7B avec d'autres classes.

Tableau 123 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC7B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.10 ExcIEEEAC8B

Modèle de type AC8B de la norme IEEE 421.5-2005. Ce modèle représente un régulateur de tension PID équipé d'une excitatrice sans balais ou d'une excitatrice en courant continu. La régulation automatique de tension (AVR – automatic voltage regulation) de ce modèle est composée d'une commande PID, à constantes séparées pour les gains proportionnels (KPR), intégraux (KIR) et par dérivation (KDR). La représentation de l'excitatrice sans balais (TE, KE, SE, KC, KD) est similaire au modèle de type AC2A. Le modèle de type AC8B peut être utilisé pour représenter les régulateurs de tension statique appliqués aux systèmes d'excitation sans balais. Les régulateurs de tension numériques qui alimentent les excitatrices principales tournantes en courant continu peuvent être représentés par le modèle de type AC8B en courant alternatif avec les paramètres KC et KD définis sur 0. Pour les étages de puissance de thyristor alimentés par les bornes du générateur, il convient que les limites VRMAX et VRMIN soient fonction de la tension aux bornes: VT x VRMAX et VT x VRMIN.

Référence: IEEE 421.5-2005, 6.8.

Le Tableau 124 présente tous les attributs d'ExcIEEEAC8B.

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Tableau 124 – Attributs d'ExcitationSystemDynamics::ExcIEEEAC8B

nom	mult	type	description
kpr	0..1	PU	Gain proportionnel du régulateur de tension (KPR) (> 0 si ExcIEEEAC8B.kir = 0). Valeur classique = 80.
kir	0..1	PU	Gain intégral du régulateur de tension (KIR) (>= 0). Valeur classique = 5.
kdr	0..1	PU	Gain par dérivation du régulateur de tension (KDR) (>= 0). Valeur classique = 10.
tdr	0..1	Seconds	Constante de temps de réponse (TDR) (> 0). Valeur classique = 0,1.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 35.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (<= 0). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 1.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 1,2.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (VFEMAX). Valeur classique = 6.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (VEMIN) (<= 0). Valeur classique = 0.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,55.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (KD) (>= 0). Valeur classique = 1,1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE1) (> 0). Valeur classique = 6,5.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE1, derrière la réactance de commutation (SE[VE1]) (>= 0). Valeur classique = 0,3.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (VE2) (> 0). Valeur classique = 9.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, VE2, derrière la réactance de commutation (SE[VE2]) (>= 0). Valeur classique = 3.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 125 présente toutes les extrémités d'association d'ExcIEEEAC8B avec d'autres classes.

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Tableau 125 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEAC8B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.11 ExcIEEEDC1A

Modèle de type DC1A de l'IEEE 421.5-2005. Ce modèle représente les excitatrices de commutateur en courant continu à contrôleur de champ avec régulateurs de tension à action continue (plus particulièrement les types d'amplificateurs tournants à résistances à action directe et d'amplificateurs magnétiques). Ce modèle étant largement mis en œuvre par le secteur industriel, il est parfois utilisé pour représenter d'autres types de systèmes lorsque les données détaillées leur étant destinées ne sont pas disponibles ou qu'un modèle simplifié est exigé.

Référence: IEEE 421.5-2005, 5.1.

Le Tableau 126 présente tous les attributs d'ExcIEEEDC1A.

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Tableau 126 – Attributs d'ExcitationSystemDynamics::ExcIEEEDC1A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 46.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,06.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 0.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> ExcIEEEDC1A.vrmin). Valeur classique = 1.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (> 0 et < ExcIEEEDC1A.vrmax). Valeur classique = -0,9.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,46.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,1.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 1.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD1) (> 0). Valeur classique = 3,1.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD1 (SE[EFD1]) (>= 0). Valeur classique = 0,33.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD2) (> 0). Valeur classique = 2,3.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD2 (SE[EFD2]) (>= 0). Valeur classique = 0,1.
uelin	0..1	Boolean	Entrée UEL (uelin). true = l'entrée est connectée à la vanne HT false = l'entrée se connecte au signal d'erreur. Valeur classique = true.
exclim	0..1	Boolean	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = une limite inférieure de zéro n'est pas appliquée à la sortie de l'intégrateur Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 127 présente toutes les extrémités d'association d'ExcIEEEDC1A avec d'autres classes.

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Tableau 127 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEDC1A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.12 ExcIEEEDC2A

Modèle de type DC2A de la norme IEEE 421.5-2005. Ce modèle représente les excitatrices de commutateur en courant continu à contrôleur de champ avec des régulateurs de tension à action continue alimentés par le générateur ou le bus auxiliaire. Il diffère du modèle de type DC1A uniquement dans les limites de sortie du régulateur de tension, qui sont désormais proportionnelles à la tension aux bornes VT.

Il est représentatif des remplacements à semiconducteurs des différentes formes d'ancien amplificateur mécanique ou tournant régulant les équipements raccordés aux excitatrices de commutateur en courant continu.

Référence: IEEE 421.5-2005, 5.2.

Le Tableau 128 présente tous les attributs d'ExcIEEEDC2A.

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Tableau 128 – Attributs d'ExcitationSystemDynamics::ExcIEEEDC2A

nom	mult	type	description
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD1) (> 0). Valeur classique = 3,05.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD2) (> 0). Valeur classique = 2,29.
exclim	0..1	PU	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. Valeur classique = -999, ce qui signifie qu'aucune limite n'est appliquée.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 300.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,1.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD1 (SE[EFD1]) (>= 0). Valeur classique = 0,279.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD2 (SE[EFD2]) (>= 0). Valeur classique = 0,117.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,01.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 1,33.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (> 0). Valeur classique = 0,675.
uelin	0..1	Boolean	Entrée UEL (uelin). true = l'entrée est connectée à la vanne HT false = l'entrée se connecte au signal d'erreur. Valeur classique = true.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> ExcIEEEDC2A.vrmin). Valeur classique = 4,95.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< ExcIEEEDC2A.vrmax). Valeur classique = -4,9.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 129 présente toutes les extrémités d'association d'ExcIEEEDC2A avec d'autres classes.

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Tableau 129 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEDC2A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.13 ExcIEEEDC3A

Modèle de type DC3A de la norme IEEE 421.5-2005. Ce modèle représente les anciens systèmes, en particulier les excitatrices de commutateur en courant continu équipées de régulateurs à action non continue, qui étaient communément utilisées avant l'apparition des types à action continue. Ces systèmes répondent à deux taux fondamentalement différents, en fonction de l'amplitude de l'erreur de tension. Pour les petites erreurs, l'ajustement est périodique avec un signal envoyé à un rhéostat motorisé. Les erreurs importantes provoquent le court-circuitage ou l'insertion rapide des résistances, ainsi que l'application d'un fort signal de forçage à l'excitatrice. Le mouvement continu du rhéostat motorisé se produit pour des signaux d'erreur plus importante, même s'il est contourné par l'action du contacteur.

Référence: IEEE 421.5-2005, 5.3.

Le Tableau 130 présente tous les attributs d'ExcIEEEDC3A.

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Tableau 130 – Attributs d'ExcitationSystemDynamics::ExcIEEEDC3A

nom	mult	type	description
trh	0..1	Seconds	Temps de déplacement du rhéostat (TRH) (> 0). Valeur classique = 20.
kv	0..1	PU	Réglage du contact à levée/abaissement rapide (KV) (> 0). Valeur classique = 0,05.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 1.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (<= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,5.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 0,05.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD1) (> 0). Valeur classique = 3,375.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD1 (SE[EFD1]) (>= 0). Valeur classique = 0,267.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD2) (> 0). Valeur classique = 3,15.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD2 (SE[EFD2]) (>= 0). Valeur classique = 0,068.
exclim	0..1	Boolean	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = une limite inférieure de zéro n'est pas appliquée à la sortie de l'intégrateur Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 131 présente toutes les extrémités d'association d'ExcIEEEDC3A avec d'autres classes.

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Tableau 131 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEDC3A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.14 ExcIEEEDC4B

Modèle de type DC4B de la norme IEEE 421.5-2005. Ces systèmes d'excitation utilisent une excitatrice de commutateur en courant continu à contrôleur de champ équipée d'un régulateur de tension à action continue alimenté par le générateur ou le bus auxiliaire.

Référence: IEEE 421.5-2005, 5.4.

Le Tableau 132 présente tous les attributs d'ExcIEEEDC4B.

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Tableau 132 – Attributs d'ExcitationSystemDynamics::ExcIEEEDC4B

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 1.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,2.
kp	0..1	PU	Gain proportionnel du régulateur (KP) (>= 0). Valeur classique = 20.
ki	0..1	PU	Gain intégral du régulateur (KI) (>= 0). Valeur classique = 20.
kd	0..1	PU	Gain par dérivation du régulateur (KD) (>= 0). Valeur classique = 20.
td	0..1	Seconds	Constante de temps du filtre de dérivation du régulateur (TD) (> 0 si ExcIEEEDC4B.kd > 0). Valeur classique = 0,01.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> ExcIEEEDC4B.vrmin). Valeur classique = 2,7.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (<= 0 et < ExcIEEEDC4B.vrmax). Valeur classique = -0,9.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,8.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (>= 0). Valeur classique = 1.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD1) (> 0). Valeur classique = 1,75.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD1 (SE[EFD1]) (>= 0). Valeur classique = 0,08.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (EFD2) (> 0). Valeur classique = 2,33.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, EFD2 (SE[EFD2]) (>= 0). Valeur classique = 0,27.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (VEMIN) (<= 0). Valeur classique = 0.
oelin	0..1	Boolean	Entrée OEL (OELin). true = vanne BT false = soustrait du signal d'erreur. Valeur classique = true.
uelin	0..1	Boolean	Entrée UEL (UELin). true = vanne HT false = ajout au signal d'erreur. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 133 présente toutes les extrémités d'association d'ExcIEEEDC4B avec d'autres classes.

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Tableau 133 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEDC4B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.15 ExcIEEEST1A

Modèle de type ST1A de la norme IEEE 421.5-2005. Ce modèle représente les systèmes dans lesquels la puissance d'excitation est assurée par un transformateur depuis les bornes du générateur (ou du bus auxiliaire de l'unité) et est régulée par un redresseur commandé. La tension maximale de l'excitatrice disponible à partir de ces systèmes est directement liée à la tension aux bornes du générateur.

Référence: IEEE 421.5-2005, 7.1.

Le Tableau 134 présente tous les attributs d'ExcIEEEST1A.

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Tableau 134 – Attributs d'ExcitationSystemDynamics::ExcIEEEST1A

nom	mult	type	description
ilr	0..1	PU	Référence de limite de courant de sortie de l'excitatrice (ILR). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 190.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,08.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0.
klr	0..1	PU	Gain du limiteur de courant de sortie de l'excitatrice (KLR). Valeur classique = 0.
pssin	0..1	Boolean	Sélecteur d'entrée (PSSin) du stabilisateur de système de puissance (PSS) true = entrée PSS (Vs) ajoutée au signal d'erreur false = entrée PSS (Vs) ajoutée à la sortie du régulateur de tension. Valeur classique = true.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (>= 0). Valeur classique = 0.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 10.
tb1	0..1	Seconds	Constante de temps du régulateur de tension (TB1) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 1.
tc1	0..1	Seconds	Constante de temps du régulateur de tension (TC1) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (>= 0). Valeur classique = 1.
uelin	0..1	ExcIEEEST1AUELselectorKind	Sélecteur de la connexion de l'entrée UEL (UELin). Valeur classique = ignoreUELsignal.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 14,5.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = -14,5.
vimax	0..1	PU	Limite d'entrée maximale du régulateur de tension (VIMAX) (> 0). Valeur classique = 999.
vimin	0..1	PU	Limite d'entrée minimale du régulateur de tension (VIMIN) (< 0). Valeur classique = -999.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (VRMAX) (> 0). Valeur classique = 7,8.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (VRMIN) (<0). Valeur classique = -6,7.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 135 présente toutes les extrémités d'association d'ExcIEEEST1A avec d'autres classes.

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Tableau 135 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST1A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.16 ExcIEEEST2A

Modèle de type ST2A de la norme IEEE 421.5-2005. Certains systèmes statiques utilisent tant la source de courant que la source de tension (nombre de bornes du générateur) pour composer la source d'alimentation. Le régulateur commande la sortie de l'excitatrice par saturation commandée des composants du transformateur de puissance. Ces systèmes d'excitation de redresseur à source composée sont appelés type ST2A et sont représentés par ExcIEEEST2A.

Référence: IEEE 421.5-2005, 7.2.

Le Tableau 136 présente tous les attributs d'ExcIEEEST2A.

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Tableau 136 – Attributs d'ExcitationSystemDynamics::ExcIEEEST2A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Valeur classique = 120.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (> 0). Valeur classique = 0,15.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (VRMAX) (> 0). Valeur classique = 1.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (VRMIN) (<= 0). Valeur classique = 0.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (KE). Valeur classique = 1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (TE) (> 0). Valeur classique = 0,5.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (KF) (>= 0). Valeur classique = 0,05.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (>= 0). Valeur classique = 1.
kp	0..1	PU	Coefficient de gain potentiel du circuit (KP) (>= 0). Valeur classique = 4,88.
ki	0..1	PU	Coefficient de gain potentiel du circuit (KI) (>= 0). Valeur classique = 8.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 1,82.
efdmax	0..1	PU	Tension de champ maximale (EFDMax) (>= 0). Valeur classique = 99.
uelin	0..1	Boolean	Entrée UEL (UELin). true = vanne HT false = ajout au signal d'erreur. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 137 présente toutes les extrémités d'association d'ExcIEEEST2A avec d'autres classes.

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Tableau 137 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST2A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.17 ExcIEEEST3A

Modèle de type ST3A de la norme IEEE 421.5-2005. Certains systèmes statiques utilisent une boucle d'asservissement de tension pour linéariser les caractéristiques de commande de l'excitatrice. Cela rend la sortie indépendante des variations de la source d'alimentation tant que les limites d'alimentation ne sont pas atteintes. Ces systèmes utilisent un certain nombre de conceptions à redresseur commandé: compléments par thyristor complet ou ponts hybrides dans des configurations en série ou de shunt. La source d'alimentation peut être composée d'une seule source de potentiel, alimentée par les bornes de la machine ou par les enroulements internes. Certaines conceptions peuvent être équipées de sources d'alimentation composées utilisant le potentiel et le courant de la machine. Ces sources d'alimentation sont représentées par des combinaisons de phaseurs du courant et de la tension aux bornes de la machine, et sont accompagnées des paramètres correspondants du modèle de type ST3A représenté par ExcIEEEST3A.

Référence: IEEE 421.5-2005, 7.3.

Le Tableau 138 présente tous les attributs d'ExcIEEEST3A.

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Tableau 138 – Attributs d'ExcitationSystemDynamics::ExcIEEEST3A

nom	mult	type	description
vimax	0..1	PU	Limite d'entrée maximale du régulateur de tension (VIMAX) (> 0). Valeur classique = 0,2.
vimin	0..1	PU	Limite d'entrée minimale du régulateur de tension (VIMIN) (< 0). Valeur classique = −0,2.
ka	0..1	PU	Gain du régulateur de tension (KA) (> 0). Il s'agit du paramètre K de la norme IEEE. Valeur classique = 200.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (>= 0). Valeur classique = 0.
tb	0..1	Seconds	Constante de temps du régulateur de tension (TB) (>= 0). Valeur classique = 10.
tc	0..1	Seconds	Constante de temps du régulateur de tension (TC) (>= 0). Valeur classique = 1.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 10.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -10.
km	0..1	PU	Constante de gain direct du rhéostat automatique à boucle intérieure (KM) (> 0). Valeur classique = 7,93.
tm	0..1	Seconds	Constante de temps directe du rhéostat automatique à boucle intérieure (TM) (> 0). Valeur classique = 0,4.
vmmax	0..1	PU	Sortie de boucle intérieure maximale (VMMax) (> 0). Valeur classique = 1.
vmmin	0..1	PU	Sortie de boucle intérieure minimale (VMMin) (<= 0). Valeur classique = 0.
kg	0..1	PU	Constante de gain de la boucle de rétroaction du rhéostat automatique à boucle intérieure (KG) (>= 0). Valeur classique = 1.
kp	0..1	PU	Coefficient de gain potentiel du circuit (KP) (> 0). Valeur classique = 6,15.
thetap	0..1	AngleDegrees	Angle de phase du circuit potentiel (thetap). Valeur classique = 0.
ki	0..1	PU	Coefficient de gain potentiel du circuit (KI) (>= 0). Valeur classique = 0.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,2.
xl	0..1	PU	Réactance associée à la source de potentiel (XL) (>= 0). Valeur classique = 0,081.
vbmax	0..1	PU	Tension d'excitation maximale (VBMax) (> 0). Valeur classique = 6,9.
vgmax	0..1	PU	Tensions d'asservissement de boucle intérieure maximale (VGMax) (>= 0). Valeur classique = 5,8.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 139 présente toutes les extrémités d'association d'ExcIEEEST3A avec d'autres classes.

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Tableau 139 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST3A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.18 ExcIEEEST4B

Modèle de type ST4B de la norme IEEE 421.5-2005. Ce modèle est une variante du modèle de type ST3A, avec un bloc de régulateur proportionnel et intégral (PI) remplaçant la caractéristique de régulateur d'avance/retard du modèle ST3A. Les systèmes d'excitation de redresseur à source de potentiel et source composée sont modélisés. Les limites de non-dépassement des blocs de régulateur PI sont représentées. Le régulateur de tension de ce modèle fait en général l'objet d'une mise en œuvre numérique.

Référence: IEEE 421.5-2005, 7.4.

Le Tableau 140 présente tous les attributs d'ExcIEEEST4B.

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Tableau 140 – Attributs d'ExcitationSystemDynamics::ExcIEEEST4B

nom	mult	type	description
kpr	0..1	PU	Gain proportionnel du régulateur de tension (KPR). Valeur classique = 10,75.
kir	0..1	PU	Gain intégral du régulateur de tension (KIR). Valeur classique = 10,75.
ta	0..1	Seconds	Constante de temps du régulateur de tension (TA) (>= 0). Valeur classique = 0,02.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 1.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -0,87.
kpm	0..1	PU	Sortie du gain proportionnel du régulateur de tension (KPM). Valeur classique = 1.
kim	0..1	PU	Sortie du gain intégral du régulateur de tension (KIM). Valeur classique = 0.
vmmax	0..1	PU	Sortie de boucle intérieure maximale (VMMax) (> ExcIEEEST4B.vmmin). Valeur classique = 99.
vmmin	0..1	PU	Sortie de boucle intérieure minimale (VMMin) (< ExcIEEEST4B.vmmax). Valeur classique = -99.
kg	0..1	PU	Constante de gain de la boucle de rétroaction du rhéostat automatique à boucle intérieure (KG) (>= 0). Valeur classique = 0.
kp	0..1	PU	Coefficient de gain potentiel du circuit (KP) (> 0). Valeur classique = 9,3.
thetap	0..1	AngleDegrees	Angle de phase du circuit potentiel (thetap). Valeur classique = 0.
ki	0..1	PU	Coefficient de gain potentiel du circuit (KI) (>= 0). Valeur classique = 0.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (KC) (>= 0). Valeur classique = 0,113.
xl	0..1	PU	Réactance associée à la source de potentiel (XL) (>= 0). Valeur classique = 0,124.
vbmax	0..1	PU	Tension d'excitation maximale (VBMax) (> 0). Valeur classique = 11,63.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 141 présente toutes les extrémités d'association d'ExcIEEEST4B avec d'autres classes.

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Tableau 141 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST4B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.19 ExcIEEEST5B

Modèle de type ST5B de la norme IEEE 421.5-2005. Le système d'excitation de type ST5B est une variante du modèle de type ST1A, avec d'autres entrées de surexcitation et sous-excitation et des limites supplémentaires.

Le diagramme de bloc de la norme IEEE 421.5 contient un signal d'entrée Vc et n'indique pas le point de sommation avec Vref. La mise en œuvre d'ExcIEEEST5B doit tenir compte du point de sommation avec Vref.

Référence: IEEE 421.5-2005, 7.5.

Le Tableau 142 présente tous les attributs d'ExcIEEEST5B.

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Tableau 142 – Attributs d'ExcitationSystemDynamics::ExcIEEEST5B

nom	mult	type	description
kr	0..1	PU	Gain du régulateur (KR) (> 0). Valeur classique = 200.
t1	0..1	Seconds	Constante de temps du circuit d'allumage (T1) (>= 0). Valeur classique = 0,004.
kc	0..1	PU	Facteur de régulation du redresseur (KC) (>= 0). Valeur classique = 0,004.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 5.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -4.
tc1	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (TC1) (>= 0). Valeur classique = 0,8.
tb1	0..1	Seconds	Constante de temps de réponse du régulateur (TB1) (>= 0). Valeur classique = 6.
tc2	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (TC2) (>= 0). Valeur classique = 0,08.
tb2	0..1	Seconds	Constante de temps de réponse du régulateur (TB2) (>= 0). Valeur classique = 0,01.
toc1	0..1	Seconds	Constante de délai de mise en œuvre OEL (TOC1) (>= 0). Valeur classique = 0,1.
tob1	0..1	Seconds	Constante de temps de réponse OEL (TOB1) (>= 0). Valeur classique = 2.
toc2	0..1	Seconds	Constante de délai de mise en œuvre OEL (TOC2) (>= 0). Valeur classique = 0,08.
tob2	0..1	Seconds	Constante de temps de réponse OEL (TOB2) (>= 0). Valeur classique = 0,08.
tuc1	0..1	Seconds	Constante de délai de mise en œuvre UEL (TUC1) (>= 0). Valeur classique = 2.
tub1	0..1	Seconds	Constante de temps de réponse UEL (TUB1) (>= 0). Valeur classique = 10.
tuc2	0..1	Seconds	Constante de délai de mise en œuvre UEL (TUC2) (>= 0). Valeur classique = 0,1.
tub2	0..1	Seconds	Constante de temps de réponse UEL (TUB2) (>= 0). Valeur classique = 0,05.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 143 présente toutes les extrémités d'association d'ExcIEEEST5B avec d'autres classes.

