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NEPLAN V555

EXCITER MODELS

Standard Dynamic Excitation Systems in NEPLAN Power System Analysis Tool

Contents

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

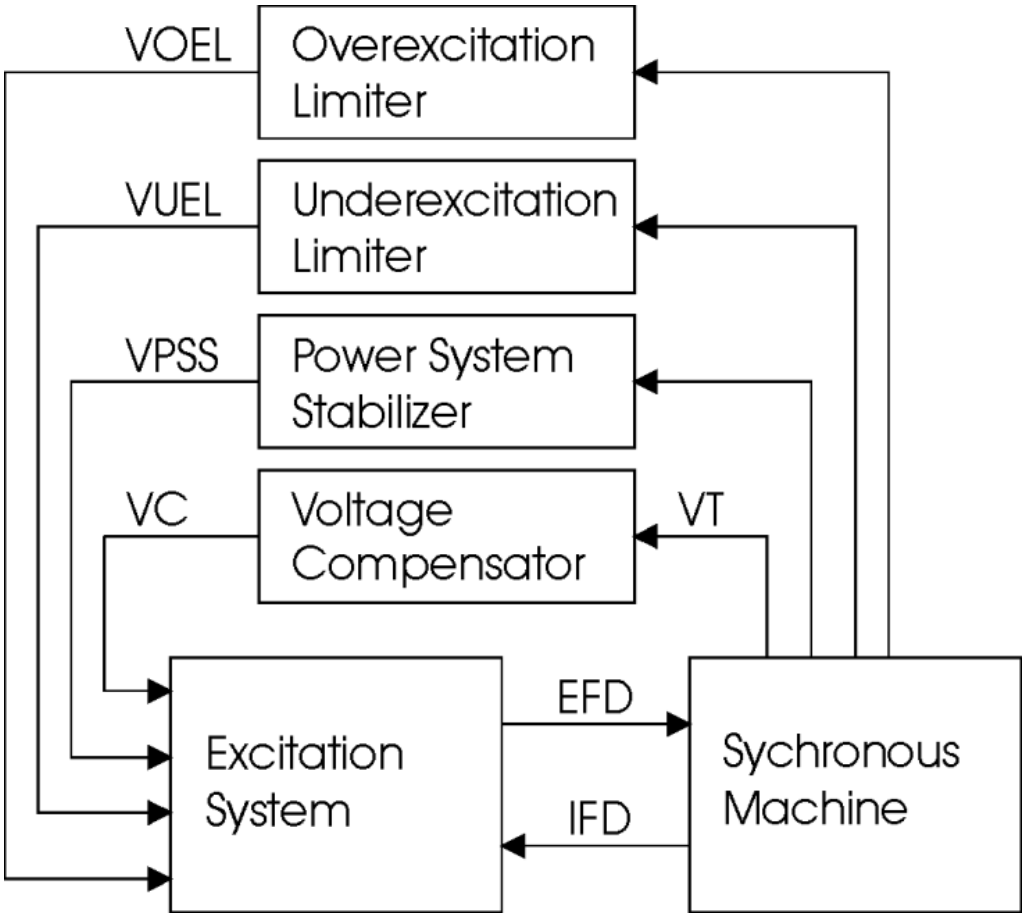
ENTSO-E, an association of the European electricity transmission system operators, selected the Common Information Model (CIM) standards of the International Electrotechnical Commission (IEC) as a basis for its own CIM standards. These standards aim at ensuring the reliability of grid models and market information exchanges.
In 2013, ENTSO-E adopted a new standard for grid models exchange called the Common Grid Model Exchange Standard (CGMES). The CGMES is a superset of the IEC CIM standards (belonging to IEC CIM16). It was developed to meet necessary requirements for the transmission system operators, which exchange data in the areas of system operations, network planning and integrated electricity markets.

All the CIM/CGMES regulators models are included in NEPLAN Power System Analysis Tools.

Per Unit (p.u.) System:

One p.u. field current is the current required to produce rated voltage on the air-gap line of the open-circuit synchronous machine. Other machine p.u. values are based on the machine ratings.

Excitation system Diagram



Input Signals to the Excitation System:

VT	Bus voltage, positive sequence, p.u.
IT	Stator output current, positive sequence, p.u.
IFD	Field current, positive sequence, p.u.
VPSS	Output signal from the power system stabilizers.
VUEL	Output signal from the Under Excitation Limiter.
VOEL	Output from Field Current Limiter
VOEL	Output from Stator Current Limiter

Ouput Signals to the Excitation System:

EFD	Field voltage (p.u.)

Voltage Compensator

When defining the real and imaginary parts of the bus voltage U and the stator output current I as:

VT = VD + jVQ
I = ID + jIQ

the controlled voltage VC can be derived by the voltage transducer as:

$$VC = \sqrt{(VD - ID \cdot RC + IQ \cdot XC)^2 + (UQ - IQ \cdot RC - ID \cdot XC)^2}$$

XC	Reactive compensation degree. A negative value means a droop is created in the bus voltage, proportional to the reactive current output at an over-excited machine. Analogously, a positive value means a voltage rise. Reactive current at an under-excited machine gives opposite signs. Parameter Range: 0 < |XC| < 1.0
RC	Active compensation degree. Analogously defined. Parameter Range: 0 < |RC| < 1.0

Saturation in exciter controller

Saturation is represented like a quadratic function:

For $|U| < 0$ $SE(U) = 0$

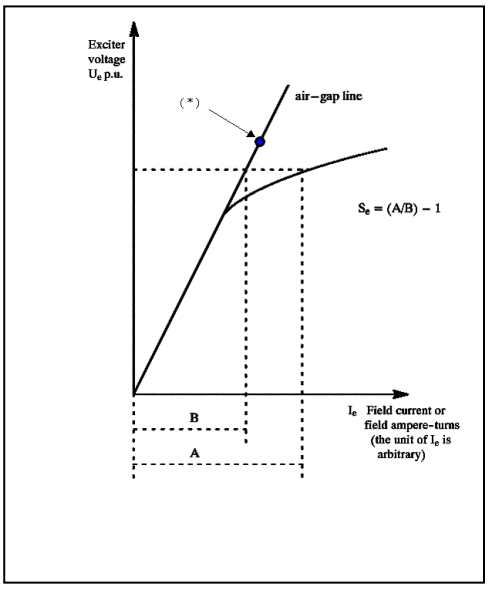
Else $SE(U) = \frac{B(U-A)^2}{U}$

Where:

$$A = \sqrt{E1 \cdot E2} \cdot \frac{\sqrt{E1} - \sqrt{E2 \cdot K}}{\sqrt{E2} - \sqrt{E1 \cdot K}}$$

$$B = SE2 \cdot \frac{\left(\sqrt{E2} - \sqrt{E1 \cdot K}\right)^2}{(E1 - E2)^2}$$

with $K = \frac{SE1}{SE2}$



Saturation values:

SE_{max} = Saturation SE at U_{max}

$SE_{0.75}$ = Saturation SE at 0.75·U

Rectifier Regulation Characteristic according to FMOD

For the following systems, there are two modes for the function FEX = f(IN) :
TYPE ST2, ST3, WC, WF, WFA, WH, WHA.

If the Rectifier Regulation Characteristic according to FMOD=0.

If IN ≤ I0	FEX= F0A
If I0 <IN ≤ I1	FEX= F1A-F1B · IN
If I1 <IN ≤ I2	FEX=-F2A · (IN+F2B)^2+F2C
If I2 <IN ≤ I3	FEX= F3A-F3B · IN
If IN > I3	FEX= F4A

If the Rectifier Regulation Characteristic according to FMOD=1.

If IN ≤ I0	FEX= F0A
If I0 <IN ≤ I1	FEX= F1A-F1B · IN
If I1 <IN ≤ I2	$FEX = \sqrt{F2A - F2B \cdot IN^2}$
If I2 <IN ≤ I3	FEX= F3A · (F3B - IN)
If IN > I3	FEX= F4A

Default values for Rectifier Regulation Characteristic

	FMOD=0	FMOD=1
I0	= 0	= 0
I1	= 0.51	= 0.433
I2	= 0.715	= 0.75
I3	= 1.0	= 1.0
F0A	= 0	= 0
F1A	= 1	= 1
F1B	= 0.58	= 0.577
F2A	= 0.865	= 0.75
F2B	= 0.00826	= 1.0
F2C	= 0.9233	not applicable
F3A	= 1.68	= 1.732
F3B	= 1.714	= 1.
F4A	= 0	= 0

Inputs <<enumeration>> of EXCITERS, STEREOTYPE <<enum>>

Type of connection for the UEL input used in ExcIEEEST1A

0	Ignore UEL signal	<<enum>> ignoreUELsignal
1	UEL input added to error signal	<<enum>> inputAddedToErrorSignal
2	UEL input HV gate with error si gnal	<<enum>> inputHVgateErrorSignal
3	UEL input HV gate with voltage regulator output	<<enum>> inputHVgateVoltageOutput

Type of rate feedback signals used in REXSYS

0	The exciter field current is used	<<enum>> fieldCurrent
1	The voltage regulator output voltage is used. It is the same as exciter field voltage	<<enum>> filedVoltage
2	The output voltage of the exciter is used	<<enum>> outputVoltage

Type of connection for the OEL input used for static excitation systems type 6B

0	No OEL input is used	<<enum>> noOELinput
1	The connection is before UEL	<<enum>> beforeUEL
2	The connection is after UEL	<<enum>> afterUEL