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Tableau 143 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST5B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.20 ExcIEEEST6B

Modèle de type ST6B de la norme IEEE 421.5-2005. Ce modèle est composé d'un régulateur de tension PI avec rhéostat automatique à boucle intérieure et précommande. Le rhéostat automatique met en œuvre une commande proportionnelle. La précommande et le retard dans le circuit de réaction augmentent la réponse dynamique.

Référence: IEEE 421.5-2005, 7.6.

Le Tableau 144 présente tous les attributs d'ExcIEEEST6B.

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Tableau 144 – Attributs d'ExcitationSystemDynamics::ExcIEEEST6B

nom	mult	type	description
ilr	0..1	PU	Référence de limite de courant de sortie de l'excitatrice (ILR) (> 0). Valeur classique = 4,164.
kci	0..1	PU	Ajustement de la limite de courant de sortie de l'excitatrice (KCI) (> 0). Valeur classique = 1,0577.
kff	0..1	PU	Constante de gain de précommande du rhéostat automatique à boucle intérieure (KFF). Valeur classique = 1.
kg	0..1	PU	Constante de gain de la boucle de rétroaction du rhéostat automatique à boucle intérieure (KG) (>= 0). Valeur classique = 1.
kia	0..1	PU	Gain intégral du régulateur de tension (KIA) (> 0). Valeur classique = 45,094.
klr	0..1	PU	Gain du limiteur de courant de sortie de l'excitatrice (KLR) (> 0). Valeur classique = 17,33.
km	0..1	PU	Constante de gain direct du rhéostat automatique à boucle intérieure (KM). Valeur classique = 1.
kpa	0..1	PU	Gain proportionnel du régulateur de tension (KPA) (> 0). Valeur classique = 18,038.
oelin	0..1	ExcST6BOELselectorKind	Sélecteur d'entrée OEL (OELin). Valeur classique = noOELinput.
tg	0..1	Seconds	Constante de temps de réaction du rhéostat automatique à boucle intérieure (TG) (>= 0). Valeur classique = 0,02.
vamax	0..1	PU	Sortie maximale du régulateur de tension (VAMAX) (> 0). Valeur classique = 4,81.
vamin	0..1	PU	Sortie minimale du régulateur de tension (VAMIN) (< 0). Valeur classique = -3,85.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 4,81.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -3,85.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 145 présente toutes les extrémités d'association d'ExcIEEEST6B avec d'autres classes.

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Tableau 145 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST6B avec d'autres classes

mult à partir de	Nnom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.21 ExcIEEEST7B

Modèle de type ST7B de l'IEEE 421.5-2005. Ce modèle est représentatif des systèmes d'excitation à source de potentiel statique. Dans ces systèmes, la régulation automatique de tension (AVR) est composée d'un régulateur de tension PI. Un filtre d'avance-retard de phase en série permet d'introduire une fonction dérivée, en général utilisée avec les systèmes d'excitation sans balais. Dans ce cas, le régulateur est de type PID. De plus, le canal de tension aux bornes comprend un filtre d'avance-retard de phase. L'AVR contient les entrées appropriées sur sa référence, du limiteur de surexcitation (OEL1), du limiteur de sous-excitation (UEL), du limiteur de courant du stator (SCL), et du compensateur de courant (DROOP). Toutes ces limitations, si elles apparaissent au niveau de référence de tension, maintiennent le PSS (signal VS du PSS) en fonctionnement. Toutefois, la limitation UEL peut également être transférée à la vanne haute tension (HT) qui agit sur le signal de sortie. De plus, le signal de sortie traverse une vanne basse tension (BT) pour un limiteur de surexcitation du plafond (OEL2).

Référence: IEEE 421.5-2005, 7.7.

Le Tableau 146 présente tous les attributs d'ExcIEEEST7B.

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Tableau 146 – Attributs d'ExcitationSystemDynamics::ExcIEEEST7B

nom	mult	type	description
kh	0..1	PU	Gain de contre-réaction de vitesse de la vanne à valeur élevée (KH) (>= 0). Valeur classique = 1.
kia	0..1	PU	Gain intégral du régulateur de tension (KIA) (>= 0). Valeur classique = 1.
kl	0..1	PU	Gain de contre-réaction de vitesse de la vanne à faible valeur (KL) (>= 0). Valeur classique = 1.
kpa	0..1	PU	Gain proportionnel du régulateur de tension (KPA) (> 0). Valeur classique = 40.
oelin	0..1	ExcST7BOELselectorKind	Sélecteur d'entrée OEL (OELin). Valeur classique = noOELinput.
tb	0..1	Seconds	Constante de temps de réponse du régulateur (TB) (>= 0). Valeur classique = 1.
tc	0..1	Seconds	Constante de délai de mise en œuvre du régulateur (TC) (>= 0). Valeur classique = 1.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (TF) (>= 0). Valeur classique = 1.
tg	0..1	Seconds	Constante de temps de réaction du rhéostat automatique à boucle intérieure (TG) (>= 0). Valeur classique = 1.
tia	0..1	Seconds	Constante de temps de réaction (TIA) (>= 0). Valeur classique = 3.
uelin	0..1	ExcST7BUELselectorKind	Sélecteur d'entrée UEL (UELin). Valeur classique = noUELinput.
vmax	0..1	PU	Signal de référence de tension maximale (VMAX) (> 0 et > ExcIEEEST7B.vmin). Valeur classique = 1,1.
vmin	0..1	PU	Signal de référence de tension minimale (VMIN) (> 0 et < ExcIEEEST7B.vmax). Valeur classique = 0,9.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (VRMAX) (> 0). Valeur classique = 5.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (VRMIN) (< 0). Valeur classique = -4,5.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 147 présente toutes les extrémités d'association d'ExcIEEEST7B avec d'autres classes.

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Tableau 147 – Extrémités d'association d'ExcitationSystemDynamics::ExcIEEEST7B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine Dynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizer Dynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiter Dynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitation ControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensator Dynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.22 ExcAC1A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC1A avec source différente de contre-réaction de vitesse.

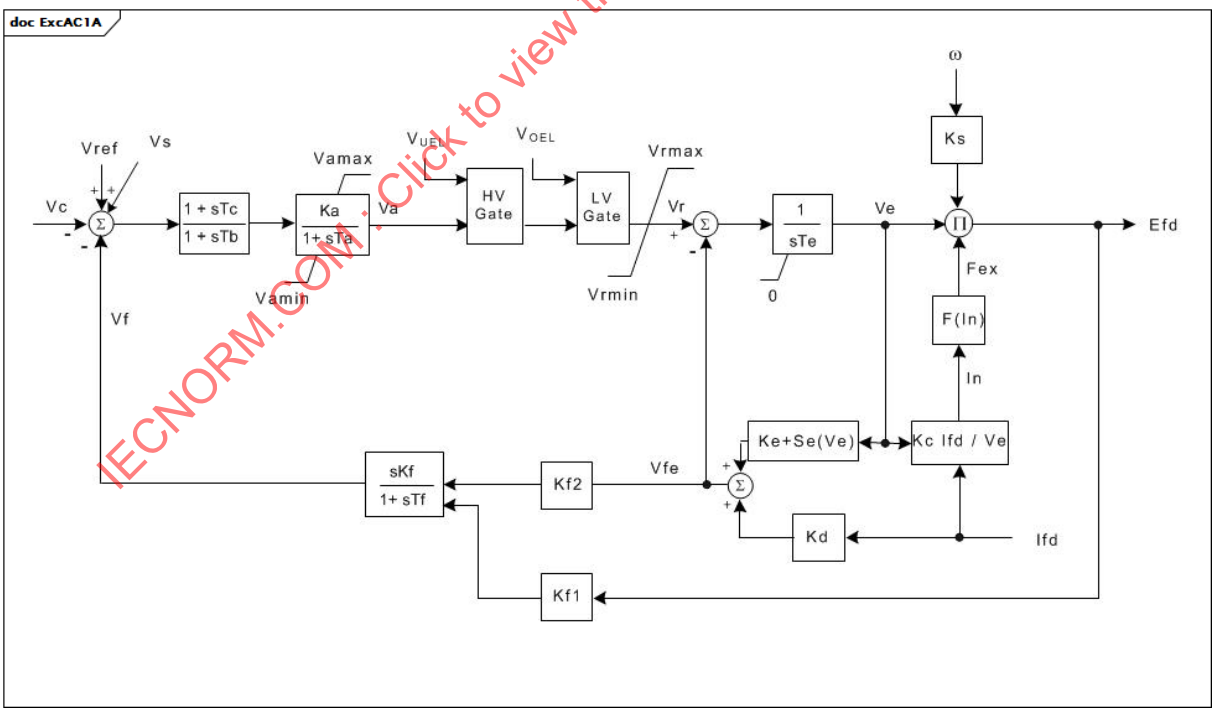

Figure 91 – ExcAC1A

Figure 91: Ce diagramme décrit le modèle de système d'excitation ExcAC1A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

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Le Tableau 148 présente tous les attributs d'ExcAC1A.

Tableau 148 – Attributs d'ExcitationSystemDynamics::ExcAC1A

nom	mult	type	description
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 400.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,02.
vamax	0..1	PU	Sortie maximale du régulateur de tension (Vamax) (> 0). Valeur classique = 14,5.
vamin	0..1	PU	Sortie minimale du régulateur de tension (Vamin) (< 0). Valeur classique = -14,5.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 0,8.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,03.
kf1	0..1	PU	Coefficient permettant une utilisation différente du modèle (Kf1) (>= 0). Valeur classique = 0.
kf2	0..1	PU	Coefficient permettant une utilisation différente du modèle (Kf2) (>= 0). Valeur classique = 1.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (> 0). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0,2.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (Kd) (>= 0). Valeur classique = 0,38.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 4,18.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 0,1.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 3,14.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 0,03.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (Vrmax) (> 0). Valeur classique = 6,03.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (Vrmin) (< 0). Valeur classique = -5,43.
hvlvgates	0..1	Boolean	Indique si la vanne HT et la vanne BT sont actives (HVLVgates). true = les vannes sont utilisées false = les vannes ne sont pas utilisées. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 149 présente toutes les extrémités d'association d'ExcAC1A avec d'autres classes.

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Tableau 149 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC1A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine Dynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizer Dynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiter Dynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitation ControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensator Dynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.23 ExcAC2A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC2A avec limite différente de courant de champ.

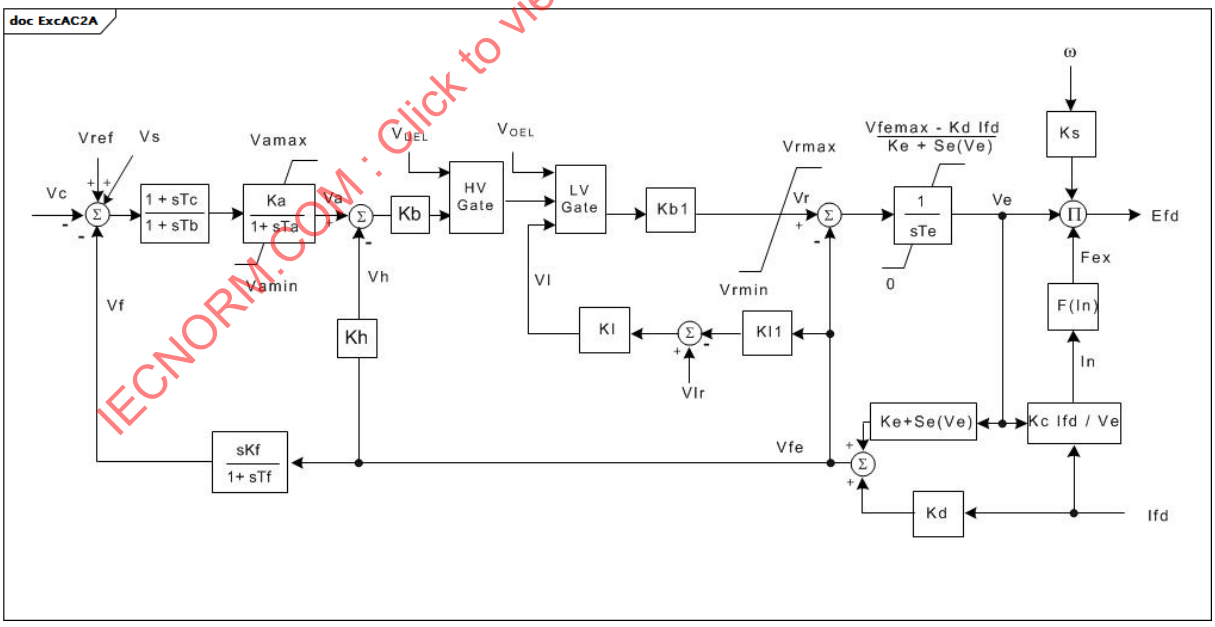

Figure 92 – ExcAC2A

Figure 92: Ce diagramme décrit le modèle de système d'excitation ExcAC2A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur;

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2) La limite supérieure Ve représente les effets du limiteur de courant de champ. Si Vfemax est nul, cette limite n'est pas imposée. Dans le système réel, le limiteur est mis en œuvre par une vanne à faible valeur, juste avant Kb. L'entrée de cette vanne BT est Kl x (Vlr – Vfe). Si les valeurs de Kl et de Vlr sont données, Vfemax peut être calculé sous la forme Vlr x Kl x Kb / (1 + Kl x Kb).

Le Tableau 150 présente tous les attributs d'ExcAC2A.

Tableau 150 – Attributs d'ExcitationSystemDynamics::ExcAC2A

nom	mult	type	description
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 400.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,02.
vamax	0..1	PU	Sortie maximale du régulateur de tension (Vamax) (> 0). Valeur classique = 8.
vamin	0..1	PU	Sortie minimale du régulateur de tension (Vamin) (< 0). Valeur classique = -8.
kb	0..1	PU	Gain du régulateur de deuxième étage (KB) (> 0). Gain du limiteur de courant de champ de l'excitatrice. Valeur classique = 25.
kb1	0..1	PU	Gain du régulateur de deuxième étage (Kb1). Il s'agit du régulateur de courant de champ de l'excitatrice utilisé à la place de Kb pour représenter une variante du modèle ExcAC2A. Valeur classique = 25.
vrmax	0..1	PU	Sorties maximales du régulateur de tension (Vrmax) (> 0). Valeur classique = 105.
vrmin	0..1	PU	Sorties minimales du régulateur de tension (Vrmin) (< 0). Valeur classique = -95.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 0,6.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (Vfemax) (>= 0). Valeur classique = 4,4.
kh	0..1	PU	Gain de la boucle de rétroaction du courant de champ de l'excitatrice (Kh) (>= 0). Valeur classique = 1.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,03.
kl	0..1	PU	Gain du limiteur de courant de champ de l'excitatrice (Kl). Valeur classique = 10.
vlr	0..1	PU	Courant de champ maximal de l'excitatrice (Vlr) (> 0). Valeur classique = 4,4.
kl1	0..1	PU	Coefficient permettant une utilisation différente du modèle (Kl1). Valeur classique = 1.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks) (>= 0). Valeur classique = 0.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (> 0). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0,28.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (Kd) (>= 0). Valeur classique = 0,35.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 4,4.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 0,037.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 3,3.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 0,012.

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nom	mult	type	description
hvgate	0..1	Boolean	Indique si la vanne HT est active (HVgate). true = la vanne est utilisée false = la vanne n'est pas utilisée. Valeur classique = true.
lvgate	0..1	Boolean	Indique si la vanne BT est active (LVgate). true = la vanne est utilisée false = la vanne n'est pas utilisée. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 151 présente toutes les extrémités d'association d'ExcAC2A avec d'autres classes.

Tableau 151 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC2A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.24 ExcAC3A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC3A avec limite différente de courant de champ.

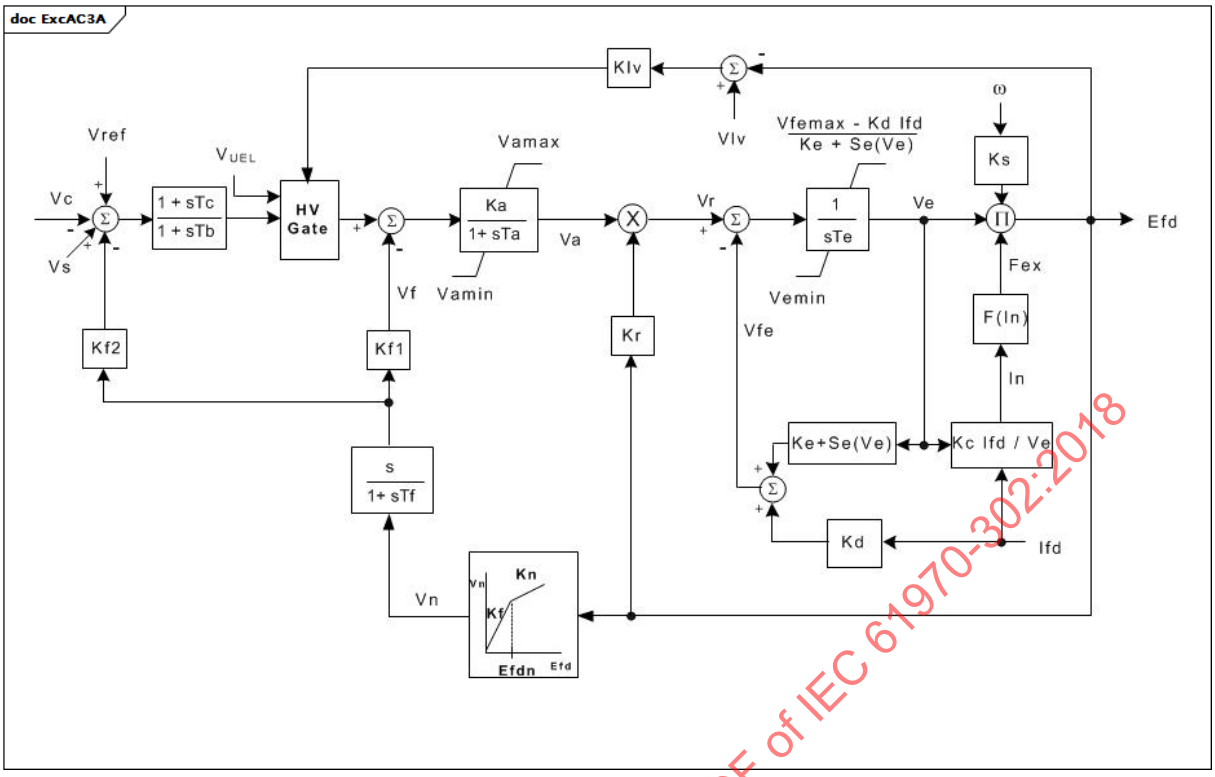

Figure 93 – ExcAC3A

Figure 93: Ce diagramme décrit le modèle de système d'excitation ExcAC3A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur;
2) La limite supérieure Ve est une représentation approximative des effets du limiteur de courant de champ maximal. Si Vfemax est nul, cette limite n'est pas imposée. La limite inférieure (Vemin) sur Ve est une représentation approximative du limiteur de courant de champ minimal.

Le Tableau 152 présente tous les attributs d'ExcAC3A.

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Tableau 152 – Attributs d'ExcitationSystemDynamics::ExcAC3A

nom	mult	type	description
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
ka	0..1	Seconds	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 45,62.
ta	0..1	PU	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,013.
vamax	0..1	PU	Sortie maximale du régulateur de tension (Vamax) (> 0). Valeur classique = 1.
vamin	0..1	PU	Sortie minimale du régulateur de tension (Vamin) (< 0). Valeur classique = -0,95.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1,17.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (Vemin) (<= 0). Valeur classique = 0,1.
kr	0..1	PU	Constante associée au régulateur et alimentation du champ stator (Kr) (> 0). Valeur classique = 3,77.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,143.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (> 0). Valeur classique = 1.
kn	0..1	PU	Gain du stabilisateur de système de commande d'excitation (Kn) (>= 0). Valeur classique = 0,05.
efdn	0..1	PU	Valeur d'EFD à laquelle le gain de la boucle de rétroaction change (Efdn) (> 0). Valeur classique = 2,36.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0,104.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (Kd) (>= 0). Valeur classique = 0,499.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
klv	0..1	PU	Gain utilisé dans la boucle du limiteur de tension de champ minimale (Klv). Valeur classique = 0,194.
kf1	0..1	PU	Coefficient permettant une utilisation différente du modèle (Kf1). Valeur classique = 1.
kf2	0..1	PU	Coefficient permettant une utilisation différente du modèle (Kf2). Valeur classique = 0.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (Vfemax) (>= 0). Valeur classique = 16.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 6,24.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 1,143.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 4,68.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 0,1.
vlv	0..1	PU	Tension de champ utilisée dans la boucle du limiteur de tension de champ minimale (Vlv). Valeur classique = 0,79.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 153 présente toutes les extrémités d'association d'ExcAC3A avec d'autres classes.

Tableau 153 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC3A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.25 ExcAC4A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC4A avec sortie minimale de régulateur différente.

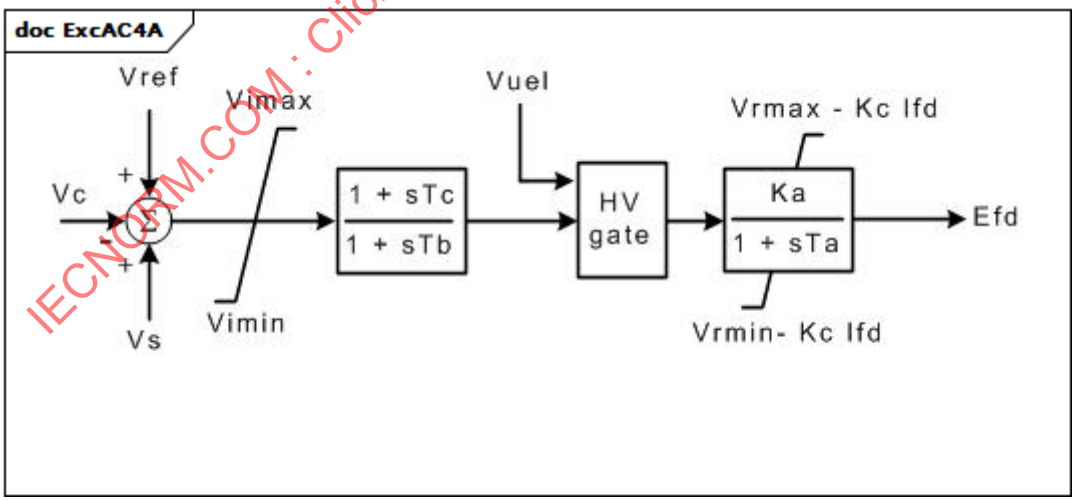

Figure 94 – ExcAC4A

Figure 94: Ce diagramme représente le modèle du système d'excitation ExcAC4A.