Type of connection for the OEL input used for static excitation systems type 7B

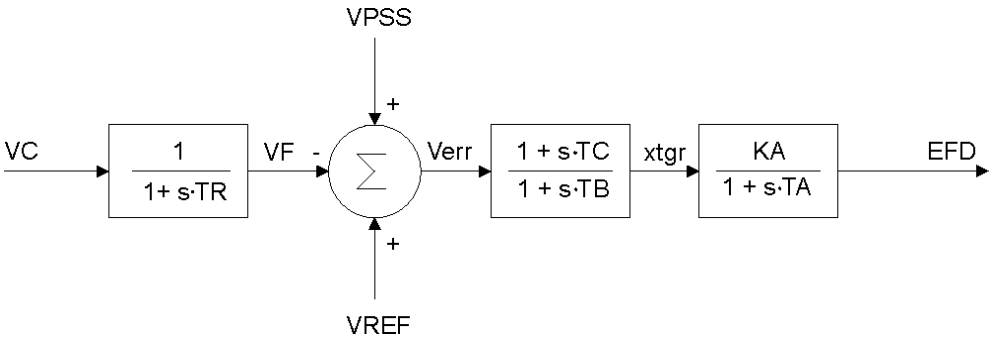
0	No OEL input is used	<<enum>> noOELinput
1	The signal is added to Vref	<<enum>> addVref
2	The signal is connected in the input of the LV gate	<<enum>> inputLVgate
3	The signal is connected in the output of the LV gate	<<enum>> outputLVgate

Type of connection for the UEL input used for static excitation systems type 7B

0	No UEL input is used	<<enum>> noUELinput
1	The signal is added to Vref	<<enum>> addVref
2	The signal is connected in the input of the HV gate	<<enum>> inputHVgate
3	The signal is connected in the output of the HV gate	<<enum>> outputHVgate

EXCITER Simple

Simple AVR



Parameters

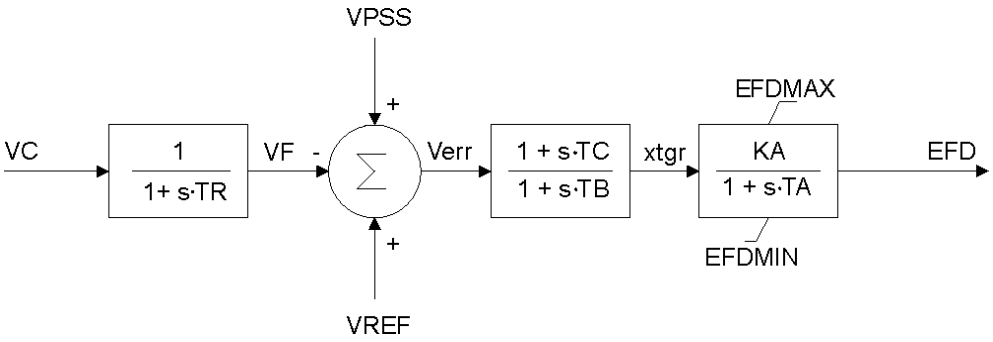
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER Simple with Limits

Simple AVR with EFD limit



Parameters

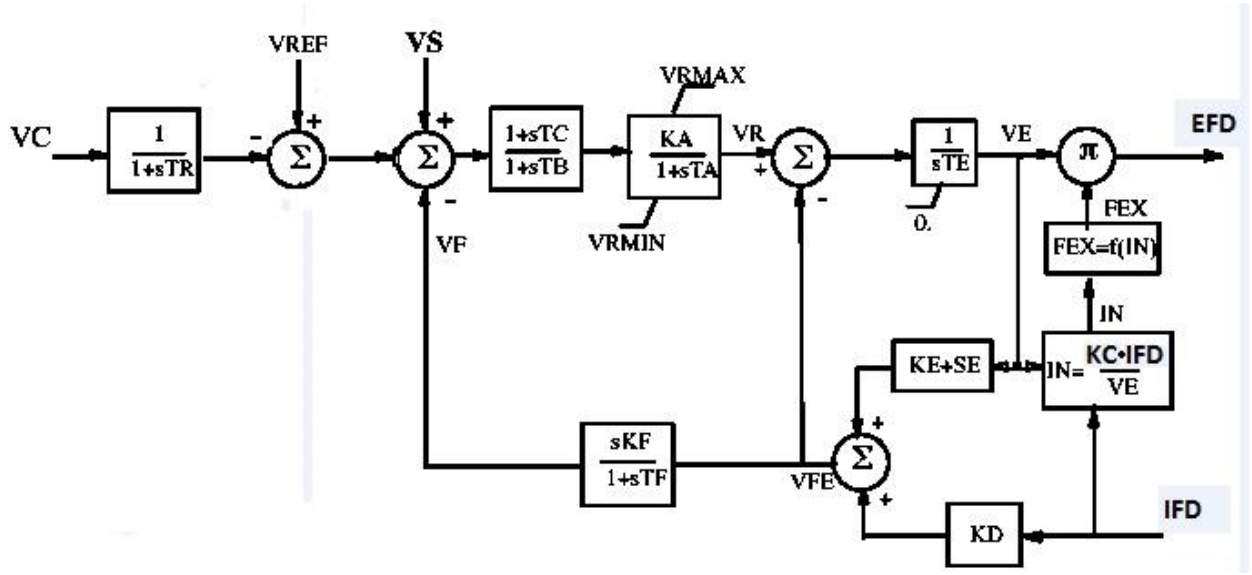
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
EFDMAX	pu	Minimum voltage regulator output
EFDMIN	pu	Minimum voltage regulator output

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER AC1

IEEE Type AC1 Excitation System model 1981



Parameters

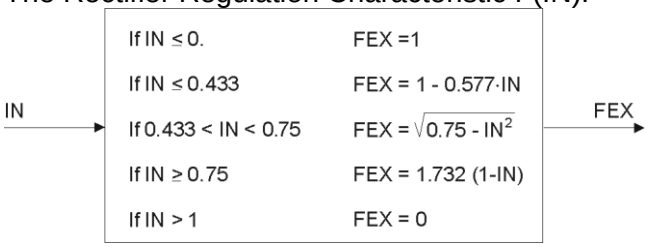
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
VRMAX	pu	Minimum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.49	0.02 < TE < 2
0 < TB < 19.99	0 < KF ≤ 0.3
0 < TC < 19.99	0.02 < TF < 1.5
0 < KA < 999.99	0 ≤ KC ≤ 1
0 < TA < 9.99	0 ≤ KD ≤ 1
0 < VAMAX ≤ 15	0 < KE ≤ 1
0 ≤ E1	0 ≤ SE(E1) < 1
-15 ≤ VRMIN < -0.01	E1 < E2
0 < VRMAX ≤ 15.0	
SE(E1) < SE (E2)	

Notes

The Rectifier Regulation Characteristic F(IN):

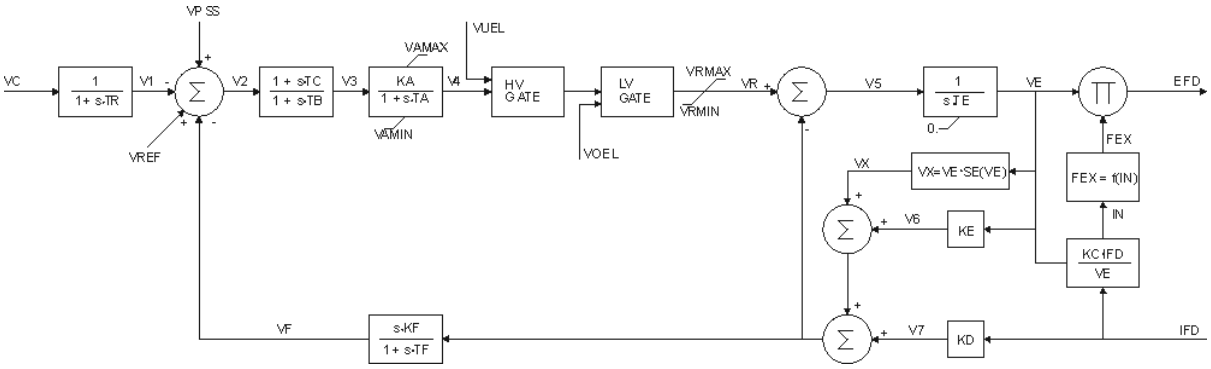


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER AC1A

IEEE Type AC1A Excitation System



Parameters

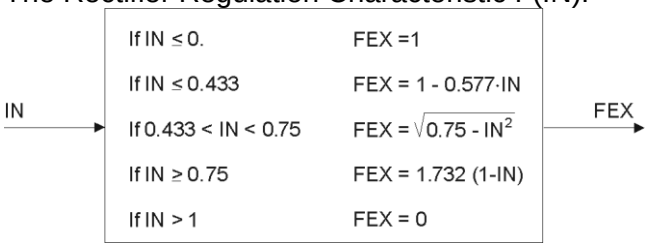
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
VAMAX	pu	Minimum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs

Parameters Range:

0 < TR < 0.5	0.02 < TE < 2
0 < TB < 20	0< KF ≤ 0.3
0 < TC < 20	0.02 < TF < 1.5
0 < KA < 1000	0 ≤ KC ≤ 1
0 < TA < 10.0	0 ≤ KD ≤ 1
0 < VAMAX ≤ 15	0 < KE ≤ 1
-15 ≤ VAMIN < 0	0 ≤ E1
-10 ≤ VRMIN < 0	0 ≤ SE(E1) < 1
0 < VRMAX ≤ 10.0	E1 < E2
	SE(E1) < SE (E2)

Notes

The Rectifier Regulation Characteristic F(IN):