Le Tableau 154 présente tous les attributs d'ExcAC4A.

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Tableau 154 – Attributs d'ExcitationSystemDynamics::ExcAC4A

nom	mult	type	description
vimax	0..1	PU	Limite d'entrée maximale du régulateur de tension (Vimax) (> 0). Valeur classique = 10.
vimin	0..1	PU	Limite d'entrée minimale du régulateur de tension (Vimin) (< 0). Valeur classique = -10.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 1.
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 10.
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 200.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,015.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> 0). Valeur classique = 5,64.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0). Valeur classique = -4,53.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 155 présente toutes les extrémités d'association d'ExcAC4A avec d'autres classes.

Tableau 155 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC4A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.26 ExcAC5A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC5A avec sortie minimale de régulateur différente.

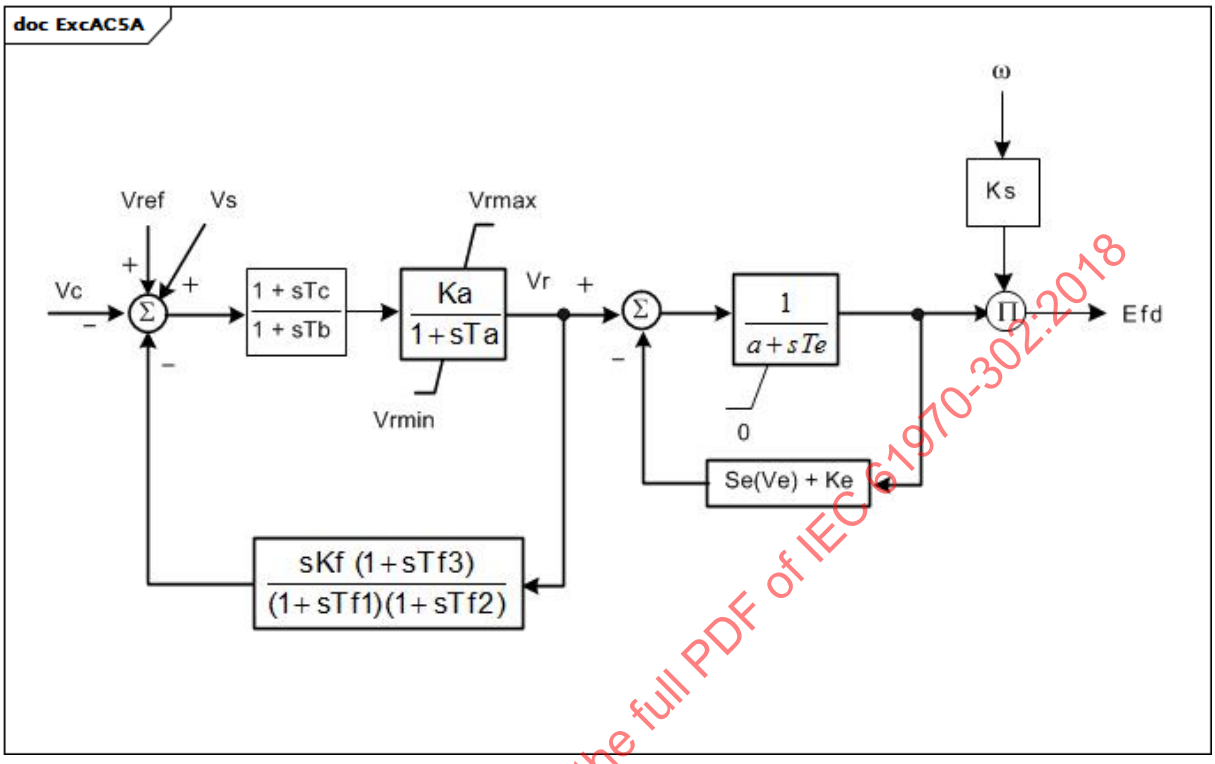

Figure 95 – ExcAC5A

Figure 95: Ce diagramme décrit le modèle de système d'excitation ExcAC5A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

Le Tableau 156 présente tous les attributs d'ExcAC5A.

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Tableau 156 – Attributs d'ExcitationSystemDynamics::ExcAC5A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 400.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,02.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> 0). Valeur classique = 7,3.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0). Valeur classique = -7,3.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 0,8.
kf	0..1	PU	Gains du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,03.
tf1	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf1) (> 0). Valeur classique = 1.
tf2	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf2) (>= 0). Valeur classique = 0,8.
tf3	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf3) (>= 0). Valeur classique = 0.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd1) (> 0). Valeur classique = 5,6.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd1 (Se[Efd1]) (>= 0). Valeur classique = 0,86.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd2) (> 0). Valeur classique = 4,2.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd2 (Se[Efd2]) (>= 0). Valeur classique = 0,5.
a	0..1	Float	Coefficient permettant une utilisation différente du modèle (a). Valeur classique = 1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 157 présente toutes les extrémités d'association d'ExcAC5A avec d'autres classes.

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Tableau 157 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC5A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.27 ExcAC6A

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC6A avec entrée de vitesse.

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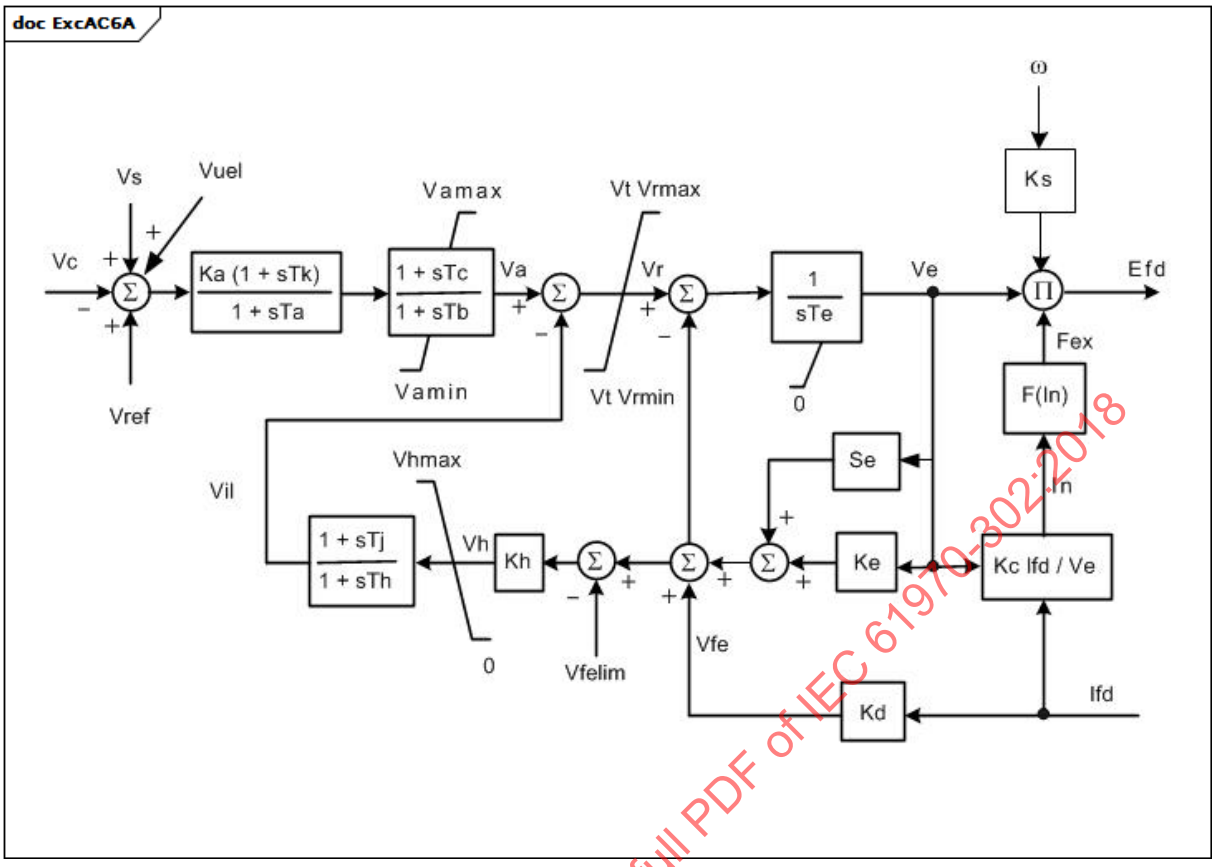

Figure 96 – ExcAC6A

Figure 96: Ce diagramme décrit le modèle de système d'excitation ExcAC6A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

Le Tableau 158 présente tous les attributs d'ExcAC6A.

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Tableau 158 – Attributs d'ExcitationSystemDynamics::ExcAC6A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 536.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (>= 0). Valeur classique = 0,086.
tk	0..1	Seconds	Constante de temps du régulateur de tension (Tk) (>= 0). Valeur classique = 0,18.
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 9.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 3.
vamax	0..1	PU	Sortie maximale du régulateur de tension (Vamax) (> 0). Valeur classique = 75.
vamin	0..1	PU	Sortie minimale du régulateur de tension (Vamin) (< 0). Valeur classique = -75.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> 0). Valeur classique = 44.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0). Valeur classique = -36.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1.
kh	0..1	PU	Gain du limiteur de courant de champ de l'excitatrice (Kh) (>= 0). Valeur classique = 92.
tj	0..1	Seconds	Constante de temps du limiteur de courant de champ de l'excitatrice (Tj) (>= 0). Valeur classique = 0,02.
th	0..1	Seconds	Constante de temps du limiteur de courant de champ de l'excitatrice (Th) (> 0). Valeur classique = 0,08.
vfelim	0..1	PU	Référence de limite de courant de champ de l'excitatrice (Vfelim) (> 0). Valeur classique = 19.
vhmax	0..1	PU	Référence du signal du limiteur de courant de champ maximal (Vhmax) (> 0). Valeur classique = 75.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0,173.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (Kd) (>= 0). Valeur classique = 1,91.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1,6.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 7,4.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 0,214.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 5,55.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 0,044.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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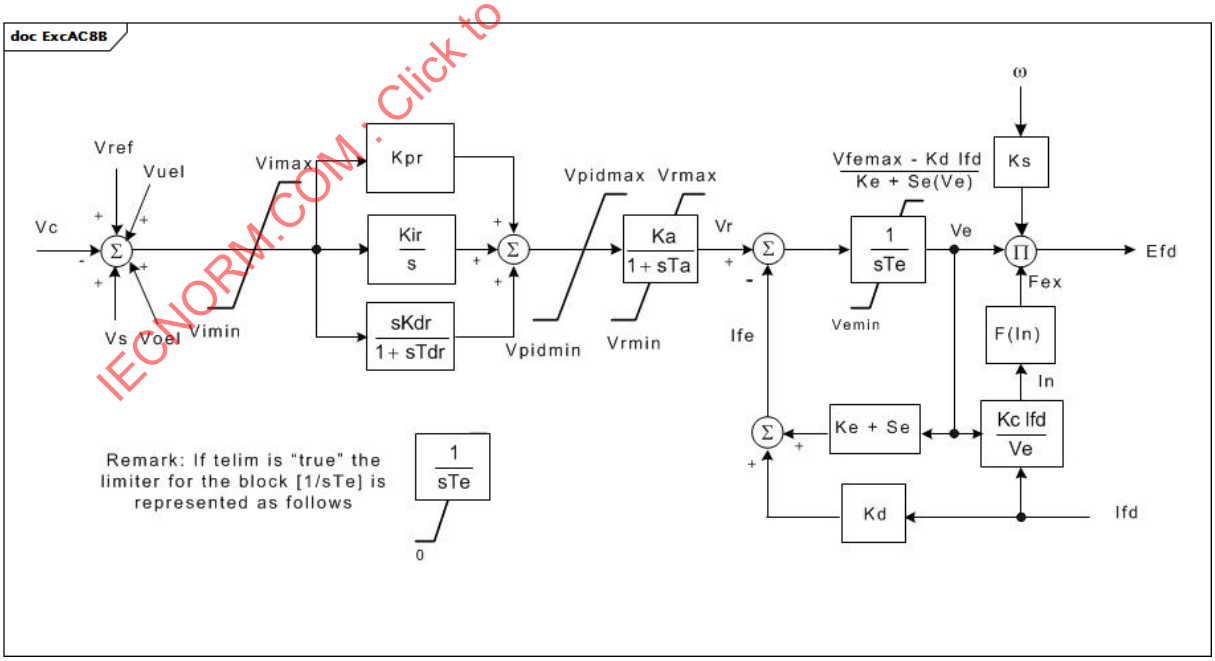
Le Tableau 159 présente toutes les extrémités d'association d'ExcAC6A avec d'autres classes.

Tableau 159 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC6A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.28 ExcAC8B

Système modifié d'excitation de redresseur alimenté par alternateur IEEE AC8B avec entrée de vitesse et limiteur d'entrée.



Anglais	Français
Remark: If telim is "true" the limiter for the block [1/sTe] is represented as follows	Remarque: si la valeur "true" est attribuée à telim, le bloc [1/sTe] est représenté comme suit

Figure 97 – ExcAC8B

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Figure 97: Ce diagramme décrit le modèle de système d'excitation ExcAC8A.

Détails sur les paramètres:

1) La limite supérieure Ve représente les effets du limiteur de courant de champ. Si Vfemax est nul, cette limite n'est pas imposée.
2) Les limites de non-dépassement sont définies dans l'Annexe E de l'IEEE 421.5-2005.
3) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

Le Tableau 160 présente tous les attributs d'ExcAC8B.

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Tableau 160 – Attributs d'ExcitationSystemDynamics::ExcAC8B

nom	mult	type	description
inlim	0..1	Boolean	Indicateur de limiteur d'entrée. true = Vimax et Vimin du limiteur d'entrée pris en compte false = Vimax et Vimin du limiteur d'entrée non pris en compte. Valeur classique = true.
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 1.
kc	0..1	PU	Facteur de charge du redresseur proportionnel à la réactance de commutation (Kc) (>= 0). Valeur classique = 0,55.
kd	0..1	PU	Facteur démagnétisant, fonction des réactances de l'alternateur d'excitation (Kd) (>= 0). Valeur classique = 1,1.
kdr	0..1	PU	Gain par dérivation du régulateur de tension (Kdr) (>= 0). Valeur classique = 10.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
kir	0..1	PU	Gain intégral du régulateur de tension (Kir) (>= 0). Valeur classique = 5.
kpr	0..1	PU	Gain proportionnel du régulateur de tension (Kpr) (> 0 si ExcAC8B.kir = 0). Valeur classique = 80.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
pidlim	0..1	Boolean	Indicateur de limiteur PID. true = Vpidmax et Vpidmin du limiteur d'entrée pris en compte false = Vpidmax et Vpidmin du limiteur d'entrée non pris en compte. Valeur classique = true.
seve1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 0,3.
seve2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 3.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (>= 0). Valeur classique = 0.
tdr	0..1	Seconds	Constante de temps de réponse (Tdr) (> 0 si ExcAC8B.kdr > 0). Valeur classique = 0,1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1,2.
telim	0..1	Boolean	Sélecteur du limiteur sur le bloc (1/sTe). Voir le diagramme pour la signification des valeurs "true" et "false". Valeur classique = false.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 6,5.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 9.
vemin	0..1	PU	Tension de sortie minimale de l'excitatrice (Vemin) (<= 0). Valeur classique = 0.
vfemax	0..1	PU	Référence de limite de courant de champ de l'excitatrice (Vfemax). Valeur classique = 6.
vimax	0..1	PU	Signal d'entrée maximal (Vimax) (> ExcAC8B.vimin). Valeur classique = 35.
vimin	0..1	PU	Signal d'entrée minimal (Vimin) (< ExcAC8B.vimax). Valeur classique = -10.
vpidmax	0..1	PU	Sortie maximale du régulateur PID (Vpidmax) (> ExcAC8B.vpidmin). Valeur classique = 35.
vpidmin	0..1	PU	Sortie minimale du régulateur PID (Vpidmin) (< ExcAC8B.vpidmax). Valeur classique = -10.

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nom	mult	type	description
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> 0). Valeur classique = 35.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0). Valeur classique = 0.
vtmult	0..1	Boolean	Multiplier par l'indicateur de tension aux bornes du générateur. true = les limites Vrmax et Vrmin sont multipliées par la tension aux bornes du générateur afin de représenter un étage de puissance de thyristor alimenté par les bornes du générateur false = les limites ne sont pas multipliées par la tension aux bornes du générateur. Valeur classique = false.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 161 présente toutes les extrémités d'association d'ExcAC8B avec d'autres classes.

Tableau 161 – Extrémités d'association d'ExcitationSystemDynamics::ExcAC8B avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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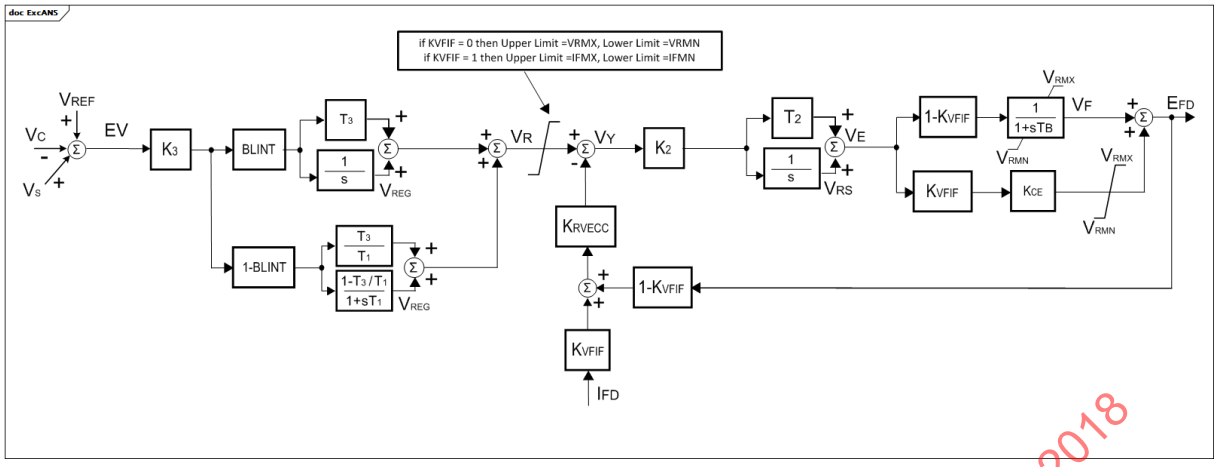
5.3.9.29 ExcANS

Système d'excitation italien. Il représente la tension de champ statique ou le système d'excitation de la boucle de rétroaction du courant d'excitation.



Anglais	Français
If KVFIF = 0 then Upper Limit = VRMX, Lower Limit = VRMN	Si KVFIF = 0, alors Limite supérieure = VRMX, Limite inférieure = VRMN
If KVFIF = 1 then Upper Limit = IFMX, Lower Limit = IFMN	Si KVFIF = 1, alors Limite supérieure = IFMX, Limite inférieure = IFMN

Figure 98 – ExcANS

Figure 98: Ce diagramme décrit le modèle de système d'excitation ExcANS.

Détails sur les paramètres:

1) Les limites sur le signal VR sont modélisées comme suit:
   – Si KVFIF = 0, alors Limite supérieure = VRMX, Limite inférieure = VRMN;
   – Si KVFIF = 1, alors Limite supérieure = IFMX, Limite inférieure = IFMN.

Le Tableau 162 présente tous les attributs d'ExcANS.

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Tableau 162 – Attributs d'ExcitationSystemDynamics::ExcANS

nom	mult	type	description
blint	0..1	Integer	Fanion de commande du régulateur (BLINT). 0 = régulateur d'avance/retard 1 = régulateur intégral proportionnel. Valeur classique = 0.
ifmn	0..1	PU	Courant minimal de l'excitatrice (IFMN). Valeur classique = -5,2.
ifmx	0..1	PU	Courant maximal de l'excitatrice (IFMX). Valeur classique = 6,5.
k2	0..1	Float	Gain de l'excitatrice (K2). Valeur classique = 20.
k3	0..1	Float	Gain de la régulation automatique de tension (K3). Valeur classique = 1 000.
kce	0..1	Float	Tension de plafond (KCE). Valeur classique = 1.
krvecc	0..1	Integer	Activation de la rétroaction (KRVECC). 0 = Commande de boucle ouverte 1 = Commande de boucle fermée Valeur classique = 1.
kvfif	0..1	Integer	Fanion du signal de contre-réaction de vitesse (KVFIF). 0 = tension de sortie de l'excitatrice 1 = courant de champ de l'excitatrice. Valeur classique = 0.
t1	0..1	Seconds	Constante de temps (T1) (>= 0). Valeur classique = 20.
t2	0..1	Seconds	Constante de temps (T2) (>= 0). Valeur classique = 0,05.
t3	0..1	Seconds	Constante de temps (T3) (>= 0). Valeur classique = 1,6.
tb	0..1	Seconds	Constante de temps de l'excitatrice (TB) (>= 0). Valeur classique = 0,04.
vrmn	0..1	PU	Sortie minimale de l'AVR (VRMN). Valeur classique = −5,2.
vrmx	0..1	PU	Sortie maximale de l'AVR (VRMX). Valeur classique = 6,5.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
nom	0..1	String	hérité de: IdentifiedObject

Le Tableau 163 présente toutes les extrémités d'association d'ExcANS avec d'autres classes.

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Tableau 163 – Extrémités d'association d'ExcitationSystemDynamics::ExcANS avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.30 ExcAVR1

Système d'excitation italien correspondant au modèle IEEE (1968) type 1. Il représente une dynamo de l'excitatrice et le régulateur électromécanique.

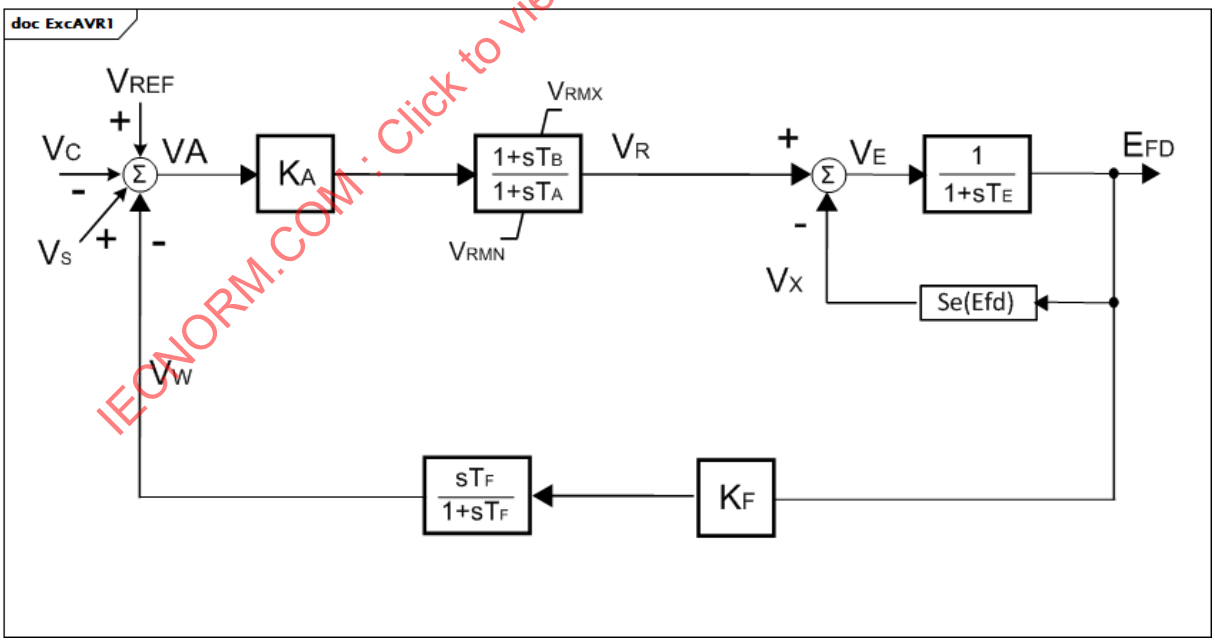

Figure 99 – ExcAVR1

Figure 99: Ce diagramme décrit le modèle de système d'excitation ExcAVR1.

Le Tableau 164 présente tous les attributs d'ExcAVR1.

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Tableau 164 – Attributs d'ExcitationSystemDynamics::ExcAVR1

nom	mult	type	description
ka	0..1	Float	Gain de la régulation automatique de tension (KA). Valeur classique = 500.
vrmn	0..1	PU	Sortie minimale de l'AVR (VRMN). Valeur classique = -6.
vrmx	0..1	PU	Sortie maximale de l'AVR (VRMX). Valeur classique = 7.
ta	0..1	Seconds	Constante de temps de la régulation automatique de tension (TA) (>= 0). Valeur classique = 0,2.
tb	0..1	Seconds	Constante de temps de la régulation automatique de tension (TB) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice (TE) (>= 0). Valeur classique = 1.
e1	0..1	PU	Valeur 1 de tension de champ (E1). Valeur classique = 4,18.
se1	0..1	Float	Facteur de saturation à E1 (S[E1]). Valeur classique = 0,1.
e2	0..1	PU	Valeur 2 de tension de champ (E2). Valeur classique = 3,14.
se2	0..1	Float	Facteur de saturation à E2 (S[E2]). Valeur classique = 0,03.
kf	0..1	Float	Gain de contre-réaction de vitesse (KF). Valeur classique = 0,12.
tf	0..1	Seconds	Constante de temps de contre-réaction de vitesse (TF) (>= 0). Valeur classique = 1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 165 présente toutes les extrémités d'association d'ExcAVR1 avec d'autres classes.

Tableau 165 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.31 ExcAVR2

Système d'excitation italien correspondant au modèle IEEE (1968) de type 2. Il représente un alternateur et les diodes tournantes, ainsi que les régulateurs de tension électromécaniques.

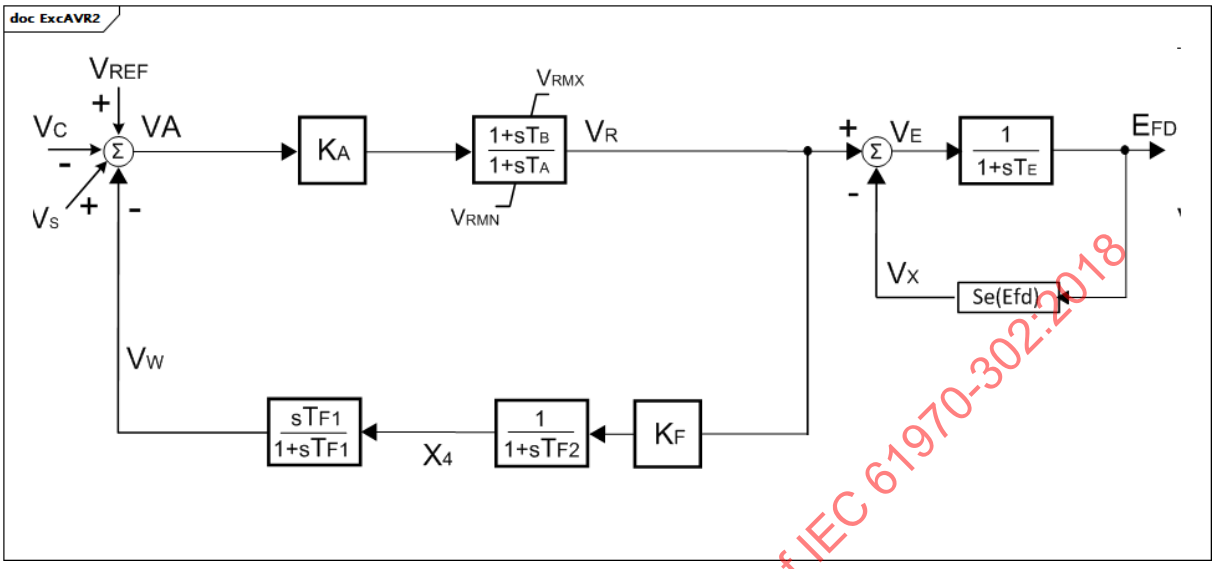

Figure 100 – ExcAVR2

Figure 100: Ce diagramme décrit le modèle de système d'excitation ExcAVR2.

Le Tableau 166 présente tous les attributs d'ExcAVR2.

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Tableau 166 – Attributs d'ExcitationSystemDynamics::ExcAVR2

nom	mult	type	description
ka	0..1	Float	Gain de la régulation automatique de tension (KA). Valeur classique = 500.
vrmn	0..1	PU	Sortie minimale de l'AVR (VRMN). Valeur classique = -6.
vrmx	0..1	PU	Sortie maximale de l'AVR (VRMX). Valeur classique = 7.
ta	0..1	Seconds	Constante de temps de la régulation automatique de tension (TA) (>= 0). Valeur classique = 0,02.
tb	0..1	Seconds	Constante de temps de la régulation automatique de tension (TB) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice (TE) (>= 0). Valeur classique = 1.
e1	0..1	PU	Valeur 1 de tension de champ (E1). Valeur classique = 4,18.
se1	0..1	Float	Facteur de saturation à E1 (S[E1]). Valeur classique = 0,1.
e2	0..1	PU	Valeur 2 de tension de champ (E2). Valeur classique = 3,14.
se2	0..1	Float	Facteur de saturation à E2 (S[E2]). Valeur classique = 0,03.
kf	0..1	Float	Gain de contre-réaction de vitesse (KF). Valeur classique = 0,12.
tf1	0..1	Seconds	Constante de temps de contre-réaction de vitesse (TF1) (>= 0). Valeur classique = 1.
tf2	0..1	Seconds	Constante de temps de contre-réaction de vitesse (TF2) (>= 0). Valeur classique = 1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 167 présente toutes les extrémités d'association d'ExcAVR2 avec d'autres classes.

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Tableau 167 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.32 ExcAVR3

Système d'excitation italien. Il représente une dynamo de l'excitatrice et un régulateur électrique.

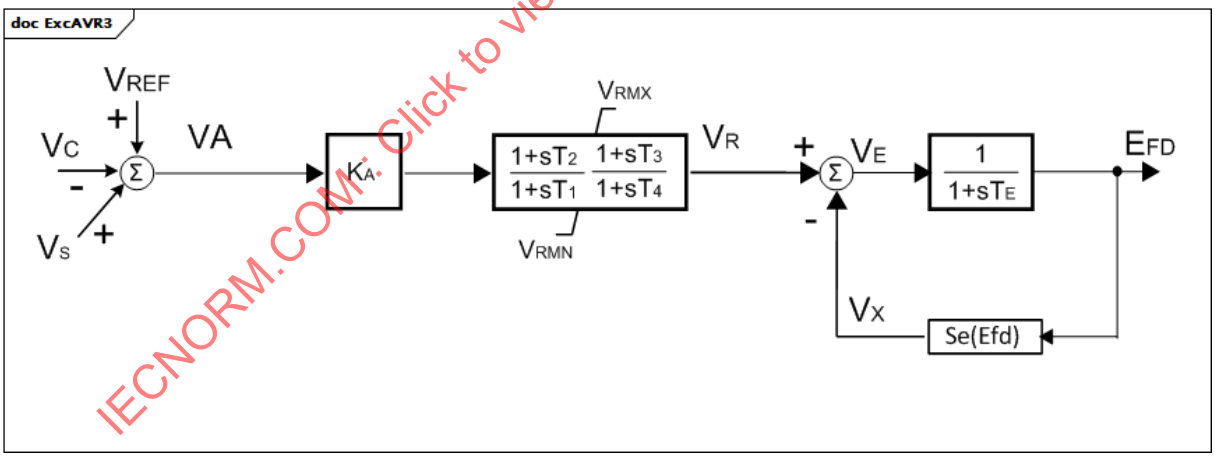

Figure 101 – ExcAVR3

Figure 101: Ce diagramme décrit le modèle de système d'excitation ExcAVR3.

Détails sur les paramètres:

1) La limite de non-dépassement est définie dans l'Annexe E de l'IEEE 421.5-2005.

Le Tableau 168 présente tous les attributs d'ExcAVR3.

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Tableau 168 – Attributs d'ExcitationSystemDynamics::ExcAVR3

nom	mult	type	description
ka	0..1	Float	Gain de la régulation automatique de tension (KA). Valeur classique = 100.
vrmn	0..1	PU	Sortie minimale de l'AVR (VRMN). Valeur classique = −7,5.
vrmx	0..1	PU	Sortie maximale de l'AVR (VRMX). Valeur classique = 7,5.
t1	0..1	Seconds	Constante de temps de la régulation automatique de tension (T1) (>= 0). Valeur classique = 20.
t2	0..1	Seconds	Constante de temps de la régulation automatique de tension (T2) (>= 0). Valeur classique = 1,6.
t3	0..1	Seconds	Constante de temps de la régulation automatique de tension (T3) (>= 0). Valeur classique = 0,66.
t4	0..1	Seconds	Constante de temps de la régulation automatique de tension (T4) (>= 0). Valeur classique = 0,07.
te	0..1	Seconds	Constante de temps de l'excitatrice (TE) (>= 0). Valeur classique = 1.
e1	0..1	PU	Valeur 1 de tension de champ (E1). Valeur classique = 4,18.
se1	0..1	Float	Facteur de saturation à E1 (S[E1]). Valeur classique = 0,1.
e2	0..1	PU	Valeur 2 de tension de champ (E2). Valeur classique = 3,14.
se2	0..1	Float	Facteur de saturation à E2 (S[E2]). Valeur classique = 0,03.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 169 présente toutes les extrémités d'association d'ExcAVR3 avec d'autres classes.

Tableau 169 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR3 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.33 ExcAVR4

Système d'excitation italien. Il représente une excitatrice statique et un régulateur de tension électrique.

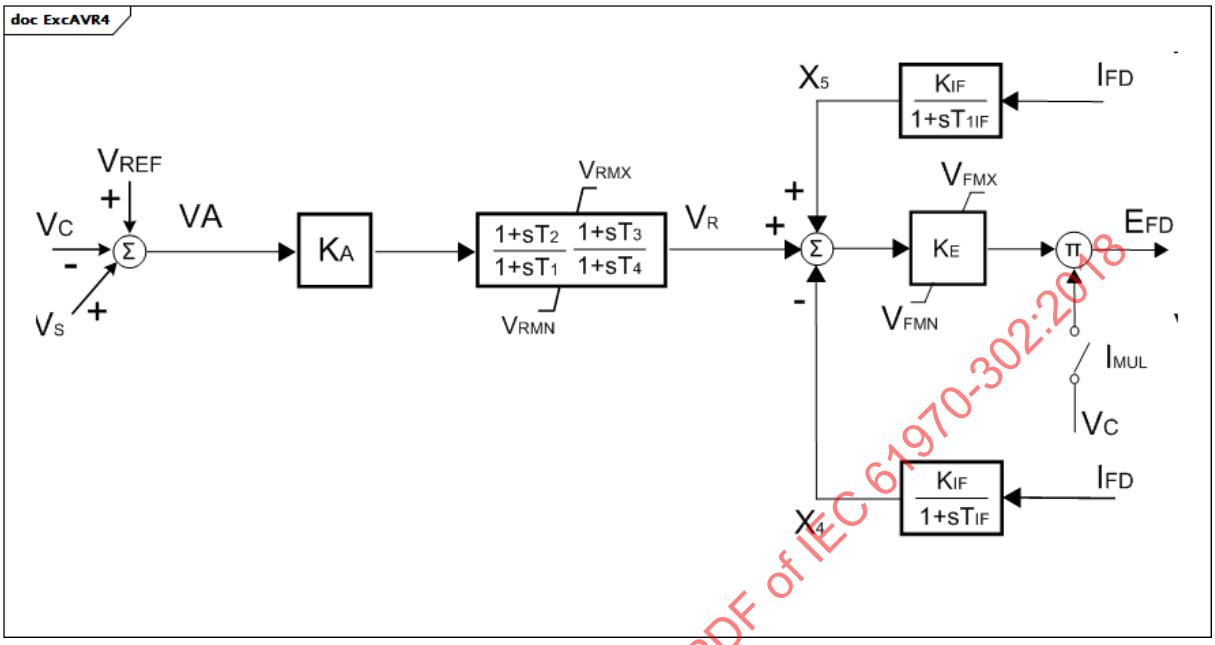

Figure 102 – ExcAVR4

Figure 102: Ce diagramme décrit le modèle de système d'excitation ExcAVR4.

Le Tableau 170 présente tous les attributs d'ExcAVR4.

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Tableau 170 – Attributs d'ExcitationSystemDynamics::ExcAVR4

nom	mult	type	description
ka	0..1	Float	Gain de la régulation automatique de tension (KA). Valeur classique = 300.
vrmn	0..1	PU	Sortie minimale de l'AVR (VRMN). Valeur classique = 0.
vrmx	0..1	PU	Sortie maximale de l'AVR (VRMX). Valeur classique = 5.
t1	0..1	Seconds	Constante de temps de la régulation automatique de tension (T1) (>= 0). Valeur classique = 4,8.
t2	0..1	Seconds	Constante de temps de la régulation automatique de tension (T2) (>= 0). Valeur classique = 1,5.
t3	0..1	Seconds	Constante de temps de la régulation automatique de tension (T3) (>= 0). Valeur classique = 0.
t4	0..1	Seconds	Constante de temps de la régulation automatique de tension (T4) (>= 0). Valeur classique = 0.
ke	0..1	Float	Gain de l'excitatrice (KE). Valeur classique = 1.
vfmx	0..1	PU	Sortie maximale de l'excitatrice (VFMX). Valeur classique = 5.
vfmn	0..1	PU	Sortie minimale de l'excitatrice (VFMN). Valeur classique = 0.
kif	0..1	Float	Réactance interne de l'excitatrice (KIF). Valeur classique = 0.
tif	0..1	Seconds	Constante de temps de rétroaction de courant de l'excitatrice (TIF) (>= 0). Valeur classique = 0.
t1if	0..1	Seconds	Constante de temps de rétroaction de courant de l'excitatrice (T1IF) (>= 0). Valeur classique = 60.
imul	0..1	Boolean	Sélecteur de dépendance de tension de sortie de l'AVR (IMUL). true = le sélecteur est connecté false = le sélecteur n'est pas connecté. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 171 présente toutes les extrémités d'association d'ExcAVR4 avec d'autres classes.

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Tableau 171 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR4 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachine Dynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizer Dynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType 1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiter Dynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitation ControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType 2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensator Dynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.34 ExcAVR5

Commande d'excitation manuelle avec résistance de circuit de champ. Ce modèle peut faire office de représentation très simple de la commande manuelle de tension.

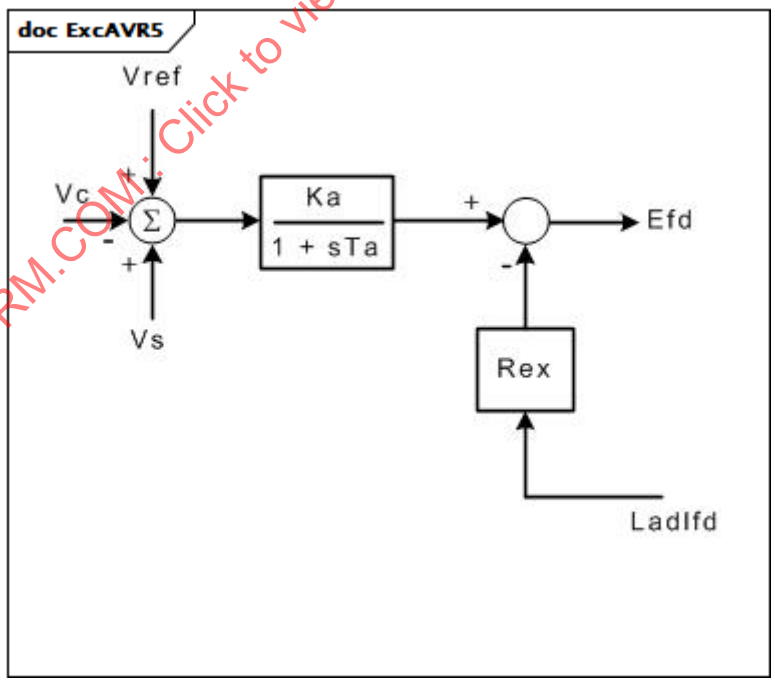

Figure 103 – ExcAVR5

Figure 103: Ce diagramme décrit le modèle de système d'excitation ExcAVR5.

Le Tableau 172 présente tous les attributs d'ExcAVR5.

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Tableau 172 – Attributs d'ExcitationSystemDynamics::ExcAVR5

nom	mult	type	description
ka	0..1	PU	Gain (Ka).
ta	0..1	Seconds	Constante de temps (Ta) (>= 0).
rex	0..1	PU	Résistance effective de sortie (Rex). Rex représente la résistance effective de sortie perçue par le système d'excitation.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 173 présente toutes les extrémités d'association d'ExcAVR5 avec d'autres classes.

Tableau 173 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR5 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.35 ExcAVR7

Système d'excitation IVO.

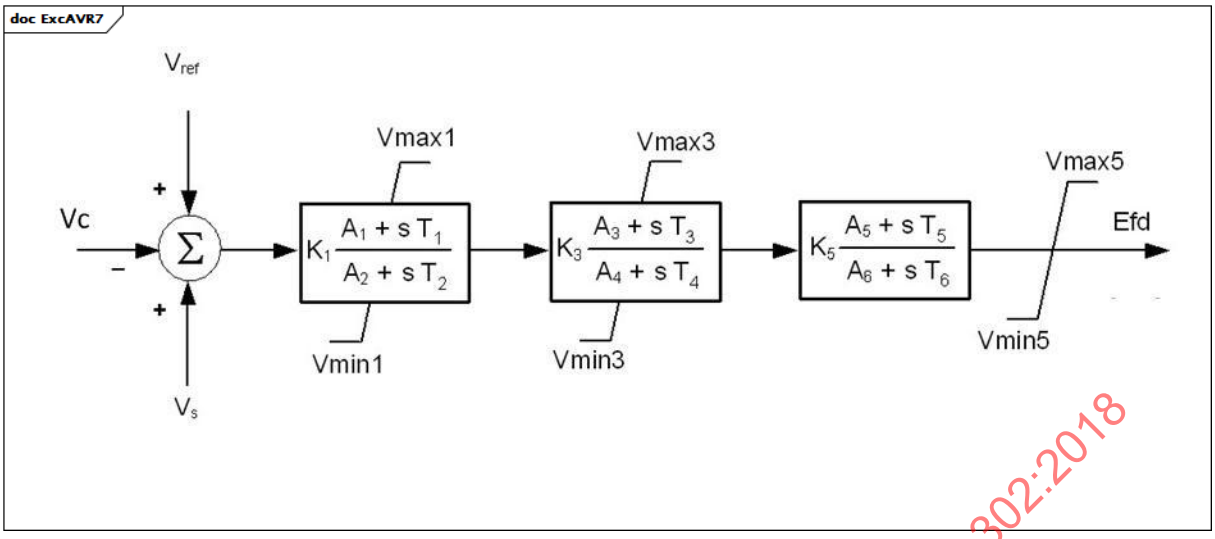

Figure 104 – ExcAVR7

Figure 104: Ce diagramme décrit le modèle de système d'excitation ExcAVR7.