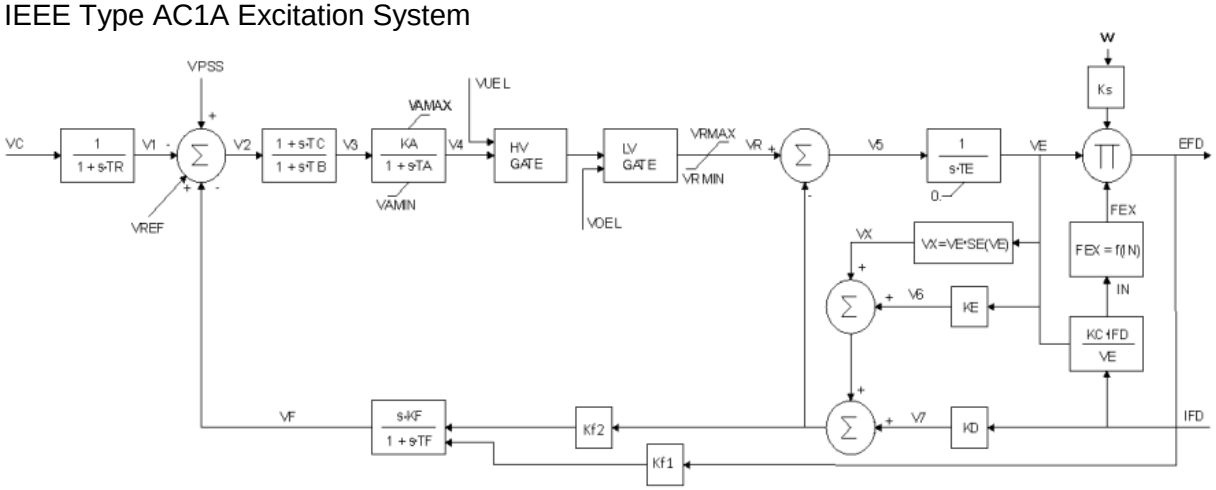


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcIEEEAC1A

EXCITER AC1A CIM/CGMES

IEEE Type AC1A Excitation System



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
VAMAX	pu	Minimum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
KF1	pu	Coefficient to allow different usage of the model. Typical Value = 0

KF2	pu	Coefficient to allow different usage of the model. Typical Value = 1
HVLVGATES	Boolean	Indicates if both HV gate and LV gate are active (HVLVgates). true = gates are used false = gates are not used.Typical Value = true.

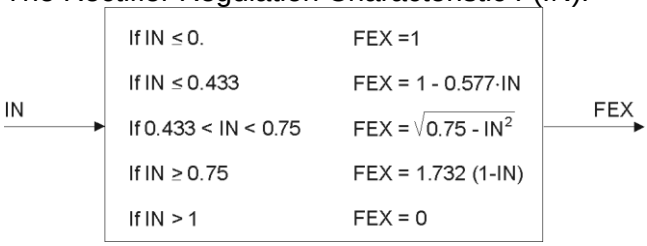
Parameters Range:

0 < TR < 0.5
0 < TB < 20
0 < TC < 20
0 < KA < 1000
0 < TA < 10.0
0 < VAMAX ≤ 15
-15 ≤ VAMIN < 0
-10 ≤ VRMIN < 0
0 < VRMAX ≤ 10.0

0.02 < TE < 2
0 < KF ≤ 0.3
0.02 < TF < 1.5
0 ≤ KC ≤ 1
0 ≤ KD ≤ 1
0 < KE ≤ 1
0 ≤ E1
0 ≤ SE(E1) < 1
E1 < E2
SE(E1) < SE (E2)

Notes

The Rectifier Regulation Characteristic F(IN):

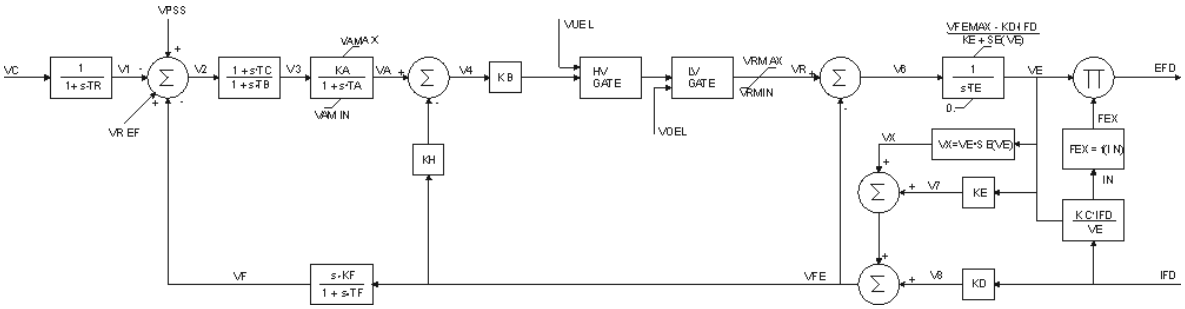


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- EXAC1A

EXCITER AC2A

IEEE Type AC2A Excitation System



Parameters

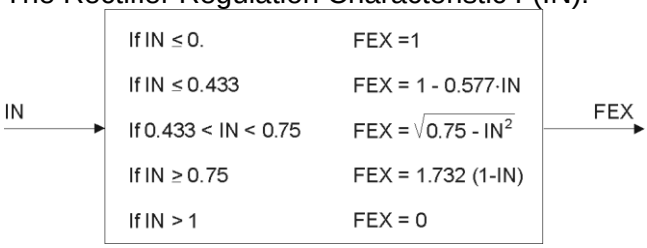
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
VAMAX	pu	Minimum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
KB	pu	Second stage regulator gain
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VFEMAX	pu	Exciter field current limit reference
KH	pu	Exciter field current feedback gain
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5	0.02 < TE < 2
0 < TB < 20	0 < KF ≤ 0.3
0 < TC < 20	0.02 < TF < 1.5
0 < KA < 1000	0 ≤ KC ≤ 1
0 < TA < 10.0	0 ≤ KD ≤ 1
0 < VAMAX ≤ 10	0 < KE ≤ 1
-10 ≤ VAMIN < 0	0 ≤ E1
-500 ≤ VRMIN < 0	0 ≤ SE(E1) < 1
0 < VRMAX ≤ 500	E1 < E2
0 < KB ≤ 500	SE(E1) < SE (E2)
0 ≤ KH ≤ 1.1	- 5 < VFEMAX ≤ 20

Notes

The Rectifier Regulation Characteristic F(IN):

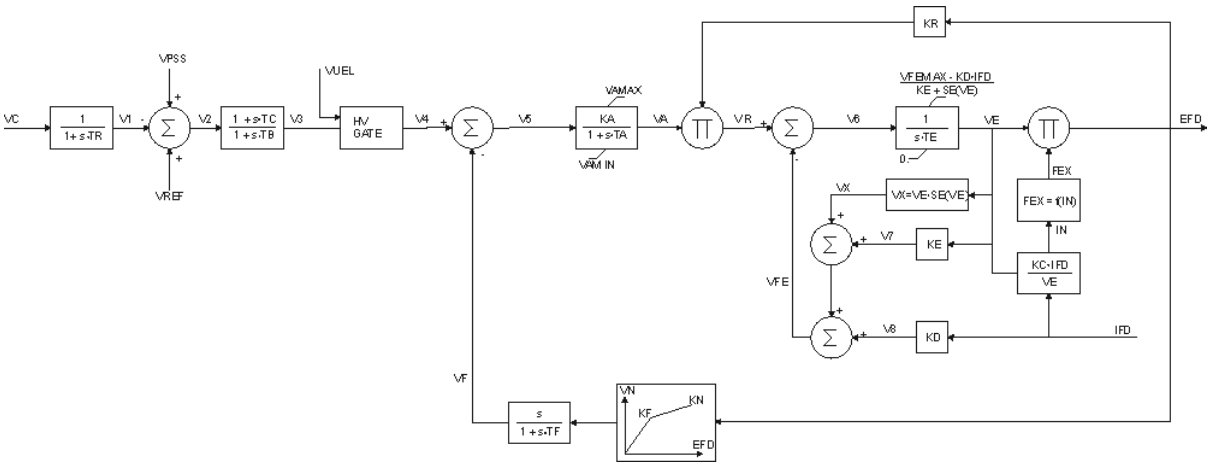


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcIEEEAC2A

EXCITER AC3A

IEEE Type AC3A Excitation System



Parameters

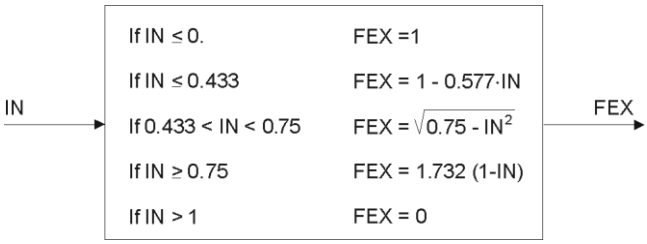
NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Maximum voltage regulator output
VAMAX	pu	Minimum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VFEMIN	pu	Minimum exciter voltage output
KR	pu	Constant associated with regulator and alternator field power supply
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KN	pu	Excitation control system stabilizer gain
EFDN	pu	Value of EFD at which feedback gain changes
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5	0.02 < TE < 4
0 < TB < 20	0 < KF ≤ 0.3
0 < TC < 20	0.02 < TF < 1.5
0 < KA < 1000	0 ≤ KC ≤ 1
0 < TA < 10.0	0 ≤ KD ≤ 1
0 < VAMAX ≤ 10	0 < KE ≤ 1
-10 ≤ VAMIN < 0	0 ≤ E1
-10 ≤ VRMIN < 0	0 ≤ SE(E1) < 1
0 < VRMAX ≤ 10	E1 < E2
0 ≤ KR < 75	SE(E1) < SE (E2)
0 ≤ KN < 0.3	- 5 < VFEMAX ≤ 20

Notes

The Rectifier Regulation Characteristic F(IN):

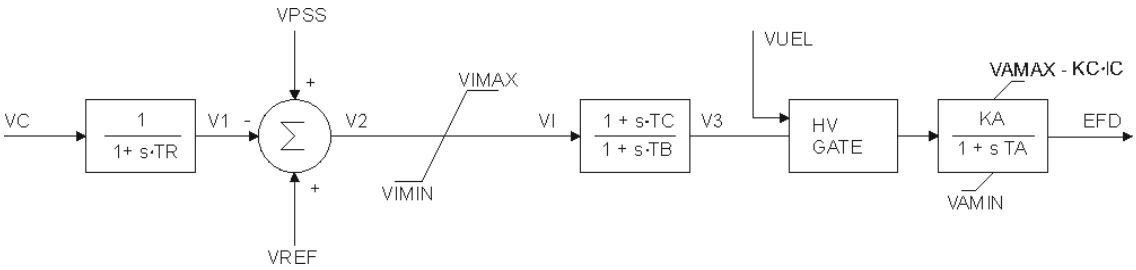


Saturation:
See the paragraph Saturation in exciter.