Le Tableau 174 présente tous les attributs d'ExcAVR7.

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Tableau 174 – Attributs d'ExcitationSystemDynamics::ExcAVR7

nom	mult	type	description
k1	0..1	PU	Gain (K1). Valeur classique = 1.
a1	0..1	PU	Coefficient d'avance (A1). Valeur classique = 0,5.
a2	0..1	PU	Coefficient de retard (A2). Valeur classique = 0,5.
t1	0..1	Seconds	Constante de délai de mise en œuvre (T1) (>= 0). Valeur classique = 0,05.
t2	0..1	Seconds	Constante de temps de réponse (T2) (>= 0). Valeur classique = 0,1.
vmax1	0..1	PU	Limite maximale d'avance-retard (Vmax1) (> ExcAVR7.vmin1). Valeur classique = 5.
vmin1	0..1	PU	Limite minimale d'avance-retard (Vmin1) (< ExcAVR7.vmax1). Valeur classique = -5.
k3	0..1	PU	Gain (K3). Valeur classique = 3.
a3	0..1	PU	Coefficient d'avance (A3). Valeur classique = 0,5.
a4	0..1	PU	Coefficient de retard (A4). Valeur classique = 0,5.
t3	0..1	Seconds	Constante de délai de mise en œuvre (T3) (>= 0). Valeur classique = 0,1.
t4	0..1	Seconds	Constante de temps de réponse (T4) (>= 0). Valeur classique = 0,1.
vmax3	0..1	PU	Limite maximale d'avance-retard (Vmax3) (> ExcAVR7.vmin3). Valeur classique = 5.
vmin3	0..1	PU	Limite minimale d'avance-retard (Vmin3) (< ExcAVR7.vmax3). Valeur classique = -5.
k5	0..1	PU	Gain (K5). Valeur classique = 1.
a5	0..1	PU	Coefficient d'avance (A5). Valeur classique = 0,5.
a6	0..1	PU	Coefficient de retard (A6). Valeur classique = 0,5.
t5	0..1	Seconds	Constante de délai de mise en œuvre (T5) (>= 0). Valeur classique = 0,1.
t6	0..1	Seconds	Constante de temps de réponse (T6) (>= 0). Valeur classique = 0,1.
vmax5	0..1	PU	Limite maximale d'avance-retard (Vmax5) (> ExcAVR7.vmin5). Valeur classique = 5.
vmin5	0..1	PU	Limite minimale d'avance-retard (Vmin5) (< ExcAVR7.vmax5). Valeur classique = -2.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 175 présente toutes les extrémités d'association d'ExcAVR7 avec d'autres classes.

Tableau 175 – Extrémités d'association d'ExcitationSystemDynamics::ExcAVR7 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.36 ExcBBC

Système d'excitation statique alimenté par transformateur (statique avec régulateur ABB). Ce modèle représente un système d'excitation statique dans lequel un pont à thyristor asservi alimenté par un transformateur aux bornes du générateur principal alimente directement le générateur principal.

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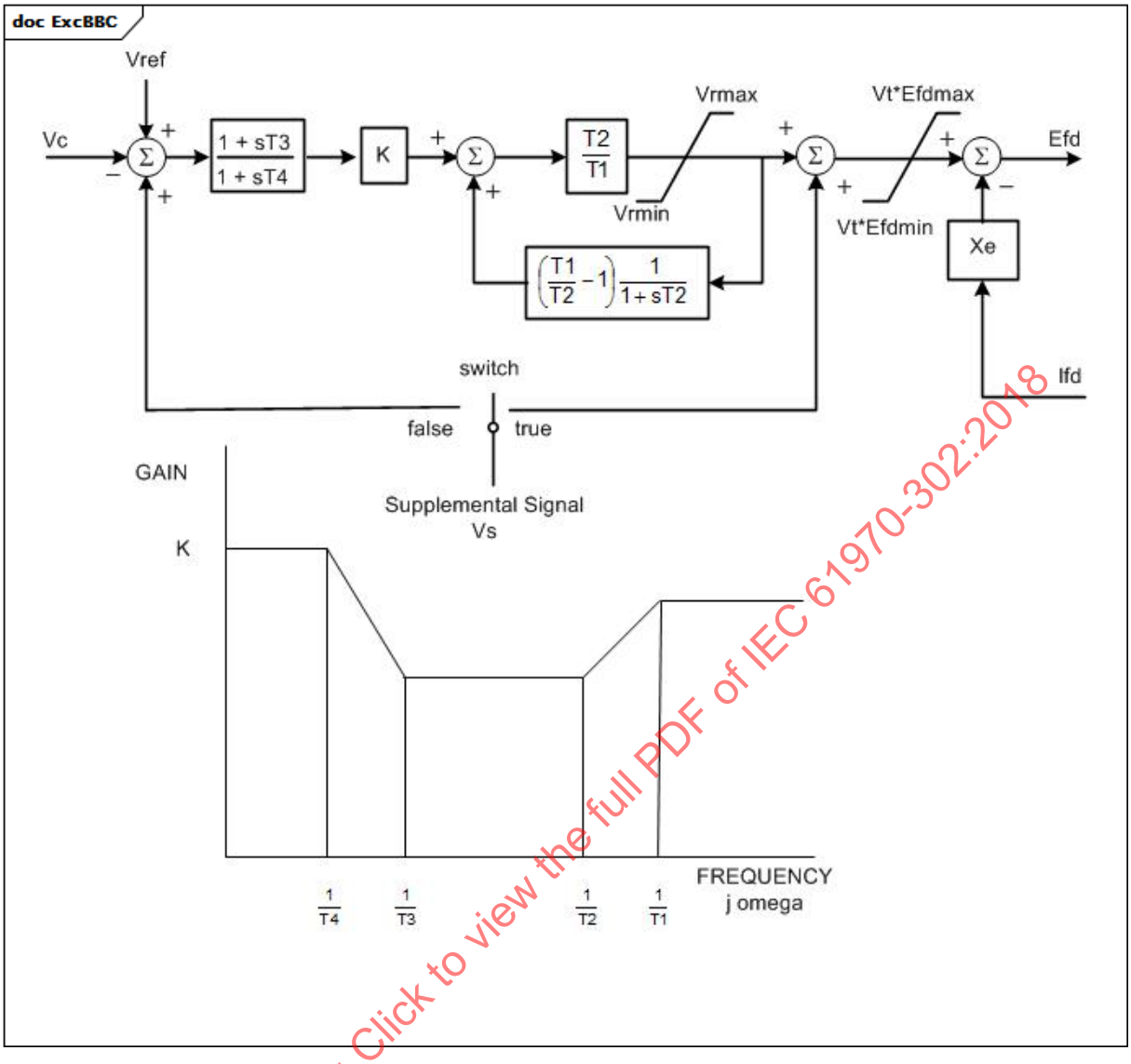

Anglais	Français
switch	commutateur
Supplemental Signal	Signal supplémentaire
FREQUENCY	FRÉQUENCE

Figure 105 – ExcBBC

Figure 105: Ce diagramme décrit le modèle de système d'excitation ExcBBC.

Le Tableau 176 présente tous les attributs d'ExcBBC.

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Tableau 176 – Attributs d'ExcitationSystemDynamics::ExcBBC

nom	mult	type	description
t1	0..1	Seconds	Constante de temps du régulateur (T1) (>= 0). Valeur classique = 6.
t2	0..1	Seconds	Constante de temps du régulateur (T2) (>= 0). Valeur classique = 1.
t3	0..1	Seconds	Constante de délai de mise en œuvre/temps de réponse (T3) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0,05.
t4	0..1	Seconds	Constante de délai de mise en œuvre/temps de réponse (T4) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0,01.
k	0..1	PU	Gain en régime établi (K) (différent de 0). Valeur classique = 300.
vrmin	0..1	PU	Sortie minimale de l'élément de commande (Vrmin) (< ExcBBC.vrmax). Valeur classique = -5.
vrmax	0..1	PU	Sortie maximale de l'élément de commande (Vrmax) (> ExcBBC.vrmin). Valeur classique = 5.
efdmin	0..1	PU	Tension minimale de l'excitatrice en circuit ouvert (Efdmin) (< ExcBBC.efdmax). Valeur classique = -5.
efdmax	0..1	PU	Tension maximale de l'excitatrice en circuit ouvert (Efdmax) (> ExcBBC.efdmin). Valeur classique = 5.
xe	0..1	PU	Réactance effective du transformateur d'excitation (Xe) (>= 0). Xe modélise la régulation du transformateur/redresseur. Valeur classique = 0,05.
switch	0..1	Boolean	Sélecteur d'acheminement de signal supplémentaire (switch). true = Vs raccordé au 3ème point de sommation false = Vs raccordé au 1er point de sommation (voir le diagramme). Valeur classique = false.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 177 présente toutes les extrémités d'association d'ExcBBC avec d'autres classes.

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Tableau 177 – Extrémités d'association d'ExcitationSystemDynamics::ExcBBC avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.37 ExcCZ

Excitatrice proportionnelle/intégrale tchèque.

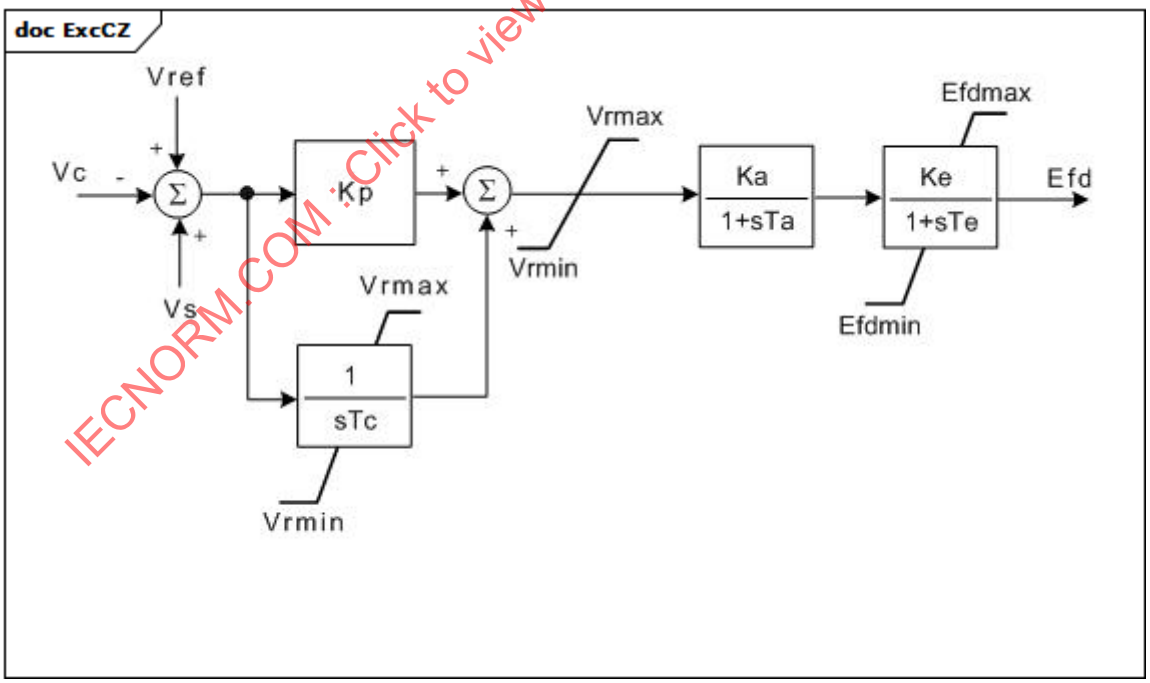

Figure 106 – ExcCZ

Figure 106: Ce diagramme décrit le modèle de système d'excitation ExcCZ.

Le Tableau 178 présente tous les attributs d'ExcCZ.

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Tableau 178 – Attributs d'ExcitationSystemDynamics::ExcCZ

nom	mult	type	description
kp	0..1	PU	Gain proportionnel du régulateur (Kp).
tc	0..1	Seconds	Constante de temps intégrale du régulateur (Tc) (>= 0).
vrmax	0..1	PU	Limite maximale du régulateur de tension (Vrmax) (> ExcCZ.vrmin).
vrmin	0..1	PU	Limite minimale du régulateur de tension (Vrmin) (< ExcCZ.vrmax).
ka	0..1	PU	Gain du régulateur (Ka).
ta	0..1	Seconds	Constante de temps du régulateur (Ta) (>= 0).
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke).
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (>= 0).
efdmax	0..1	PU	Limite maximale de sortie de l'excitatrice (Efdmax) (> ExcCZ.efdmin).
efdmin	0..1	PU	Limite minimale de sortie de l'excitatrice (Efdmin) (< ExcCZ.efdmax).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 179 présente toutes les extrémités d'association d'ExcCZ avec d'autres classes.

Tableau 179 – Extrémités d'association d'ExcitationSystemDynamics::ExcCZ avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.38 ExcDC1A

Excitatrice modifiée du commutateur de courant continu IEEE DC1A avec entrée de vitesse et sans entrée de limiteur de sous-excitation (UEL).

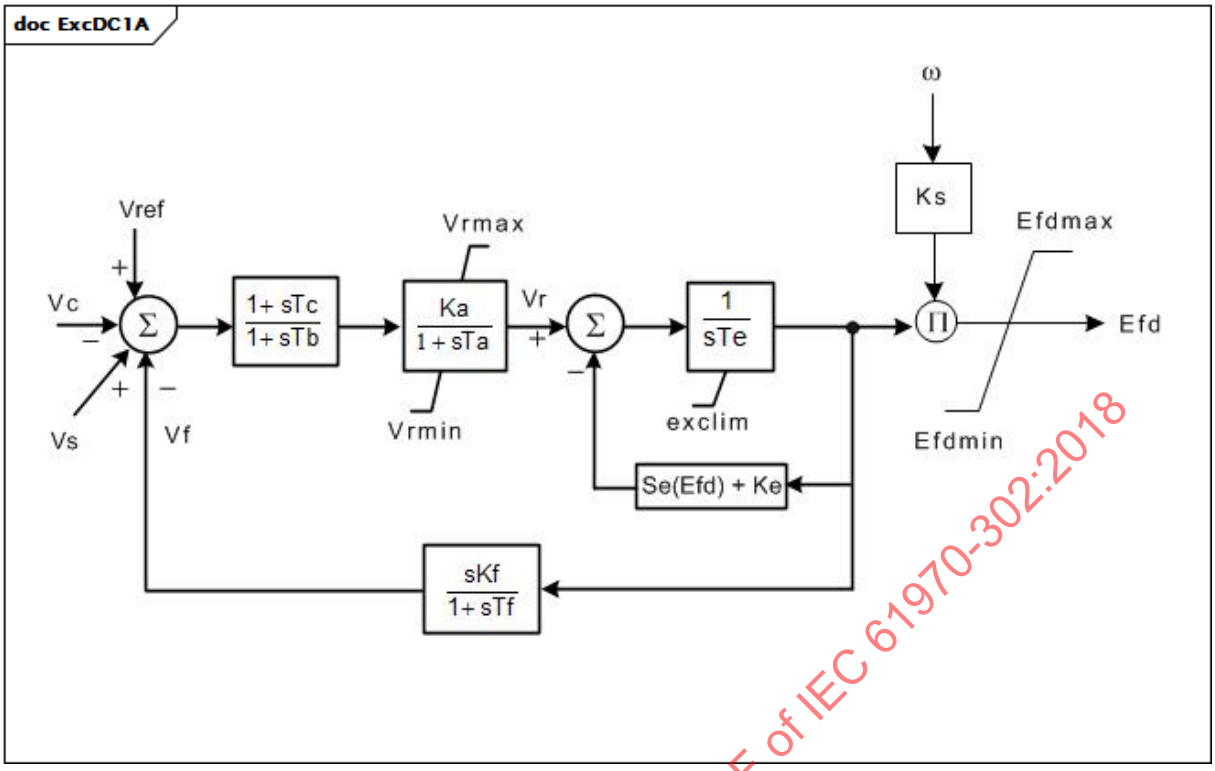

Figure 107 – ExcDC1A

Figure 107: Ce diagramme décrit le modèle de système d'excitation ExcDC1A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

Le Tableau 180 présente tous les attributs d'ExcDC1A.

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Tableau 180 – Attributs d'ExcitationSystemDynamics::ExcDC1A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 46.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,06.
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> ExcDC1A.vrmin). Valeur classique = 1.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< ExcDC1A.vrmax). Valeur classique = -0,9.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 0,46.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,1.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (> 0). Valeur classique = 1.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd1) (> 0). Valeur classique = 3,1.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd1 (Se[Eefd1]) (>= 0). Valeur classique = 0,33.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd2) (> 0). Valeur classique = 2,3.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd1 (Se[Eefd1]) (>= 0). Valeur classique = 0,1.
exclim	0..1	Boolean	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = une limite inférieure de zéro n'est pas appliquée à la sortie de l'intégrateur Valeur classique = true.
efdmin	0..1	PU	Limiteur de sortie de tension minimale de l'excitatrice (Efdmin) (< ExcDC1A.edfmax). Valeur classique = -99.
efdmax	0..1	PU	Limiteur de sortie de tension maximale de l'excitatrice (Efdmax) (> ExcDC1A.efdmin). Valeur classique = 99.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 181 présente toutes les extrémités d'association d'ExcDC1A avec d'autres classes.

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Tableau 181 – Extrémités d'association d'ExcitationSystemDynamics::ExcDC1A avec d'autres classes

mult à partir de	nom	mult vers	Type	description
0..1	SynchronousMachine Dynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizer Dynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiter Dynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitation ControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensator Dynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.39 ExcDC2A

Excitatrice modifiée du commutateur de courant continu IEEE DC2A avec entrée de vitesse, un bloc de branche supplémentaire dans la boucle d'asservissement et sans entrée de limiteur de sous-excitation (UEL). Modèle de système d'excitation en courant continu de type 2 avec multiplicateur de vitesse ajouté, avance-retard ajoutés et limites dépendantes de la tension.

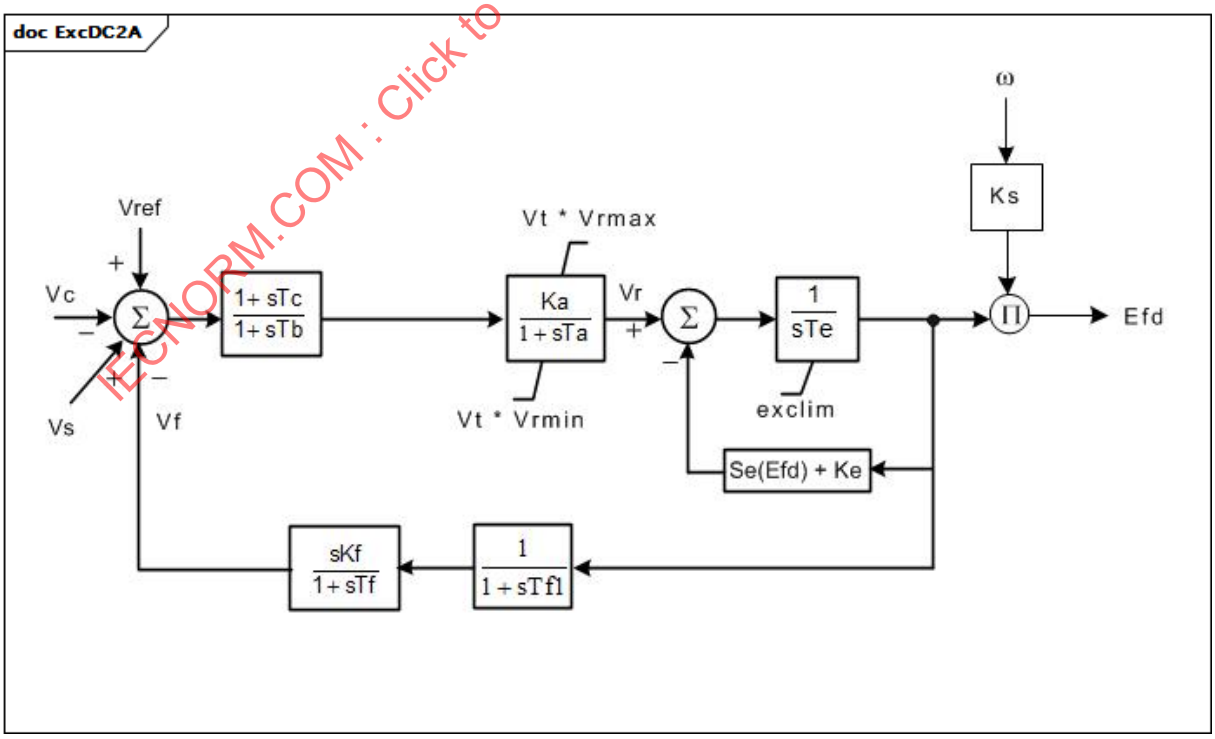

Figure 108 – ExcDC2A

Figure 108: Ce diagramme décrit le modèle de système d'excitation ExcDC2A.

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Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.

Le Tableau 182 présente tous les attributs d'ExcDC2A.

Tableau 182 – Attributs d'ExcitationSystemDynamics::ExcDC2A

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 300.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,01.
tb	0..1	Seconds	Constante de temps du régulateur de tension (Tb) (>= 0). Valeur classique = 0.
tc	0..1	Seconds	Constante de temps du régulateur de tension (Tc) (>= 0). Valeur classique = 0.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> ExcDC2A.vrmin). Valeur classique = 4,95.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0 et < ExcDC2A.vrmax). Valeur classique = -4,9.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Si Ke est nul, le modèle calcule une valeur efficace de Ke de sorte que la valeur de condition initiale de Vr soit nulle. La valeur nulle de Ke ne change pas. Si Ke est une valeur non nulle, sa valeur est utilisée directement, sans modification. Valeur classique = 1.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1,33.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,1.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (> 0). Valeur classique = 0,675.
tf1	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf1) (>= 0). Valeur classique = 0.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd1) (> 0). Valeur classique = 3,05.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd1 (Se[Efd1]) (>= 0). Valeur classique = 0,279.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd2) (> 0). Valeur classique = 2,29.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd2 (Se[Efd2]) (>= 0). Valeur classique = 0,117.
exclim	0..1	Boolean	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = une limite inférieure de zéro n'est pas appliquée à la sortie de l'intégrateur Valeur classique = true.
vtlim	0..1	Boolean	(Vtlim). true = le limiteur au niveau du bloc (Ka / [1 + sTa]) dépend de Vt false = le limiteur au niveau du bloc ne dépend pas de Vt Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 183 présente toutes les extrémités d'association d'ExcDC2A avec d'autres classes.