Equivalent model in CIM/CGMES:
- ExcIEEEAC3A

EXCITER AC4A

IEEE Type AC4A Excitation System



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	pu	Maximum voltage regulator input limit
VIMIN	pu	Minimum voltage regulator input limit
TC	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KC	pu	Rectifier loading factor proportional to commutating reactance

Parameters Range:

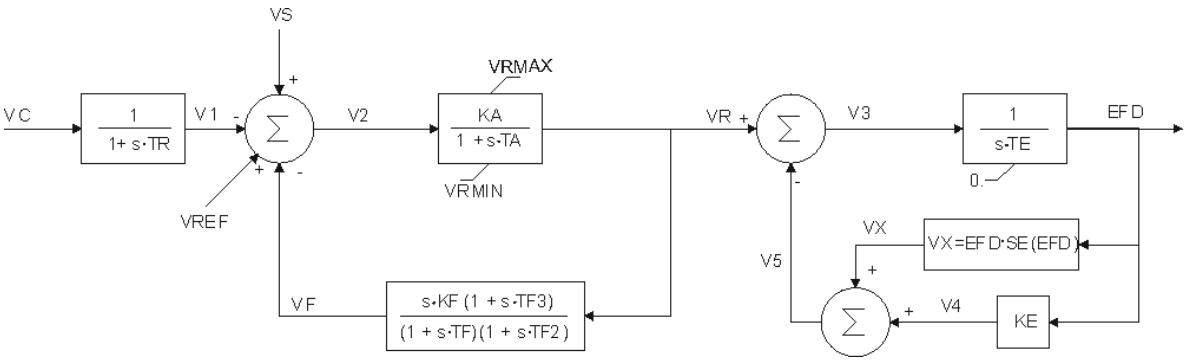
$0 < TR < 0.1$
$0 < VIMAX \leq 0.2$
$-0.2 < VIMIN \leq 0$
$0 < TC < 10.0$
$0.04 < TB < 20$
$50 < KA \leq 1000$
$0 < TA < 0.5$
$5 \leq KA \times TC/TB \leq 15$
$3 \leq VAMAX \leq 8$
$-8 < VAMIN \leq -3$

Notes

Equivalent model in CIM/CGMES:
- ExcIEEEAC4A

EXCITER AC5A

IEEE Type AC5A Excitation System



VS = VPSS+VUEL+VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF1	Seconds	Excitation control system stabilizer time constant
TF2	Seconds	Excitation control system stabilizer time constant
TF3	Seconds	Excitation control system stabilizer time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5
10 < KA < 500
0 < TA < 1.0
0.5 < VRMAX < 10.0
-10 < VRMIN < 0
0.04 < TE < 1.0

E1 < E2
0 ≤ SE(E1) < 1.0
SE(E1) < SE(E2)
5.0 ≤ TF/KF ≤ 15.0
0 < KF < 0.3
0.04 < TF1 < 1.5

$-1.0 \leq KE \leq 1.0$ $0 < TF2$

$0 \leq E1$ $0 < TF3$

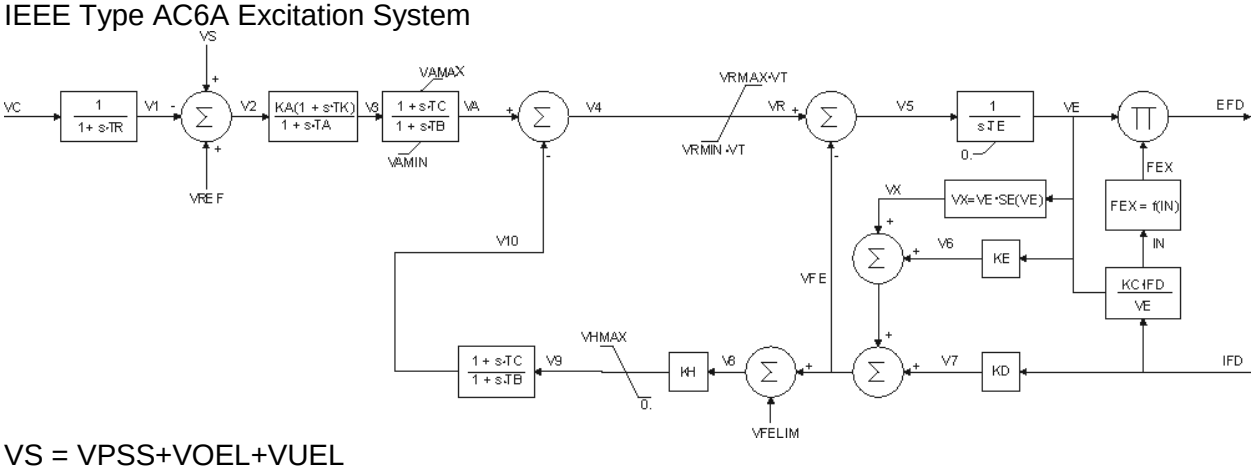
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcIEEEAC5A

EXCITER AC6A

IEEE Type AC6A Excitation System



VS = VPSS+VOEL+VUEL

Parameters

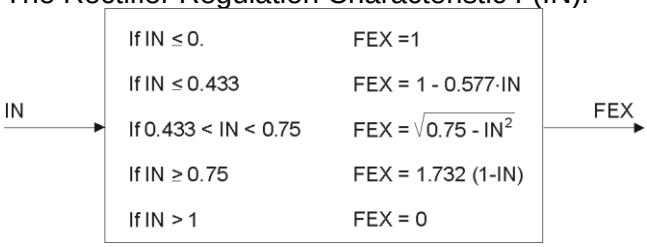
NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TK	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VAMAX	pu	Maximum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VFELIM	pu	Exciter field current limit reference
KH	pu	Exciter field current limiter gain
VHMAX	pu	Maximum field current limiter signal reference
TH	Seconds	Exciter field current limiter time constant
TJ	Seconds	Exciter field current limiter time constant
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5	0.02 < TE < 2
0 < TB < 20	0 < KF ≤ 0.3
0 < TC < 20	0.02 < TF < 1.5
0 < KA < 1000	0 ≤ KC ≤ 1
0 < TA < 10.0	0 ≤ KD ≤ 2
0 < VAMAX ≤ 10	0 < KE ≤ 2
-10 ≤ VAMIN < 0	0 ≤ E1
-100 ≤ VRMIN < 0	0 ≤ SE(E1) < 1
0 < VRMAX ≤ 100	E1 < E2
0 < TK < 10	SE(E1) < SE (E2)
0 < VFELIM ≤ 20	0 < TH ≤ 1
0 < KH ≤ 100	0 < TJ ≤ 1
0 < VHMAX ≤ 100	

Notes

The Rectifier Regulation Characteristic F(IN):

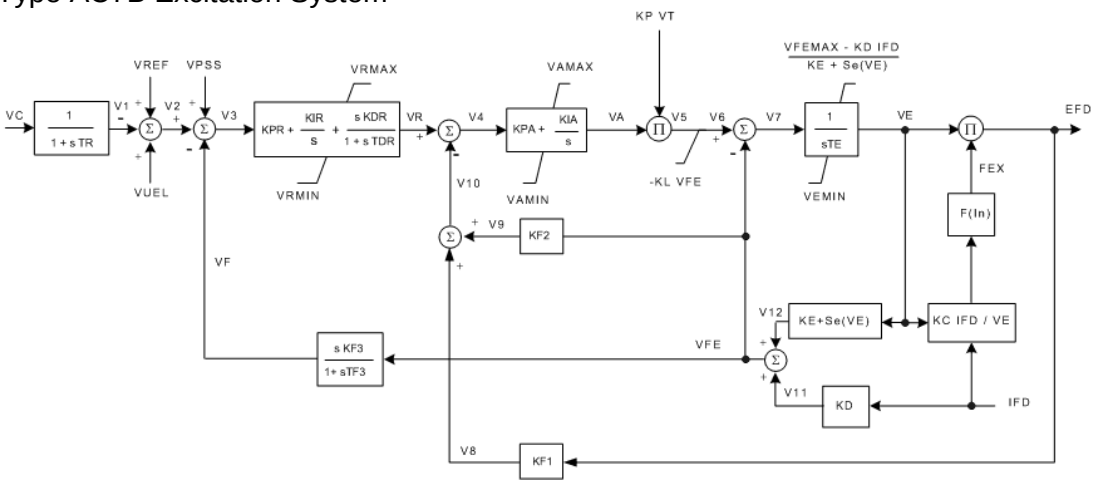


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcIEEEAC6A

EXCITER AC7B

IEEE Type AC7B Excitation System



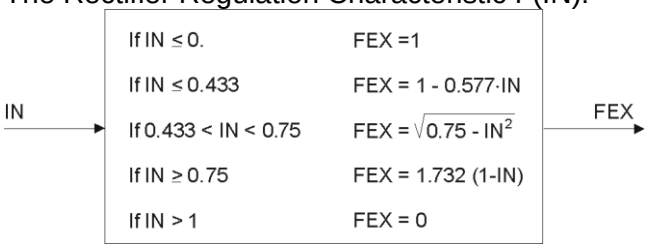
Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KPR	pu	Voltage regulator proportional gain
KIR	pu	Voltage regulator integral gain
KDR	pu	Voltage regulator derivative gain
TDR	Seconds	Lag time constant
VRMIN	pu	Maximum voltage regulator output
VRMAX	pu	Minimum voltage regulator output
KPA	pu	Voltage regulator proportional gain
KIA	pu	Voltage regulator integral gain
VAMIN	pu	Maximum voltage regulator output
VAMAX	pu	Minimum voltage regulator output
KP	pu	Potential circuit gain coefficient
KL	pu	Exciter field voltage lower limit parameter
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
KF1	pu	Excitation control system stabilizer gain
KF2	pu	Excitation control system stabilizer gain
KF3	pu	Excitation control system stabilizer gain
TF3	Seconds	Excitation control system stabilizer time constant
VEMIN	pu	Minimum exciter voltage output
VFEMAX	pu	Exciter field current limit reference
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter

		voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

The Rectifier Regulation Characteristic F(IN):



Saturation:
See the paragraph Saturation in exciter controller.

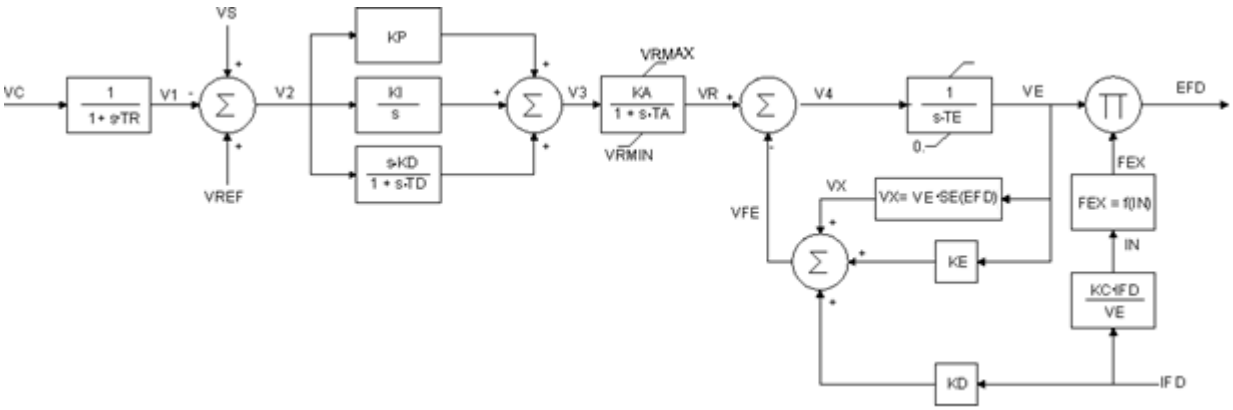
Equivalent model in CIM/CGMES:
- ExcIEEEAC7B

EXCITER - AC8B

For this exciter, please take in consideration the information about the below model ACB8 version 2005.

EXCITER - AC8B 2005

The class represents IEEE Std 421.5-2005 type AC8B model.



VS = VPSS+VUEL+VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KPR	pu	Voltage regulator proportional gain
KIR	pu	Voltage regulator integral gain
KDR	pu	Voltage regulator derivative gain
TDR	pu	Lag time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

VFEMAX	pu	Exciter field current limit reference
VEMIN	pu	Minimum exciter voltage output

Parameters Range:

0 < TR < 0.5
10 < KP < 500
10 < KI < 500
10 < KD < 500
0 < TD < 0.5
0 < KA ≤ 1
0 < TA ≤ 1
0 < VRMAX ≤ 10
–1 < VRMIN < 1.5
0 < TE
–1 ≤ KE ≤ 1
0 ≤ E1
0 ≤ SE(E1) < 1.0
E1 < E2
SE(E1) < SE(E2)

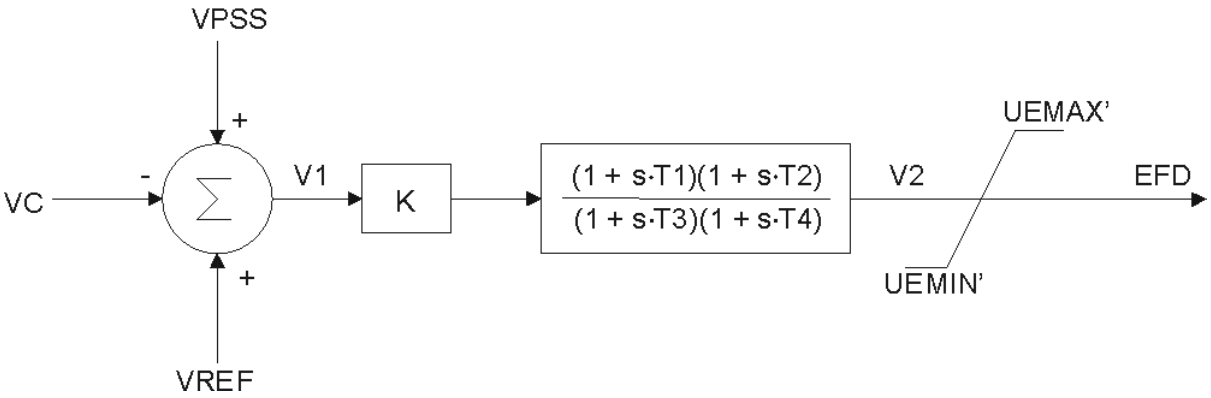
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcIEEEAC8B

EXCITER – BBC1

Excitation system with potential source controlled rectifier exciter.



Parameters

NAME	Type	Description
SWPS	Boolean	If the Switch control is false: UEMAX' = UEMAX * VT UEMIN' = UEMIN * VT else: UEMAX' = UEMAX UEMIN' = UEMIN
K	PU	Gain
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
T4	Seconds	Time constant
UEMAX	PU	Maximum limit
UEMIN	PU	Minimum limit

Notes

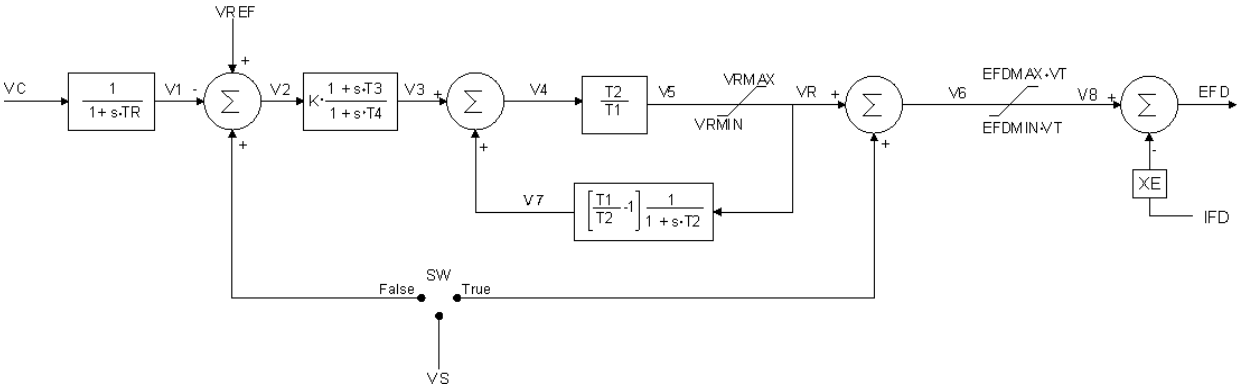
Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – BBC1 Simple

This excitation system is such as EXCITER – BBC1 but without potential source controlled rectifier exciter (SWPS).

EXCITER - BBSEX1

Brown Boveri Static Exciter



VS = VPSS + VOEL +VUEL

Parameters

NAME	Type	Description
SW	Boolean	Supplementary signal routing switch –selector (see block diagram) 0 = VS signal will be add to the output signal 1 = VS signal will be add to the error signal
TF	PU	Filter time constant
T3	Seconds	Lead/lag time constant
T4	Seconds	Lead/lag time constant
K	PU	Steady state gain
T1	Seconds	Controller time constant
T2	Seconds	Controller time constant
VRMIN	PU	Minimum control element output
VRMAX	PU	Maximum control element output
EFDMIN	PU	Minimum open circuit exciter voltage
EFDMAX	PU	Maximum open circuit exciter voltage

Parameters Range:

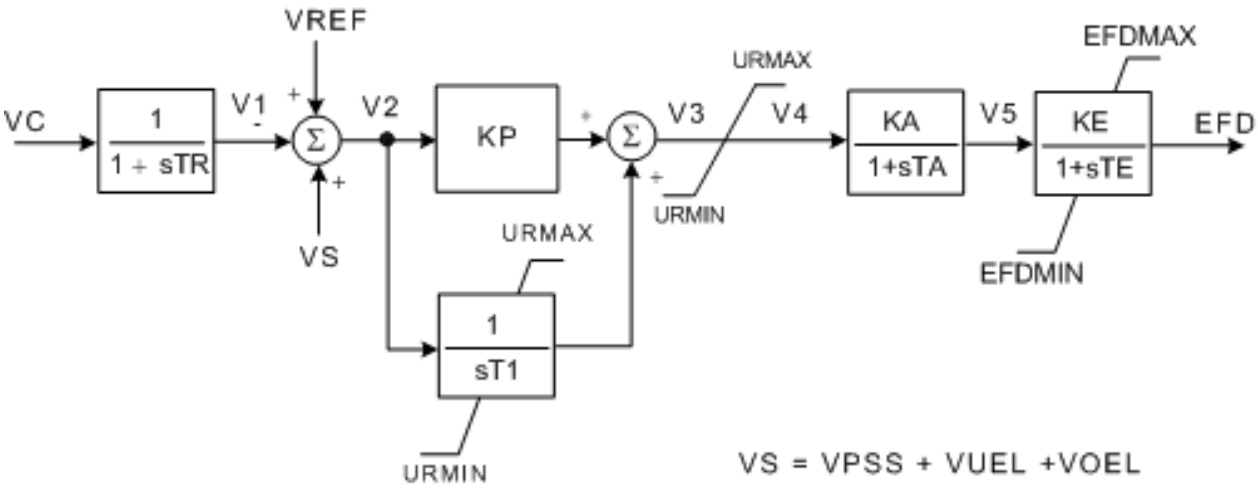
0 < TF < 0.5	0 < T4
10 < K < 500	T4 = 0 and T3 < 0
0.02 <T1 <10	0.5 < VRMAX < 10
0.02 <T2 <10	-10 < VRMIN < 0
0 < T3	0.5 ≤ K × T2/T1 ≤ 25

Notes

Equivalent model in CIM/CGMES:
- ExcBBC

EXCITER - BUDCZT

Czech Proportion/Integral Exciter.