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Tableau 183 – Extrémités d'association d'ExcitationSystemDynamics::ExcDC2A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.40 ExcDC3A

Excitatrice modifiée de commutateur de courant continu IEEE DC3A avec entrée de vitesse et zone d'insensibilité. Ancien type 4 en courant continu.

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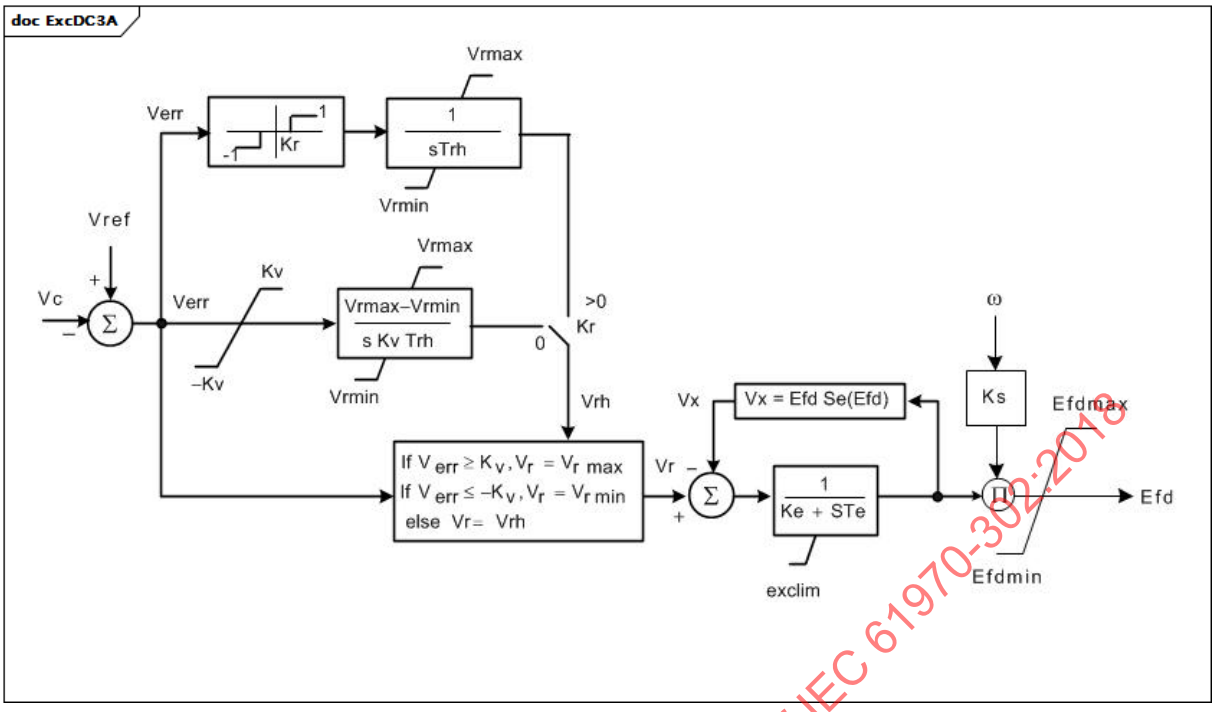

Anglais	Français
If	Si
else	sinon

Figure 109 – ExcDC3A

Figure 109: Ce diagramme décrit le modèle de système d'excitation ExcDC3A.

Détails sur les paramètres:

1) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.
2) Si Kr est non nul, l'entrée du régulateur de tension varie à vitesse constante si Verr > Kr ou Verr < -Kr, conformément au modèle IEEE (1968) type 4. Si Kr est nul, le signal d'erreur entraîne continuellement le régulateur de tension, conformément aux modèles IEEE (1980) DC3 et IEEE (1992, 2005) DC3A.

Le Tableau 184 présente tous les attributs d'ExcDC3A.

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Tableau 184 – Attributs d'ExcitationSystemDynamics::ExcDC3A

nom	mult	type	description
trh	0..1	Seconds	Temps de déplacement du rhéostat (Trh) (> 0). Valeur classique = 20.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
kr	0..1	PU	Zone d'insensibilité (Kr). Valeur classique = 0.
kv	0..1	PU	Réglage du contact à levée/abaissement rapide (Kv) (> 0). Valeur classique = 0,05.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> 0). Valeur classique = 5.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (<= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1,83.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
efd1	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd1) (> 0). Valeur classique = 2,6.
seefd1	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd1 (Se[Eefd1]) (>= 0). Valeur classique = 0,1.
efd2	0..1	PU	Tension de l'excitatrice à laquelle la saturation de l'excitatrice est définie (Efd2) (> 0). Valeur classique = 3,45.
seefd2	0..1	Float	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Efd2 (Se[Efd2]) (>= 0). Valeur classique = 0,35.
exclim	0..1	Boolean	(exclim). La norme IEEE est équivoque quant à la limite inférieure de la sortie de l'excitatrice. true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = limite inférieure de zéro non appliquée à la sortie de l'intégrateur. Valeur classique = true.
efdmax	0..1	PU	Limiteur de sortie de tension maximale de l'excitatrice (Efdmax) (> ExcDC3A.efdmin). Valeur classique = 99.
efdmin	0..1	PU	Limiteur de sortie de tension minimale de l'excitatrice (Efdmin) (< ExcDC3A.efdmax). Valeur classique = -99.
efdlim	0..1	Boolean	(Efdlim). true = le limiteur de sortie de l'excitatrice est actif false = le limiteur de sortie de l'excitatrice n'est pas actif Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 185 présente toutes les extrémités d'association d'ExcDC3A avec d'autres classes.

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Tableau 185 – Extrémités d'association d'ExcitationSystemDynamics::ExcDC3A avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.41 ExcDC3A1

Ancien système d'excitation IEEE de type 3 modifié.

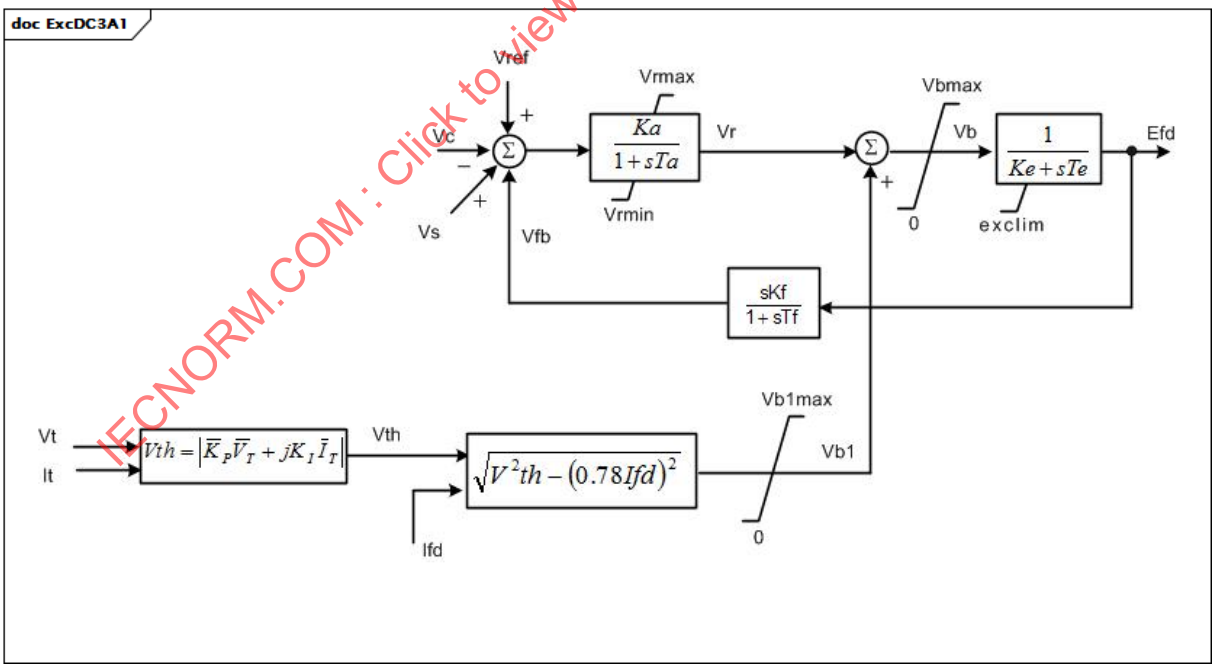

Figure 110 – ExcDC3A1

Figure 110: Ce diagramme décrit le modèle de système d'excitation ExcDC3A1.

Détails sur les paramètres:

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1) Ifd représente LadIfd (XadIfd) et est une tension proportionnelle au courant de champ dans le système en PU (IEEE 421.5-2005, Annexe B). Il est égal à Efd en régime établi.

Le Tableau 186 présente tous les attributs d'ExcDC3A1.

Tableau 186 – Attributs d'ExcitationSystemDynamics::ExcDC3A1

nom	mult	type	description
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 300.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,01.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> ExcDC3A1.vrmin). Valeur classique = 5.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< 0 et < ExcDC3A1.vrmax). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice, taux d'intégration associé à la commande d'excitatrice (Te) (> 0). Valeur classique = 1,83.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (Kf) (>= 0). Valeur classique = 0,1.
tf	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf) (>= 0). Valeur classique = 0,675.
kp	0..1	PU	Coefficient de gain potentiel du circuit (Kp) (>= 0). Valeur classique = 4,37.
ki	0..1	PU	Coefficient de gain potentiel du circuit (Ki) (>= 0). Valeur classique = 4,83.
vbmax	0..1	PU	Limiteur de tension disponible de l'excitatrice (Vbmax) (> 0). Valeur classique = 11,63.
exclim	0..1	Boolean	(exclim). true = une limite inférieure de zéro est appliquée à la sortie de l'intégrateur false = limite inférieure de zéro non appliquée à la sortie de l'intégrateur. Valeur classique = true.
ke	0..1	PU	Constante de l'excitatrice liée au champ auto excité (Ke). Valeur classique = 1.
vb1max	0..1	PU	Limiteur de tension disponible de l'excitatrice (Vb1max) (> 0). Valeur classique = 11,63.
vblim	0..1	Boolean	Indicateur de limiteur Vb. true = le limiteur Vbmax de l'excitatrice est actif false = Vb1max est actif. Valeur classique = true.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 187 présente toutes les extrémités d'association d'ExcDC3A1 avec d'autres classes.

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Tableau 187 – Extrémités d'association d'ExcitationSystemDynamics::ExcDC3A1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.42 ExcELIN1

Système d'excitation alimenté par transformateur PI statique: ELIN (VATECH) – modèle simplifié. Ce modèle représente un système d'excitation tout statique. Un régulateur de tension PI établit un point de consigne de courant de champ souhaité pour un régulateur de courant proportionnel. L'intégrateur du régulateur PI contient une entrée de suivi permettant de mettre en correspondance son signal avec le courant de champ présent. Un stabilisateur de système de puissance avec puissance absorbée est inclus dans le modèle.

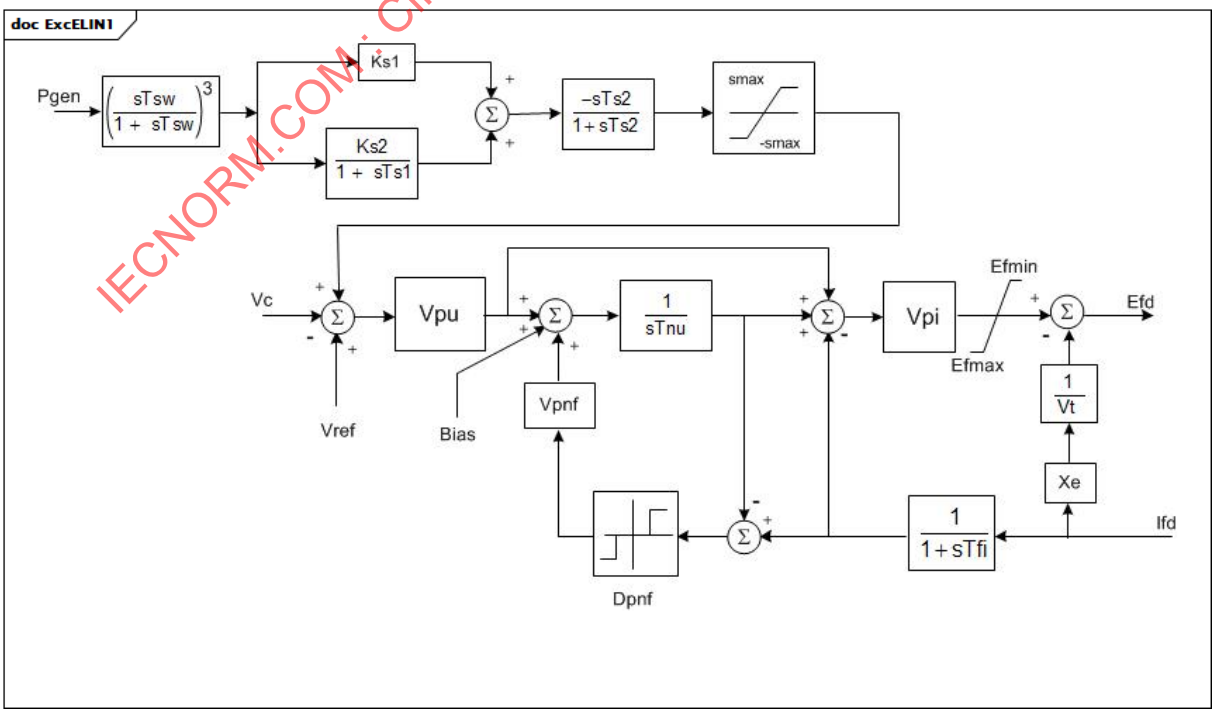

Figure 111 – ExcELIN1

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Figure 111: Ce diagramme décrit le modèle de système d'excitation ExcELIN1.

Le Tableau 188 présente tous les attributs d'ExcELIN1.

Tableau 188 – Attributs d'ExcitationSystemDynamics::ExcELIN1

nom	mult	type	description
tfi	0..1	Seconds	Constante de temps du transducteur de courant (Tfi) (>= 0). Valeur classique = 0.
tnu	0..1	Seconds	Constante de temps de réinitialisation du régulateur (Tnu) (>= 0). Valeur classique = 2.
vpu	0..1	PU	Gain proportionnel du régulateur de tension (Vpu). Valeur classique = 34,5.
vpi	0..1	PU	Gain du régulateur de courant (Vpi). Valeur classique = 12,45.
vpnf	0..1	PU	Gain de suivi du régulateur (Vpnf). Valeur classique = 2.
dpnf	0..1	PU	Zone d'insensibilité de suivi du régulateur (Dpnf). Valeur classique = 0.
tsw	0..1	Seconds	Paramètres du stabilisateur (Tsw) (>= 0). Valeur classique = 3.
efmin	0..1	PU	Tension d'excitation minimale en circuit ouvert (Efmin) (< ExcELIN1.efmax). Valeur classique = -5.
efmax	0..1	PU	Tension d'excitation maximale en circuit ouvert (Efmax) (> ExcELIN1.efmin). Valeur classique = 5.
xe	0..1	PU	Réactance effective du transformateur d'excitation (Xe) (>= 0). Xe représente la régulation du transformateur/redresseur. Valeur classique = 0,06.
ks1	0..1	PU	Gain 1 du stabilisateur (Ks1). Valeur classique = 0.
ks2	0..1	PU	Gain 2 du stabilisateur (Ks2). Valeur classique = 0.
ts1	0..1	Seconds	Constante de temps de réponse de phase du stabilisateur (Ts1) (>= 0). Valeur classique = 1.
ts2	0..1	Seconds	Constante de temps du filtre du stabilisateur (Ts2) (>= 0). Valeur classique = 1.
smax	0..1	PU	Sortie limite du stabilisateur (smax). Valeur classique = 0,1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 189 présente toutes les extrémités d'association d'ExcELIN1 avec d'autres classes.

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Tableau 189 – Extrémités d'association d'ExcitationSystemDynamics::ExcELIN1 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.43 ExcELIN2

Système d'excitation détaillé ELIN (VATECH). Ce modèle représente un système d'excitation tout statique. Un régulateur de tension PI établit un point de consigne de courant de champ souhaité pour un régulateur de courant proportionnel. L'intégrateur du régulateur PI contient une entrée de suivi permettant de mettre en correspondance son signal avec le courant de champ présent. Modèles de stabilisateur de système de puissance utilisés conjointement avec ce modèle de système d'excitation: PssELIN2, PssIEEE2B, Pss2B.

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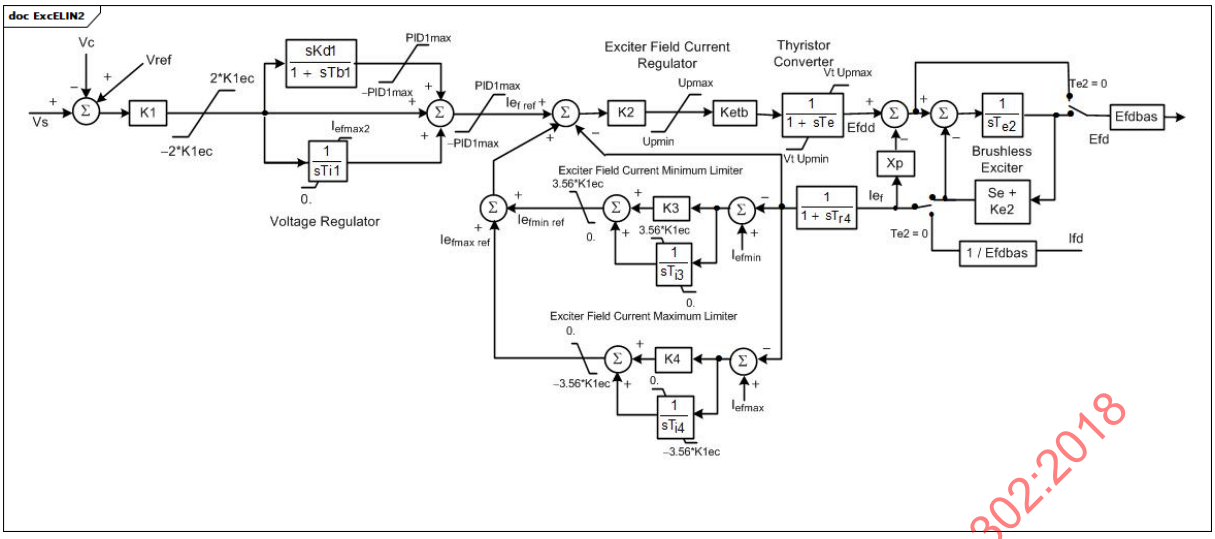

Anglais	Français
Exciter Field Current Regulator	Régulateur de courant de champ de l'excitatrice
Thyristor Converter	Convertisseur de thyristor
Voltage Regulator	Régulateur de tension
Exciter Field Current Minimum Limiter	Limiteur minimal de courant de champ de l'excitatrice
Exciter Field Current Maximum Limiter	Limiteur maximal de courant de champ de l'excitatrice
Brushless Exciter	Excitatrice sans balais

Figure 112 – ExcELIN2

Figure 112: Ce diagramme décrit le modèle de système d'excitation ExcELIN2.

Le Tableau 190 présente tous les attributs d'ExcELIN2.

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Tableau 190 – Attributs d'ExcitationSystemDynamics::ExcELIN2

nom	mult	type	description
k1	0..1	PU	Gain d'entrée du régulateur de tension (K1). Valeur classique = 0.
k1ec	0..1	PU	Limite d'entrée du régulateur de tension (K1ec). Valeur classique = 2.
kd1	0..1	PU	Gain par dérivation du régulateur de tension (Kd1). Valeur classique = 34,5.
tb1	0..1	Seconds	Constante de temps de relaxation par dérivation du régulateur de tension (Tb1) (>= 0). Valeur classique = 12,45.
pid1max	0..1	PU	Gain de suivi du régulateur (PID1max). Valeur classique = 2.
ti1	0..1	PU	Zone d'insensibilité de suivi du régulateur (Ti1). Valeur classique = 0.
iefmax2	0..1	PU	Tension d'excitation minimale en circuit ouvert (Iefmax2). Valeur classique = -5.
k2	0..1	PU	Gain (K2). Valeur classique = 5.
ketb	0..1	PU	Gain (Ketb). Valeur classique = 0,06.
upmax	0..1	PU	Limiteur (Upmax) (> ExcELIN2.upmin). Valeur classique = 3.
upmin	0..1	PU	Limiteur (Upmin) (< ExcELIN2.upmax). Valeur classique = 0.
te	0..1	Seconds	Constante de temps (Te) (>= 0). Valeur classique = 0.
xp	0..1	PU	Réactance effective du transformateur d'excitation (Xp). Valeur classique = 1.
te2	0..1	Seconds	Constante de temps (Te2) (>= 0). Valeur classique = 1.
ke2	0..1	PU	Gain (Ke2). Valeur classique = 0,1.
ve1	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve1) (> 0). Valeur classique = 3.
seve1	0..1	PU	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve1, derrière la réactance de commutation (Se[Ve1]) (>= 0). Valeur classique = 0.
ve2	0..1	PU	Tensions de sortie de l'alternateur d'excitation derrière la réactance de commutation à laquelle la saturation est définie (Ve2) (> 0). Valeur classique = 0.
seve2	0..1	PU	Valeur de la fonction de saturation de l'excitatrice à la tension correspondante de l'excitatrice, Ve2, derrière la réactance de commutation (Se[Ve2]) (>= 0). Valeur classique = 1.
tr4	0..1	Seconds	Constante de temps (Tr4) (>= 0). Valeur classique = 1.
k3	0..1	PU	Gain (K3). Valeur classique = 0,1.
ti3	0..1	Seconds	Constante de temps (Ti3) (>= 0). Valeur classique = 3.
k4	0..1	PU	Gain (K4). Valeur classique = 0.
ti4	0..1	Seconds	Constante de temps (Ti4) (>= 0). Valeur classique = 0.
iefmax	0..1	PU	Limiteur (Iefmax) (> ExcELIN2.iefmin). Valeur classique = 1.
iefmin	0..1	PU	Limiteur (Iefmin) (< ExcELIN2.iefmax). Valeur classique = 1.
efdbas	0..1	PU	Gain (Efdbas). Valeur classique = 0,1.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 191 présente toutes les extrémités d'association d'ExcELIN2 avec d'autres classes.