Parameters

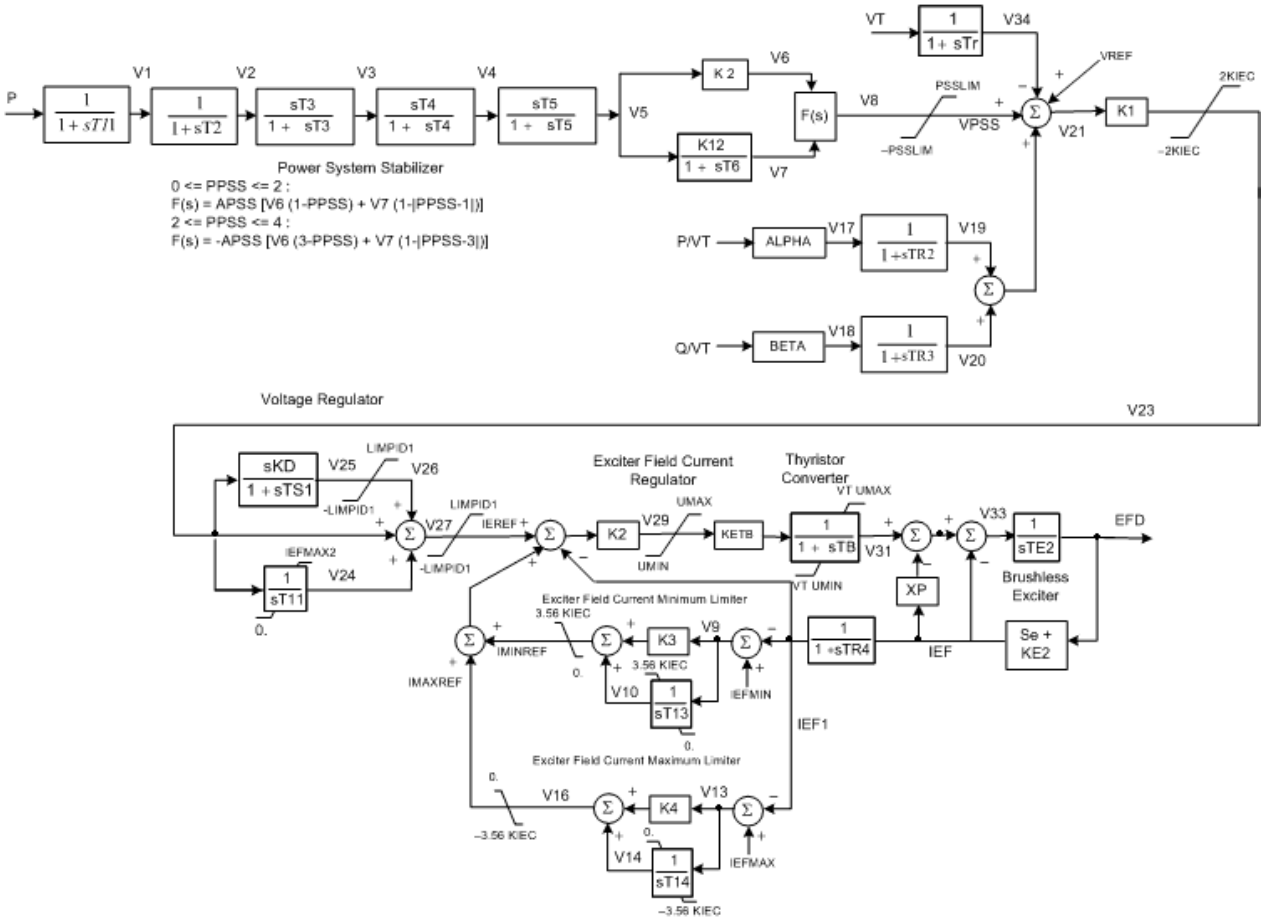
NAME	Type	Description
TR	Seconds	Filter time constant
KP	PU	Regulator proportional gain
KE	PU	Exciter constant related to self-excited field
TI	Seconds	Regulator integral time constant
KA	PU	Regulator gain
TA	Seconds	Regulator time constant
TE	Seconds	Exciter time constant, integration rate associated with exciter control
URMIN	PU	Voltage regulator minimum limit
URMAX	PU	Voltage regulator maximum limit
EFDMIN	PU	Exciter output minimum limit
EFDMAX	PU	Exciter output maximum limit

Notes

Equivalent model in CIM/CGMES:
- ExcCZ

EXCITER - CELIN

Detailed Excitation System Model - 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



Parameters

NAME	Type	Description
TR1	Seconds	Filter time constant
TR2	Seconds	Time constant
TR3	Seconds	Time constant
TR4	Seconds	Time constant
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
T4	Seconds	Time constant
T5	Seconds	Time constant
T6	Seconds	Time constant

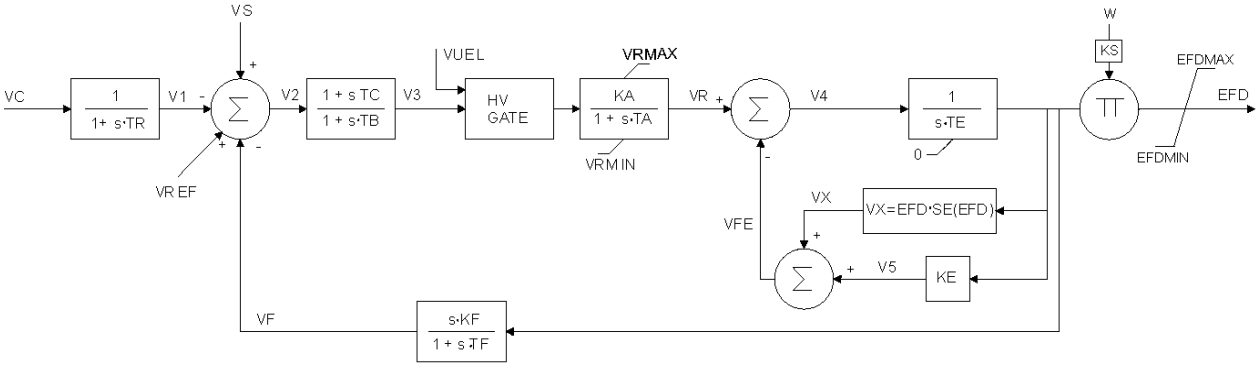
ALPHA	PU	Gain
BETA	PU	Gain
TE2	Seconds	Time Constant
NLFEFD	PU	Gain
KE2	PU	Gain
K12	PU	Gain
K2	PU	Gain
PPSS	PU	Coeficient
APSS	PU	Coeficient
PSSLIM	PU	PSS limiter
K1	PU	Voltage regulator input gain
KIEC	PU	Voltage regulator input limit
KD1	PU	Voltage controller derivative gain
TB1	Seconds	Voltage controller derivative washout time constant
T11	PU	Controller follow up dead band
LIMPID1	PU	Controller follow up gain
K22	PU	Gain
UMAX	PU	Limiter
UMIN	PU	Limiter
KETB	PU	Gain
TE	Seconds	Time constant
XP	PU	Excitation transformer effective reactance
IEFMAX2	PU	Limiter
IEFMIN	PU	Limiter
IEFMAX1	PU	Minimum open circuit excitation voltage
T13	Seconds	Time constant
T14	Seconds	Time constant
K3	PU	Gain
K4	PU	Gain
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES Model

EXCITER - DC1A

IEEE Type DC1A Excitation System



VS = VPSS+VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0 \leq TR < 0.5$
$10 < KA < 500$
$0 \leq TA < 1$
$0.5 < VRMAX < 10$
$-10 < VRMIN < 0$
$-1 \leq KE \leq 1$
$0.04 < TE < 1$
$0 < KF < 0.3$
$0.04 < TF < 1.5$
$5 \leq TF/KF \leq 15$

Notes

1) If VRMAX is zero, the model will compute a new value of it.
- If KE is zero or negative, VRMAX will just allow the exciter to reach an output voltage of E2 i.e.: VRMAX = SE(E2) × E2
- If KE is positive, VRMAX will just allow the exciter to reach an output voltage of E2 with the specified value of KE, i.e.: VRMAX = (SE (E2) + KE) × E2 In either case above, VRMIN is then set to –VRMAX.

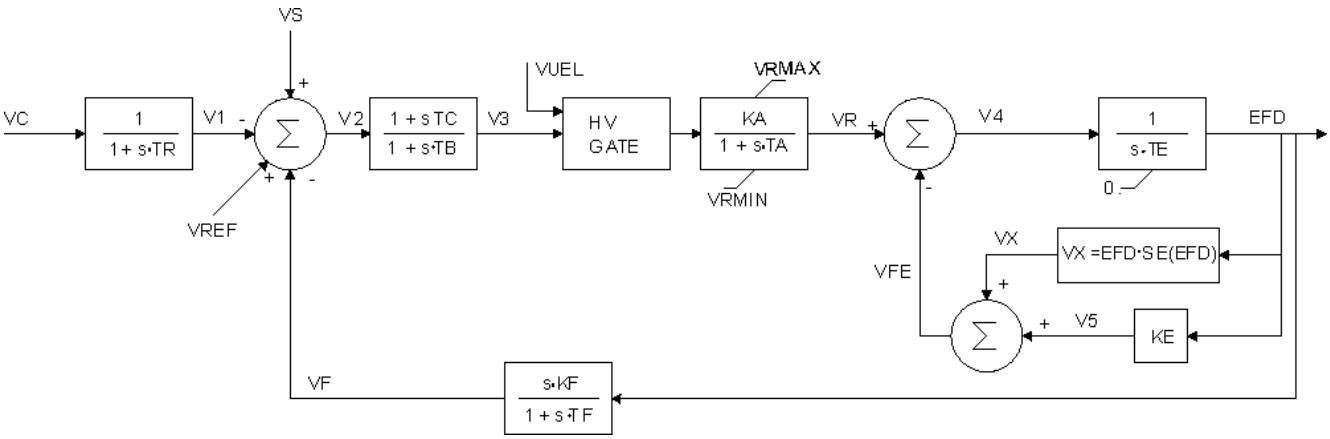
2) If KE is zero, the model will set a new value of KE.
KE is set to the value that will require a voltage regulator output of (VRMAX /10) to maintain the present value of excitation voltage, UF, i.e.: KE = VRMAX/(10*EFD) – SE(EFD)

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcDC1A

EXCITER - DC1A 2005

IEEE Type DC1A Excitation System, version 2005



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
UELIN	Boolean	UEL input 1 = VUEL input added to HV Gate. 2 = VUEL input added to error signal.
EXCLIM	Boolean	IEEE standard is ambiguous about lower limit on exciter output. 0 = no lower limit to the exciter output Else = Aplly the lower limit of 0.0 to the exciter output

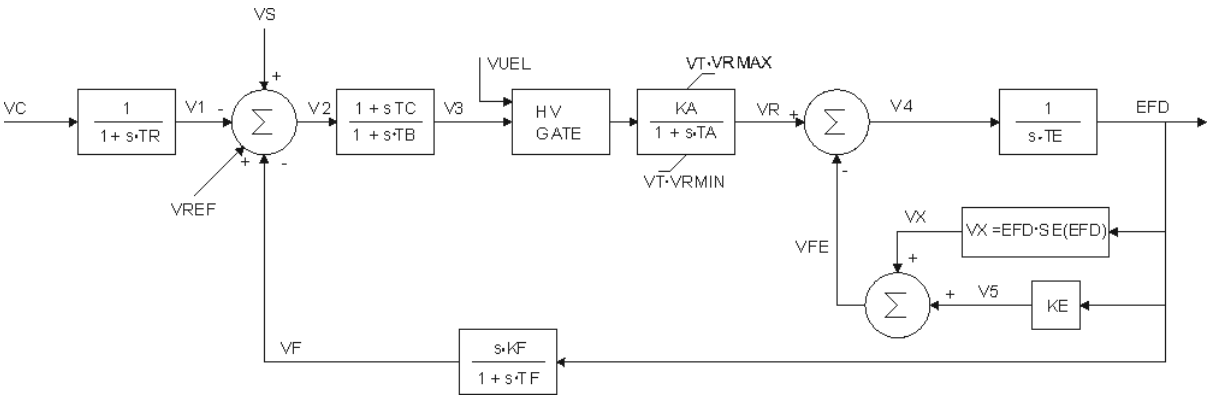
Notes

Same remarks as the DC1A model

Equivalent model in CIM/CGMES:
- ExcIEEEDC1A

EXCITER - DC2A

IEEE Type DC2A Excitation System



VS = VPSS+VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	pu	Exciter time constant, integration rate associated with exciter control
TE	Seconds	Excitation control system stabilizer gain
KF	pu	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0 \le TR < 0.5$
$10 < KA < 500$
$0 \le TA < 1.0$
$0 \le TB$
$0 \le TC$
$0 < KF < 0.3$
$0.04 < TE < 2.0$
$-1.0 \le KE \le 1.0$
$0 \le E1$
$E1 < E2$

0.5 < VRMAX < 10.0
-10 < VRMIN < 0 .
5.0 ≤ TF/KF ≤ 15.0

0 ≤ SE(E1) < 1.0
SE(E1) < SE(E2)

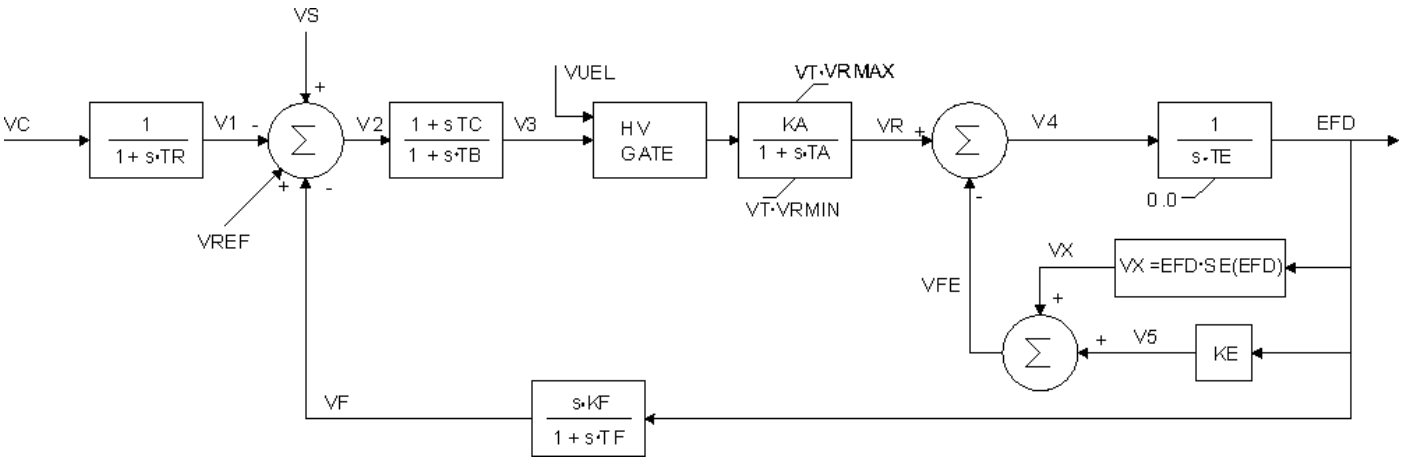
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - DC2A 2005

IEEE Type DC2A Excitation System, version 2005



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	Pu	Exciter time constant, integration rate associated with exciter control
TE	Seconds	Excitation control system stabilizer gain
KF	pu	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
UELIN	Boolean	UEL input 1 = VUEL input added to HV Gate. 2 = VUEL input added to error signal.
EXCLIM	Boolean	IEEE standard is ambiguous about lower limit on exciter output. 0 = no lower limit to the exciter output Else = Aplly the lower limit of 0.0 to the exciter output

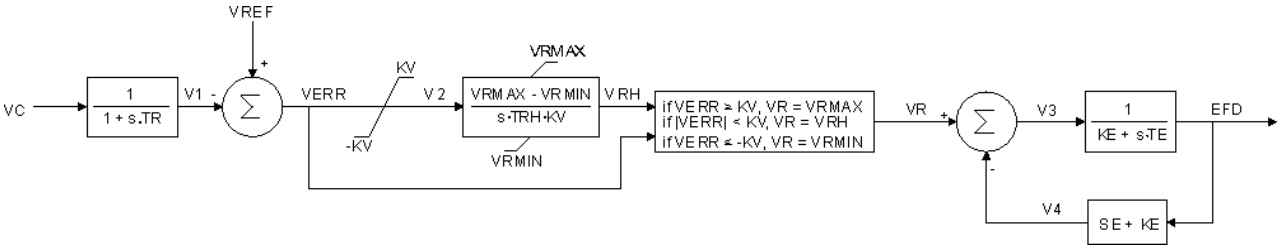
Notes

Same remarks as the DC2A model

Equivalent model in CIM/CGMES:
- ExcIEEEDC2A

EXCITER – DC3A

IEEE Type DC3A Excitation System



Parameters

NAME	Type	Description
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KV	pu	Fast raise/lower contact setting
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
TRH	Seconds	Rheostat travel time
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

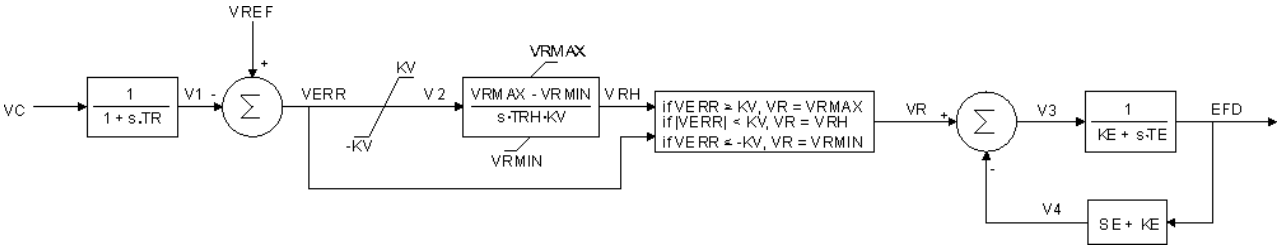
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – DC3A 2005

IEEE Type DC3A Excitation System, version 2005



Parameters

NAME	Type	Description
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KV	pu	Fast raise/lower contact setting
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
TRH	Seconds	Rheostat travel time
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
EXCLIM	Boolean	IEEE standard is ambiguous about lower limit on exciter output 0 = no lower limit to the exciter output Else = Aplly the lower limit of 0.0 to the exciter output

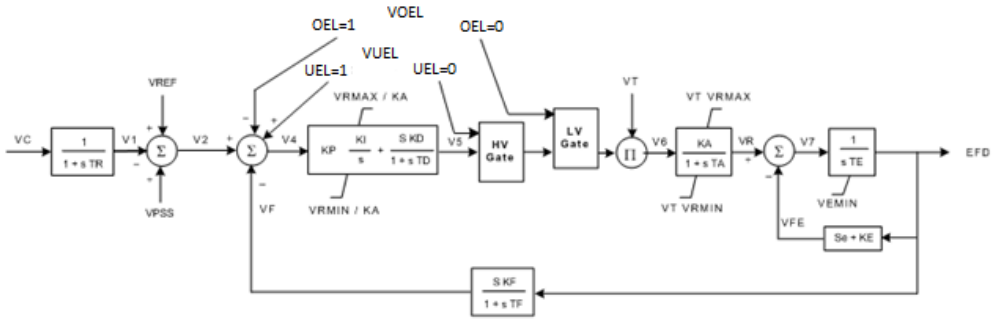
Notes

Same remarks as the DC3A model

Equivalent model in CIM/CGMES:
- ExcIEEEDC3A

EXCITER – DC4B

IEEE Type DC4B Excitation System.