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Tableau 191 – Extrémités d'association d'ExcitationSystemDynamics::ExcELIN2 avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.44 ExcHU

Système d'excitation hongrois, avec transducteur de tension intégré.

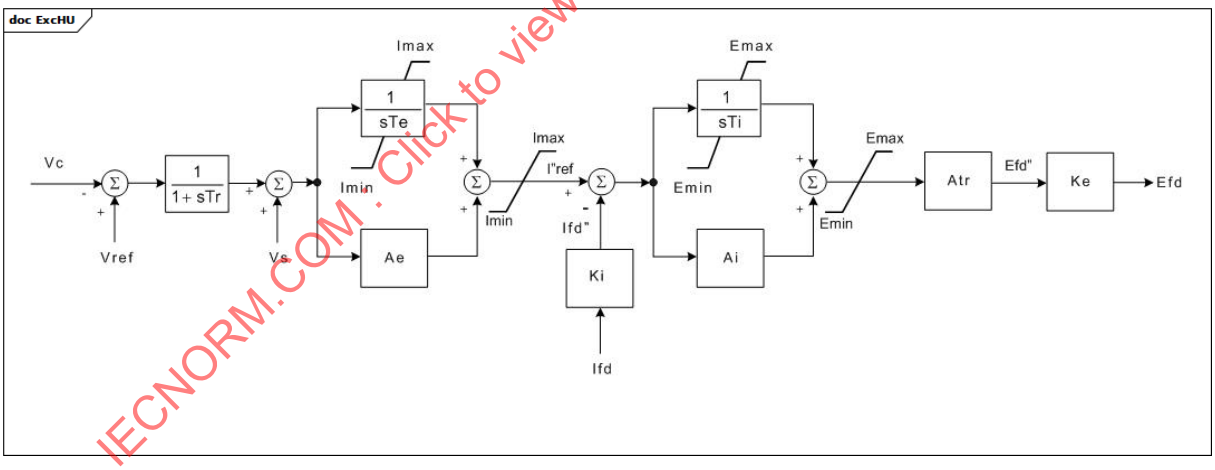

Figure 113 – ExcHU

Figure 113: Ce diagramme décrit le modèle de système d'excitation ExcHU.

Le Tableau 192 présente tous les attributs d'ExcHU.

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Tableau 192 – Attributs d'ExcitationSystemDynamics::ExcHU

nom	mult	type	description
tr	0..1	Seconds	Constante de temps du filtre (Tr) (>= 0). Si un compensateur de variation de tension est utilisé conjointement avec ce modèle de système d'excitation, il convient d'attribuer la valeur 0 à Tr. Valeur classique = 0,01.
te	0..1	Seconds	Constante de temps d'intégration de la balise PI de boucle principale (Te) (>= 0). Valeur classique = 0,154.
imin	0..1	PU	Limite inférieure du signal de sortie de la balise PI de boucle principale (Imin) (< ExcHU.imax). Valeur classique = 0,1.
imax	0..1	PU	Limite supérieure du signal de sortie de la balise PI de boucle principale (Imax) (> ExcHU.imin). Valeur classique = 2,19.
ae	0..1	PU	Facteur de gain de la balise PI de boucle principale (Ae). Valeur classique = 3.
emin	0..1	PU	Limite inférieure du signal de commande de tension de champ sur la base AVR (Emin) (< ExcHU.emax). Valeur classique = -0,866.
emax	0..1	PU	Limite supérieure du signal de commande de tension de champ sur la base AVR (Emax) (> ExcHU.emin). Valeur classique = 0,996.
ki	0..1	Float	Constante de conversion de base du courant (Ki). Valeur classique = 0,21428
ai	0..1	PU	Facteur de gain de la balise PI de boucle secondaire (Ai). Valeur classique = 22.
ti	0..1	Seconds	Constante de temps d'intégration de la balise de commande PI de boucle secondaire (Ti) (>= 0). Valeur classique = 0,01333.
atr	0..1	PU	Constante AVR (Atr). Valeur classique = 2,19.
ke	0..1	Float	Constante de conversion de base de tension (Ke). Valeur classique = 4,666.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 193 présente toutes les extrémités d'association d'ExcHU avec d'autres classes.

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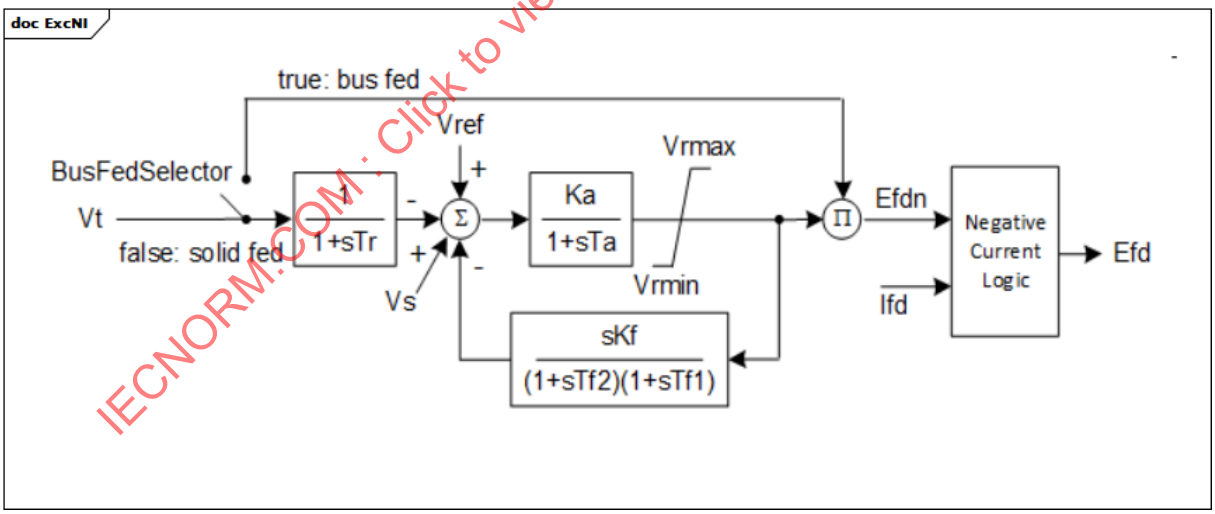
Tableau 193 – Extrémités d'association d'ExcitationSystemDynamics::ExcHU avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.45 ExcNI

Modèle de système d'excitation de pont de redresseur au silicium (SCR – *silicon-controlled rectifier*) alimenté par bus ou câble rigide de type NI (NVE).



Anglais	Français
Bus fed	Alimenté par bus
Solid fed	Alimenté par câble rigide
Negative current logic	Logique négative de courant

Figure 114 – ExcNI

Figure 114: Ce diagramme décrit le modèle de système d'excitation ExcNI.

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Détails sur les paramètres:

1) R doit être = 0 (ce qui signifie que l'excitatrice a un courant admissible négatif) ou > 0 (ce qui signifie que l'excitatrice n'a pas de courant admissible).
2) Le bloc 'Negative Current Logic' (logique négative de courant) utilise le paramètre R et les entrées Efdn et Ifd. La sortie Efd est définie comme étant égale à l'entrée Efdn, sauf si R x Ifd > 0 et R x Ifd > Efdn, auquel cas Efd est définie comme étant égale à R x Ifd. Ceci signifie que la logique négative de courant est active (R et Ifd sont utilisés pour calculer Efd) uniquement lorsque le courant est positif et que l'excitatrice n'a pas de courant admissible (c'est-à-dire, lorsque ExcNi.r est supérieur à 0).

Le Tableau 194 présente tous les attributs d'ExcNI.

Tableau 194 – Attributs d'ExcitationSystemDynamics::ExcNI

nom	mult	type	description
busFedSelector	0..1	Boolean	Sélecteur 'Fed by' (BusFedSelector). true = alimenté par bus (commutateur fermé) false = alimenté par câble rigide (commutateur ouvert). Valeur classique = true.
tr	0..1	Seconds	Constante de temps (Tr) (>= 0). Valeur classique = 0,02.
ka	0..1	PU	Gain du régulateur de tension (Ka) (> 0). Valeur classique = 210.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (> 0). Valeur classique = 0,02.
vrmax	0..1	PU	Sortie maximale du régulateur de tension (Vrmax) (> ExcNI.vrmin). Valeur classique = 5,0.
vrmin	0..1	PU	Sortie minimale du régulateur de tension (Vrmin) (< ExcNI.vrmax). Valeur classique = -2,0.
kf	0..1	PU	Gain du stabilisateur de système de commande d'excitation (Kf) (> 0). Valeur classique = 0,01.
tf2	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf2) (> 0). Valeur classique = 0,1.
tf1	0..1	Seconds	Constante de temps du stabilisateur de système de commande d'excitation (Tf1) (> 0). Valeur classique = 1,0.
r	0..1	PU	rc / rfd (R) (>= 0). 0 signifie que l'excitatrice a un courant admissible négatif > 0 signifie que l'excitatrice n'a pas de courant admissible négatif Valeur classique = 5.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 195 présente toutes les extrémités d'association d'ExcNI avec d'autres classes.

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Tableau 195 – Extrémités d'association d'ExcitationSystemDynamics::ExcNI avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.46 ExcOEX3T

Système d'excitation IEEE de type ST1 modifié avec limiteur de tension aux bornes semi-continu et à action.

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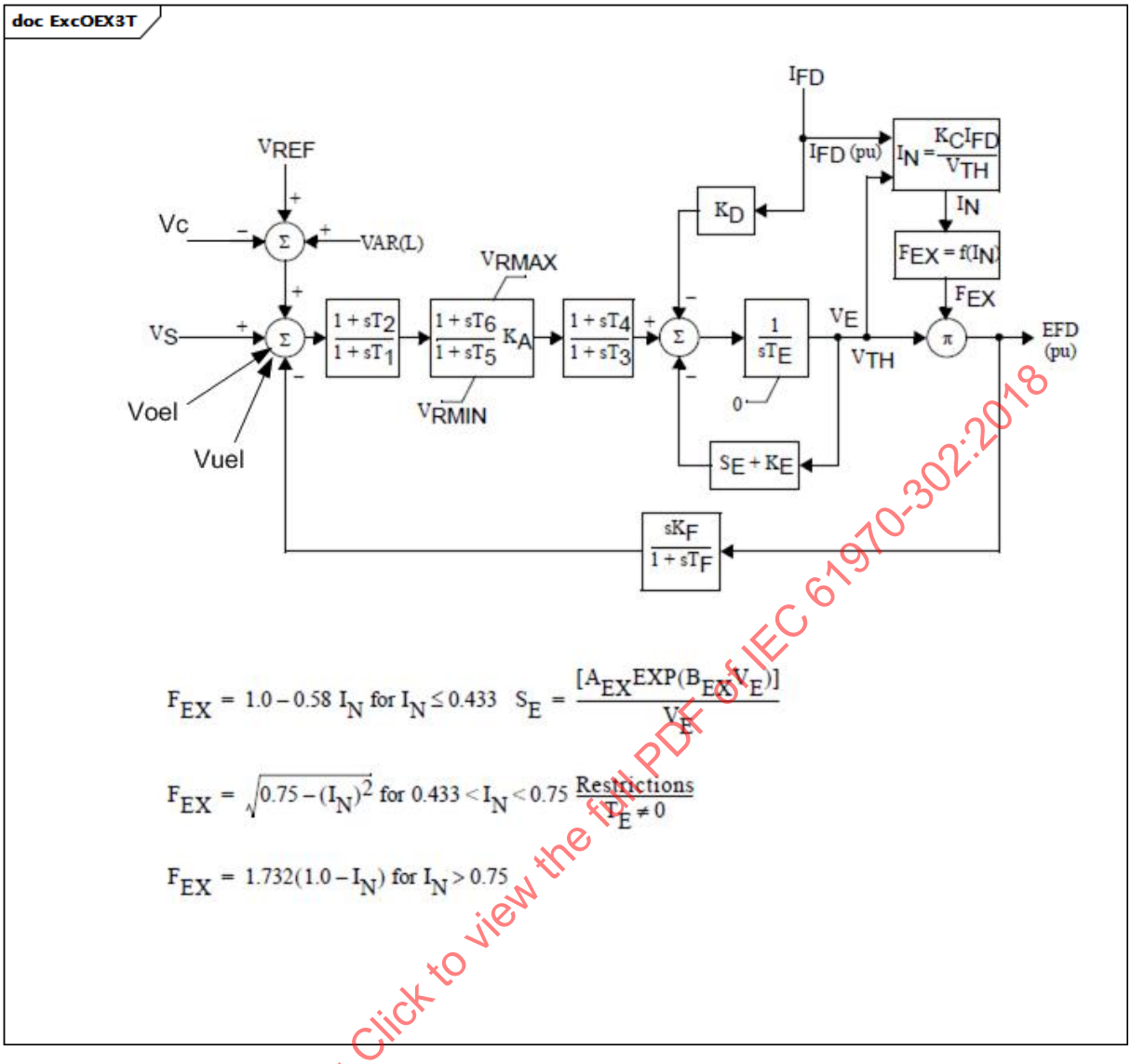

Anglais	Français
for	pour

Figure 115 – ExcOEX3T

Figure 115: Ce diagramme décrit le modèle de système d'excitation ExcOEX3T.

Le Tableau 196 présente tous les attributs d'ExcOEX3T.

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Tableau 196 – Attributs d'ExcitationSystemDynamics::ExcOEX3T

nom	mult	type	description
t1	0..1	Seconds	Constante de temps (T1) (>= 0).
t2	0..1	Seconds	Constante de temps (T2) (>= 0).
t3	0..1	Seconds	Constante de temps (T3) (>= 0).
t4	0..1	Seconds	Constante de temps (T4) (>= 0).
ka	0..1	PU	Gain (KA).
t5	0..1	Seconds	Constante de temps (T5) (>= 0).
t6	0..1	Seconds	Constante de temps (T6) (>= 0).
vrmax	0..1	PU	Limiteur (VRMAX) (> ExcOEX3T.vrmin).
vrmin	0..1	PU	Limiteur (VRMIN) (< ExcOEX3T.vrmax).
te	0..1	Seconds	Constante de temps (TE) (>= 0).
kf	0..1	PU	Gain (KF).
tf	0..1	Seconds	Constante de temps (TF) (>= 0).
kc	0..1	PU	Gain (KC).
kd	0..1	PU	Gain (KD).
ke	0..1	PU	Gain (KE).
e1	0..1	PU	Paramètre de saturation (E1).
see1	0..1	PU	Paramètre de saturation (SE[E1]).
e2	0..1	PU	Paramètre de saturation (E2).
see2	0..1	PU	Paramètre de saturation (SE[E2]).
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 197 présente toutes les extrémités d'association d'ExcOEX3T avec d'autres classes.

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Tableau 197 – Extrémités d'association d'ExcitationSystemDynamics::ExcOEX3T avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.47 ExcPIC

Système d'excitation du régulateur intégral proportionnel. Ce modèle peut être utilisé pour représenter des systèmes d'excitation avec un régulateur de tension proportionnel intégral (PI).

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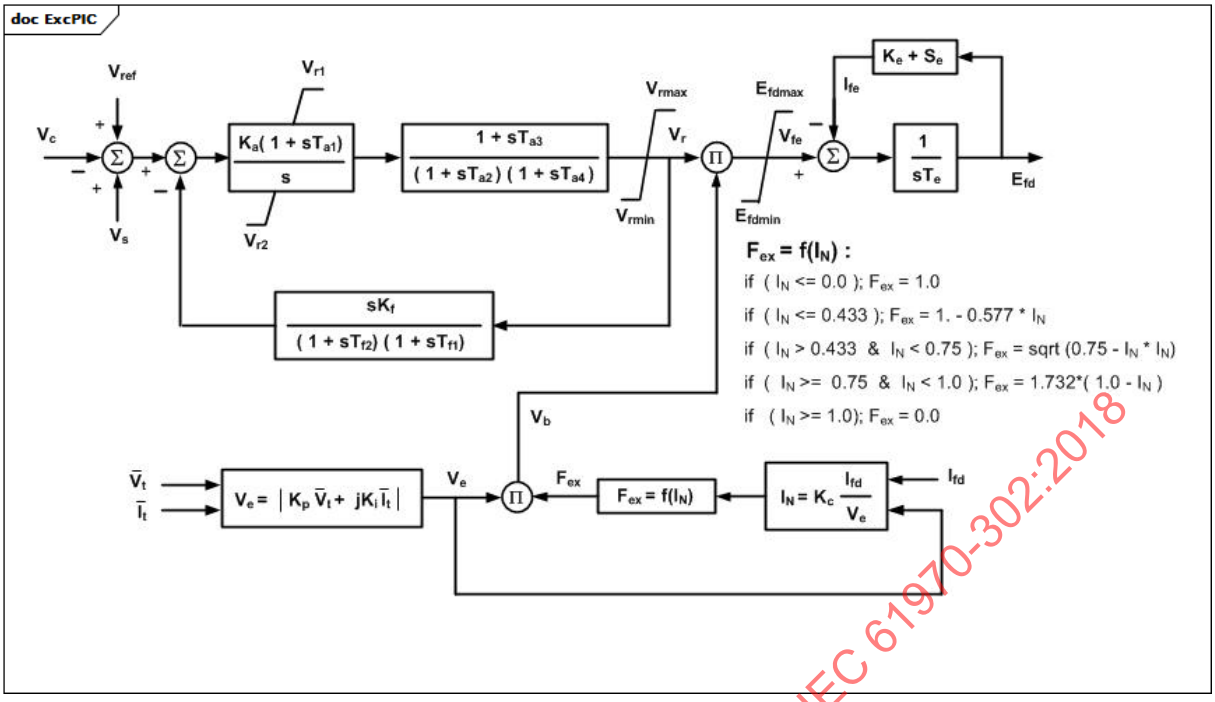

Anglais	Français
If	Si

Figure 116 – ExcPIC

Figure 116: Ce diagramme décrit le modèle de système d'excitation ExcPIC.

Le Tableau 198 présente tous les attributs d'ExcPIC.

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Tableau 198 – Attributs d'ExcitationSystemDynamics::ExcPIC

nom	mult	type	description
ka	0..1	PU	Gain du régulateur PI (Ka). Valeur classique = 3,15.
ta1	0..1	Seconds	Constante de temps du régulateur PI (Ta1) (>= 0). Valeur classique = 1.
vr1	0..1	PU	Limite maximale PI (Vr1). Valeur classique = 1.
vr2	0..1	PU	Limite minimale PI (Vr2). Valeur classique = -0,87.
ta2	0..1	Seconds	Constante de temps du régulateur de tension (Ta2) (>= 0). Valeur classique = 0,01.
ta3	0..1	Seconds	Constante de délai de mise en œuvre (Ta3) (>= 0). Valeur classique = 0.
ta4	0..1	Seconds	Constante de temps de réponse (Ta4) (>= 0). Valeur classique = 0.
vrmax	0..1	PU	Limite maximale du régulateur de tension (Vrmax) (> ExcPIC.vrmin). Valeur classique = 1.
vrmin	0..1	PU	Limite minimale du régulateur de tension (Vrmin) (< ExcPIC.vrmax). Valeur classique = -0,87.
kf	0..1	PU	Gain de contre-réaction de vitesse (Kf). Valeur classique = 0.
tf1	0..1	Seconds	Constante de temps de contre-réaction de vitesse (Tf1) (>= 0). Valeur classique = 0.
tf2	0..1	Seconds	Constante de temps de réponse de contre-réaction de vitesse (Tf2) (>= 0). Valeur classique = 0.
efdmax	0..1	PU	Limite maximale de l'excitatrice (Efdmax) (> ExcPIC.efdmin). Valeur classique = 8.
efdmin	0..1	PU	Limite minimale de l'excitatrice (Efdmin) (< ExcPIC.efdmax). Valeur classique = -0,87.
ke	0..1	PU	Constante de l'excitatrice (Ke). Valeur classique = 0.
te	0..1	Seconds	Constante de temps de l'excitatrice (Te) (>= 0). Valeur classique = 0.
e1	0..1	PU	Valeur 1 de tension de champ (E1). Valeur classique = 0.
se1	0..1	PU	Facteur de saturation à E1 (Se1). Valeur classique = 0.
e2	0..1	PU	Valeur 2 de tension de champ (E2). Valeur classique = 0.
se2	0..1	PU	Facteur de saturation à E2 (Se2). Valeur classique = 0.
kp	0..1	PU	Gain de source de potentiel (Kp). Valeur classique = 6,5.
ki	0..1	PU	Gain de source de courant (Ki). Valeur classique = 0.
kc	0..1	PU	Facteur de régulation de l'excitatrice (Kc). Valeur classique = 0,08.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

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Le Tableau 199 présente toutes les extrémités d'association d'ExcPIC avec d'autres classes.

Tableau 199 – Extrémités d'association d'ExcitationSystemDynamics::ExcPIC avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.48 ExcREXS

Système d'excitation tournant à usage général. Ce modèle peut être utilisé pour représenter un large éventail de systèmes d'excitation dont la source d'alimentation en courant continu est un générateur de courant alternatif ou de courant continu. Il couvre les modèles de systèmes d'excitation IEEE de types AC1, AC2, DC1 et DC2.

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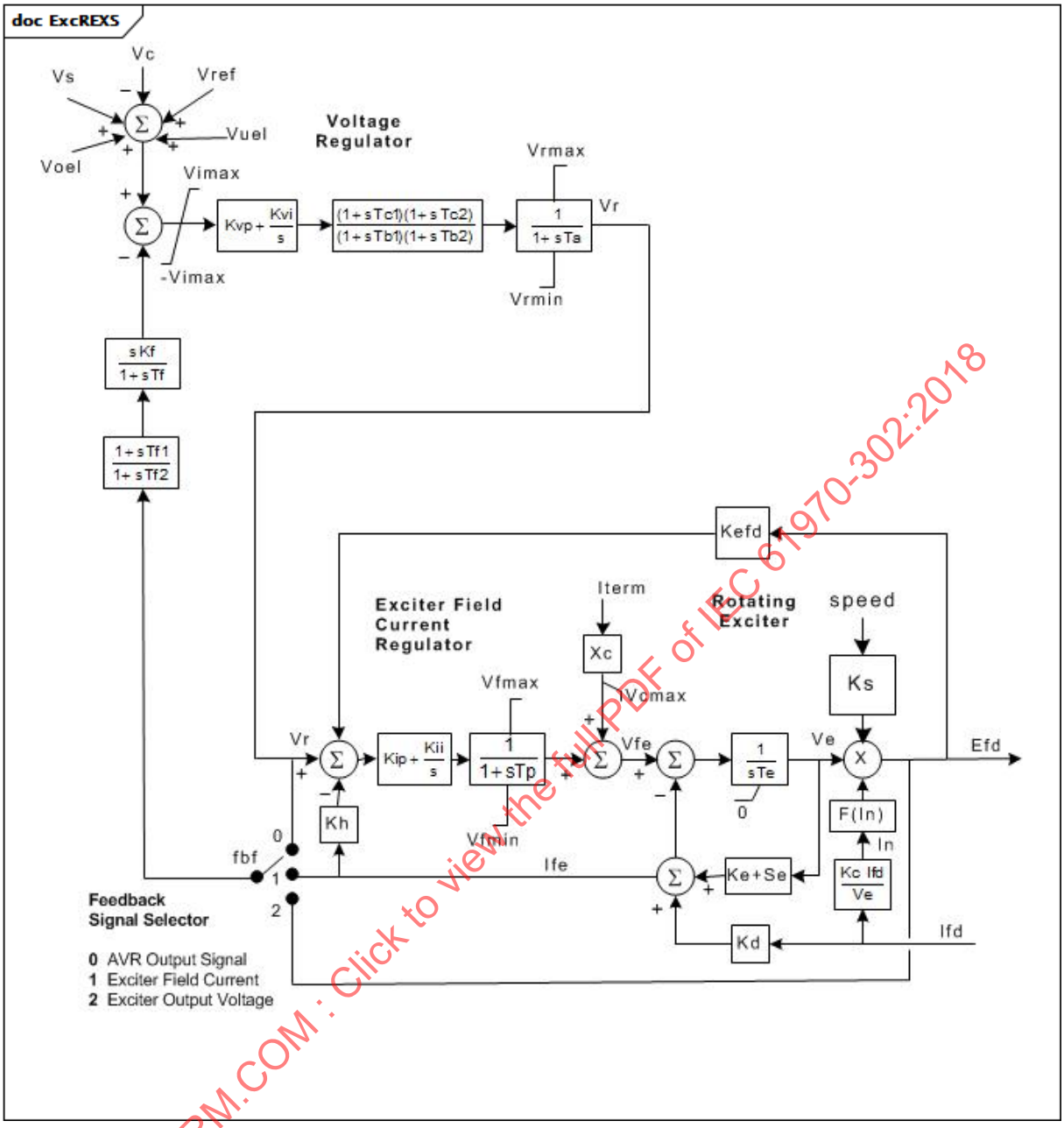

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Anglais	Français
Voltage Regulator	Régulateur de tension
Exciter Field Current Regulator	Régulateur de courant de champ de l'excitatrice
Rotating Exciter	Excitatrice tournante
speed	vitesse
Feedback Signal Selector	Sélecteur de signal de retour
AVR Output Signal	Signal de sortie de l'AVR
Exciter Fied Current	Courant de champ de l'excitatrice
Exciter Output Voltage	Tension de sortie de l'excitatrice

Figure 117 – ExcREXS

Figure 117: Ce diagramme décrit le modèle de système d'excitation ExcREXS.

Détails sur les paramètres:

1) L'excitatrice tournante peut être de type à courant continu ou à courant alternatif sans balais. Pour modéliser une excitatrice à courant continu, définir Kc = Kd = 0
2) Une excitatrice en courant alternatif peut être modélisée soit en attribuant une valeur non nulle à Kc et Kd afin de représenter respectivement la réaction d'induit de l'excitatrice et la régulation du redresseur tournant, soit en spécifiant les facteurs de saturation Se1 et Se2 pour représenter la courbe de tension de sortie d'excitation de l'excitatrice telle que chargée par la résistance de champ du générateur principal. Il est préférable d'utiliser la première approche (Kd = 0), étant donné que la dernière ne représente pas les effets de la réaction d'induit dans l'excitatrice sur son courant de champ, et invalide donc le modèle si le courant de champ est détecté par le régulateur de tension.
3) Si ce modèle est utilisé pour représenter une excitatrice à excitation séparée, il convient en principe d'attribuer une valeur proche de l'unité à Ke. Une excitatrice en courant continu à excitation dérivée peut être modélisée en attribuant la petite valeur négative appropriée à Ke permettant de représenter la relation entre la ligne d'entrefer et la ligne de résistance de champ de l'excitatrice. Noter toutefois que ce modèle ne détermine pas automatiquement la valeur de Ke lorsqu'une excitatrice en courant continu à champ de shunt est représentée
4) Le régulateur de tension peut être de type proportionnel ou de type proportionnel et intégral. Kvp ou Kvi (mais pas les deux) peuvent être nuls.
5) La sortie du régulateur de tension peut être la tension de champ appliquée directement à l'excitatrice ou l'entrée d'un régulateur de courant de champ de l'excitatrice en fonction des choix de Kip, Kii et Kh. Kip et/ou Kii doivent être non nuls. Si Kii est non nul, il convient en principe que Kh le soit également.
6) La référence du régulateur de tension est modifiée par un limiteur volts par hertz lorsque la vitesse de l'arbre passe sous Nvphz. Si la vitesse de l'arbre est inférieure à Nvphz, la référence du régulateur est réduite comme suit: Vref effective = Vref (1,0 – Kvphz (vitesse – Nvphz)). Le limiteur volts par hertz peut être désactivé en définissant Nvphz = 0 ou Kvphz = 0.
7) Les paramètres de saturation sont donnés par la définition du facteur de saturation IEEE à l'aide de la magnétisation en circuit ouvert de l'excitatrice. Le point [E1, S(E1) ou E2, S(E2)] peut être la valeur supérieure et l'autre la valeur inférieure.
8) Si la valeur 1 est attribuée à Ks, la sortie (Efd) est multipliée par la vitesse du générateur.
9) Les limites de sortie du régulateur de tension, Vrmax et Vrmin, doivent être définies comme étant des multiples de la valeur du courant de champ de l'excitatrice nécessaire au maintien de la sortie de l'excitatrice à sa valeur de base. La limite de courant de champ, Vlr, doit être définie comme étant un multiple du courant de champ de l'excitatrice nécessaire au maintien de la sortie de l'excitatrice à sa valeur de base. En d'autres termes, Vrmax et Vrmin doivent être définis en termes de tension de sortie de l'excitatrice PU à laquelle ils correspondent en régime établi.
10) Le fanion de limite de sortie du régulateur indique si l'alimentation de commande du régulateur de tension est un transformateur au niveau des bornes du générateur ou une source indépendante (un générateur à aimants permanents, par exemple). Définir Flimf comme suit:
    - Flimf = 0, les limites sur la sortie du régulateur sont Vrmax, Vrmin, Vfmax et Vfmin
    - Flimf = 1, les limites sur la sortie du régulateur sont (Vrmax x Vterm), (Vrmin x Vterm), (Vfmax x Vterm) et (Vfmin x Vterm)
11) Le sélecteur de signal de retour utilise ExcREXSFeedbackSignalKind, où:
    - 0 (Signal de sortie de l'AVR) = ExcREXSFeedbackSignalKind.fieldVoltage;
    - 1 (Courant de champ de l'excitatrice) = ExcREXSFeedbackSignalKind.fieldCurent;
    - 2 (Tension de sortie de l'excitatrice) = ExcREXSFeedbackSignalKind.outputVoltage.

Le Tableau 200 présente tous les attributs d'ExcREXS.

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Tableau 200 – Attributs d'ExcitationSystemDynamics::ExcREXS

nom	mult	type	description
e1	0..1	PU	Valeur 1 de tension de champ (E1). Valeur classique = 3.
e2	0..1	PU	Valeur 2 de tension de champ (E2). Valeur classique = 4.
fbf	0..1	ExcREXSFeedbackSignalKind	Fanion du signal de contre-réaction de vitesse (fbf). Valeur classique = fieldCurrent.
flimf	0..1	PU	Fanion de type de limite (Flimf). Valeur classique = 0.
kc	0..1	PU	Facteur de régulation du redresseur (Kc). Valeur classique = 0,05.
kd	0..1	PU	Facteur de régulation de l'excitatrice (Kd). Valeur classique = 2.
ke	0..1	PU	Constante proportionnelle du champ de l'excitatrice (Ke). Valeur classique = 1.
kefd	0..1	PU	Gain de contre-réaction de tension de champ (Kefd). Valeur classique = 0.
kf	0..1	Seconds	Gain de contre-réaction de vitesse (Kf) (>= 0). Valeur classique = 0,05.
kh	0..1	PU	Gain de contre-réaction du régulateur de tension de champ (Kh). Valeur classique = 0.
kii	0..1	PU	Gain intégral du régulateur de courant de champ (Kii). Valeur classique = 0.
kip	0..1	PU	Gain proportionnel du régulateur de courant de champ (Kip). Valeur classique = 1.
ks	0..1	PU	Coefficient permettant une utilisation différente du coefficient de vitesse du modèle (Ks). Valeur classique = 0.
kvi	0..1	PU	Gain intégral du régulateur de tension (Kvi). Valeur classique = 0.
kvp	0..1	PU	Gain proportionnel du régulateur de tension (Kvp). Valeur classique = 2 800.
kvphz	0..1	PU	Gain du limiteur V/Hz (Kvphz). Valeur classique = 0.
nvphz	0..1	PU	Vitesse de détection du limiteur V/Hz (Nvphz). Valeur classique = 0.
se1	0..1	PU	Facteur de saturation à E1 (Se1). Valeur classique = 0,0001.
se2	0..1	PU	Facteur de saturation à E2 (Se2). Valeur classique = 0,001.
ta	0..1	Seconds	Constante de temps du régulateur de tension (Ta) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0,01.
tb1	0..1	Seconds	Constante de temps de réponse (Tb1) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0.
tb2	0..1	Seconds	Constante de temps de réponse (Tb2) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0.
tc1	0..1	Seconds	Constante de délai de mise en œuvre (Tc1) (>= 0). Valeur classique = 0.
tc2	0..1	Seconds	Constante de délai de mise en œuvre (Tc2) (>= 0). Valeur classique = 0.
te	0..1	Seconds	Constante de temps du champ de l'excitatrice (Te) (> 0). Valeur classique = 1,2.
tf	0..1	Seconds	Constante de temps de contre-réaction de vitesse (Tf) (>= 0). Si = 0, le chemin de retour n'est pas utilisé. Valeur classique = 1.
tf1	0..1	Seconds	Constante de délai de mise en œuvre de la boucle de rétroaction (Tf1) (>= 0). Valeur classique = 0.
tf2	0..1	Seconds	Constante de temps de réponse de la boucle de rétroaction (Tf2) (>= 0). Si = 0, le bloc est contourné. Valeur classique = 0.
tp	0..1	Seconds	Constante de temps du pont de courant de champ (Tp) (>= 0). Valeur classique = 0.
vcmax	0..1	PU	Tension composée maximale (Vcmax). Valeur classique = 0.

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nom	mult	type	description
vfmax	0..1	PU	Courant de champ maximal de l'excitatrice (Vfmax) (> ExcREXS.vfmin). Valeur classique = 47.
vfmin	0..1	PU	Courant de champ minimal de l'excitatrice (Vfmin) (< ExcREXS.vfmax). Valeur classique = -20.
vimax	0..1	PU	Limite d'entrée du régulateur de tension (Vimax). Valeur classique = 0,1.
vrmax	0..1	PU	Sortie maximale du régulateur (Vrmax) (> ExcREXS.vrmin). Valeur classique = 47.
vrmin	0..1	PU	Sortie minimale du régulateur (Vrmin) (< ExcREXS.vrmax). Valeur classique = -20.
xc	0..1	PU	Réactance composée de l'excitatrice (Xc). Valeur classique = 0.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 201 présente toutes les extrémités d'association d'ExcPIC avec d'autres classes.

Tableau 201 – Extrémités d'association d'ExcitationSystemDynamics::ExcREXS avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

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5.3.9.49 ExcRQB

Type RQB (régulateur quatre boucles, développé en France) de système d'excitation, principalement utilisé dans les tranches thermiques ou nucléaires. Ce système d'excitation doit toujours être utilisé avec le stabilisateur de système de puissance de type PssRQB.

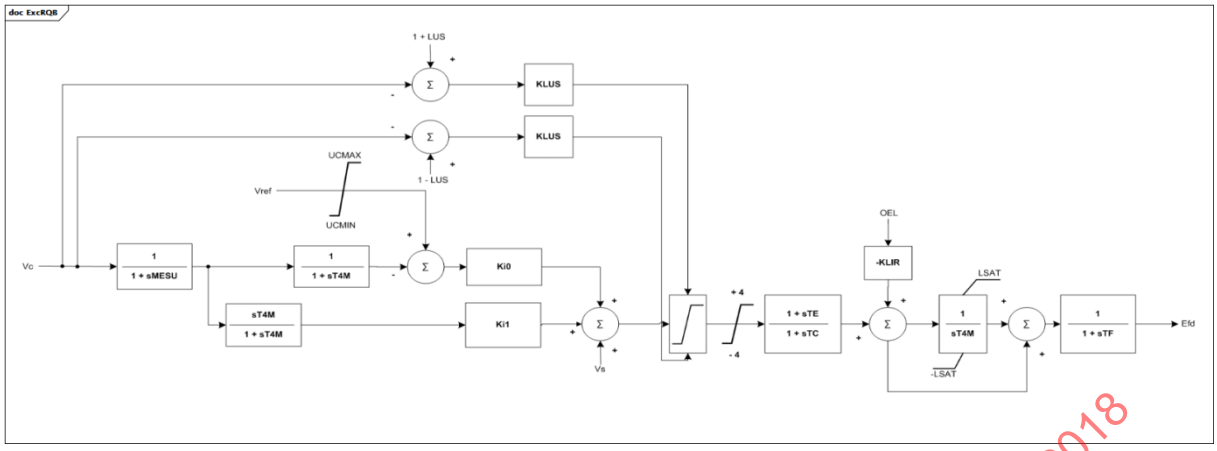

Figure 118 – ExcRQB

Figure 118: Ce diagramme décrit le modèle de système d'excitation ExcRQB.

Le Tableau 202 présente tous les attributs d'ExcRQB.

Tableau 202 – Attributs d'ExcitationSystemDynamics::ExcRQB

nom	mult	type	description
ki0	0..1	Float	Gain d'entrée de référence de tension (Ki0). Valeur classique = 12,7.
ki1	0..1	Float	Gain d'entrée de tension (Ki1). Valeur classique = −16,8.
te	0..1	Seconds	Constante de délai de mise en œuvre/temps de réponse (TE) (>= 0). Valeur classique = 0,22.
tc	0..1	Seconds	Constante de délai de mise en œuvre/temps de réponse (TC) (>= 0). Valeur classique = 0,02.
klir	0..1	Float	Gain d'entrée OEL (KLIR). Valeur classique = 12,13.
ucmin	0..1	PU	Limite de référence de tension minimale (UCMIN) (< ExcRQB.ucmax). Valeur classique = 0,9.
ucmax	0..1	PU	Limite de référence de tension maximale (UCMAX) (> ExcRQB.ucmin). Valeur classique = 1,1.
lus	0..1	PU	Point de consigne (LUS). Valeur classique = 0,12.
klus	0..1	Float	Gain du limiteur (KLUS). Valeur classique = 50.
mesu	0..1	Seconds	Constante de temps d'entrée de tension (MESU) (>= 0). Valeur classique = 0,02.
t4m	0..1	Seconds	Constante de temps d'entrée (T4M) (>= 0). Valeur classique = 5.
lsat	0..1	PU	Limiteur de l'intégrateur (LSAT). Valeur classique = 5,73.
tf	0..1	Seconds	Constante de temps de l'excitatrice (TF) (>= 0). Valeur classique = 0,01.
enabled	0..1	Boolean	hérité de: DynamicsFunctionBlock
aliasName	0..1	String	hérité de: IdentifiedObject
description	0..1	String	hérité de: IdentifiedObject
mRID	0..1	String	hérité de: IdentifiedObject
name	0..1	String	hérité de: IdentifiedObject

Le Tableau 203 présente toutes les extrémités d'association d'ExcRQB avec d'autres classes.

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Tableau 203 – Extrémités d'association d'ExcitationSystemDynamics::ExcRQB avec d'autres classes

mult à partir de	nom	mult vers	type	description
0..1	SynchronousMachineDynamics	1..1	SynchronousMachineDynamics	hérité de: ExcitationSystemDynamics
1..1	PowerSystemStabilizerDynamics	0..1	PowerSystemStabilizerDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType1Dynamics	0..1	PFVArControllerType1Dynamics	hérité de: ExcitationSystemDynamics
1..1	OverexcitationLimiterDynamics	0..1	OverexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	DiscontinuousExcitationControlDynamics	0..1	DiscontinuousExcitationControlDynamics	hérité de: ExcitationSystemDynamics
1..1	PFVArControllerType2Dynamics	0..1	PFVArControllerType2Dynamics	hérité de: ExcitationSystemDynamics
1..1	UnderexcitationLimiterDynamics	0..1	UnderexcitationLimiterDynamics	hérité de: ExcitationSystemDynamics
1..1	VoltageCompensatorDynamics	1..1	VoltageCompensatorDynamics	hérité de: ExcitationSystemDynamics
0..1	DiagramObjects	0..*	DiagramObject	hérité de: IdentifiedObject
1..1	Names	0..*	Name	hérité de: IdentifiedObject

5.3.9.50 ExcSCRX

Système d'excitation simple à caractéristiques génériques classiques de la plupart des systèmes d'excitation. Destiné à être utilisé lorsque le courant de champ négatif peut être un problème.

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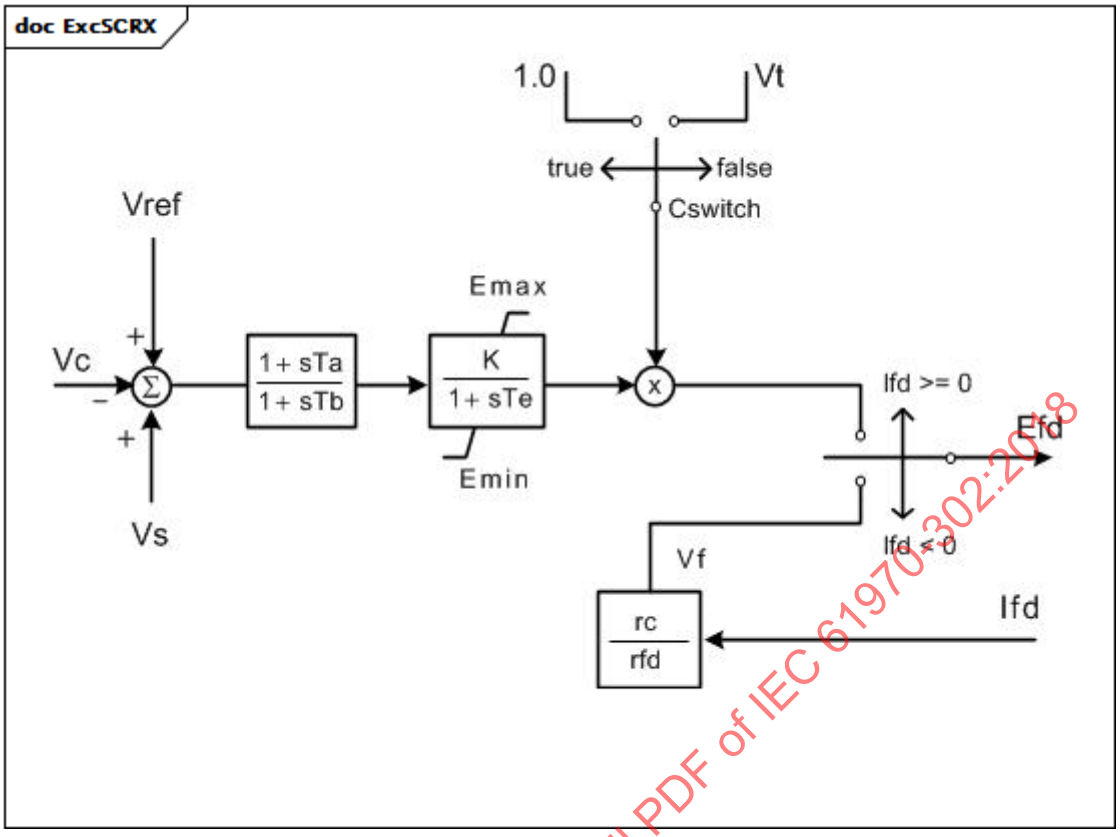

Figure 119 – ExcSCRX

Figure 119: Ce diagramme décrit le modèle de système d'excitation ExcSCRX.

Le Tableau 204 présente tous les attributs d'ExcSCRX.

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