Parameters

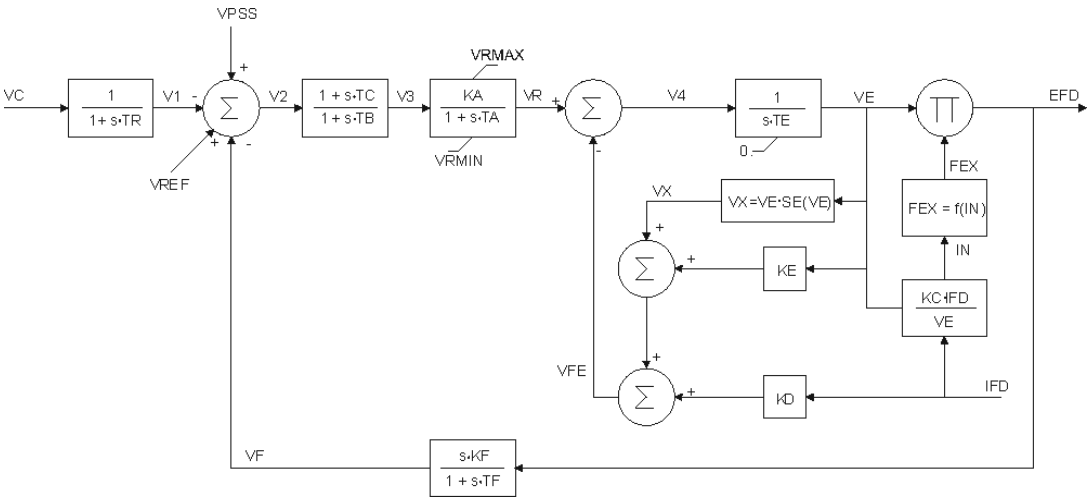
NAME	Type	Description
TR	Seconds	Filter time constant
KP	pu	Regulator proportional gain
KI	pu	Regulator integral gain
KD	pu	Regulator derivative gain
TD	Seconds	Regulator derivative filter time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
KE	pu	Exciter time constant, integration rate associated with exciter control
TE	Seconds	Seconds
KF	pu	Excitation control system stabilizer gain
TF	Seconds	Seconds
VEMIN	pu	Minimum exciter voltage output
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
OEL	Boolean	OEL input, 0 = VOEL input added to LV Gate. 1 = VOEL input added to error signal.
UEL	Boolean	UEL input, 0 = VUEL input added to HV Gate. 1 = VUEL input added to error signal.

Notes

Equivalent model in CIM/CGMES:
- ExcIEEEDC4B

EXCITER - EXAC1A

IEEE Modified Type AC1 Excitation System model.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	PU	Rectifier loading factor proportional to commutating reactance
KD	PU	Demagnetizing factor, a function of exciter alternator reactances
KE	PU	Exciter constant related to self-excited field
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

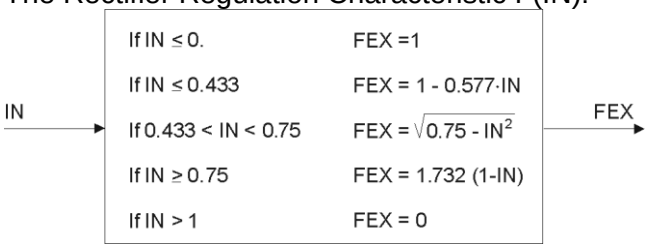
0 < TR < 0.5	0.02 < TE < 2
0 < TB < 20	0 < KF ≤ 0.3
0 < TC < 20	0.02 < TF < 1.5
0 < KA < 1000	0 ≤ KC ≤ 1
0 < TA < 10.0	0 ≤ KD ≤ 1
0 < VAMAX ≤ 15	0 < KE ≤ 1
-15 ≤ VAMIN < 0	0 ≤ E1
-10 ≤ VRMIN < 0	0 ≤ SE(E1) < 1
0 < VRMAX ≤ 10	

Notes

1) If VRMAX is zero, the model will compute a new value of it. If KE is zero or negative, VRMAX will just allow the exciter to reach an output voltage of E2 i.e.:
VRMAX = SE(E2) × E2. If KE is positive, VRMAX will just allow the exciter to reach an output voltage of E2 with the specified value of KE, i.e.: VRMAX = (SE (E2) + KE) × E2 In either case above, VRMIN is then set to –VRMAX.

2) If KE is zero, the model will set a new value of KE. KE is set to the value that will require a voltage regulator output of (VRMAX / 10) to maintain the present value of excitation voltage, UF, i.e.: KE = VRMAX / (10*EFD) – SE(EFD).

The Rectifier Regulation Characteristic F(IN):

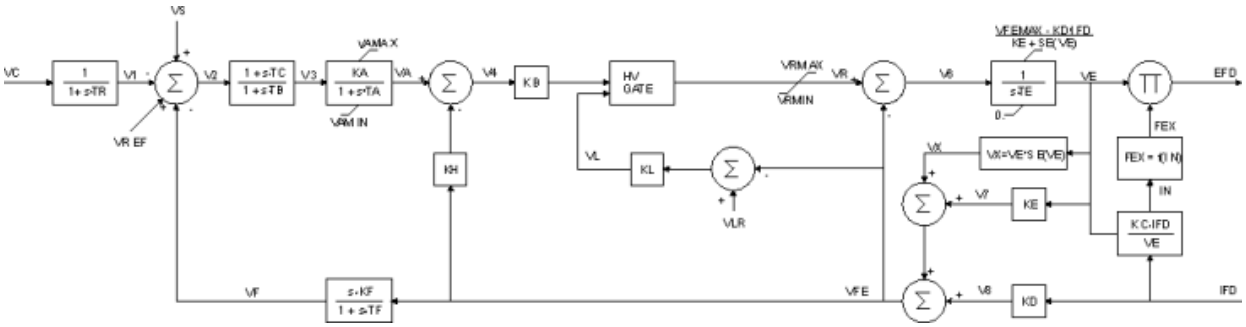


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC1A

EXCITER – EXAC2

IEEE Modified Type AC2A Excitation System model.



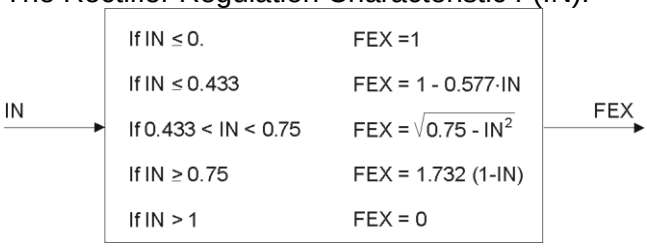
VS = VPSS+VUEL+VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	PU	Maximum voltage regulator outputs
VAMIN	PU	Minimum voltage regulator outputs
KB	PU	Second stage regulator gain
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VFEMAX	PU	Exciter field current limit reference
KH	PU	Exciter field current feedback gain
VLR	PU	Maximum exciter field current
KL	PU	Exciter field current limiter gain
KF	PU	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	PU	Rectifier loading factor proportional to commutating reactance
KD	PU	Demagnetizing factor, a function of exciter alternator reactances
KE	PU	Exciter constant related to self-excited field
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

The Rectifier Regulation Characteristic F(IN):

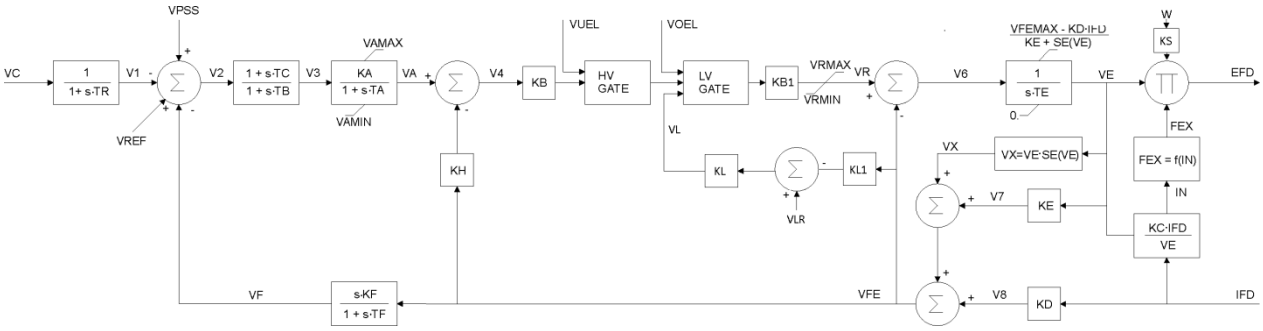


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – EXAC2A

IEEE Modified Type AC2A Excitation System model.



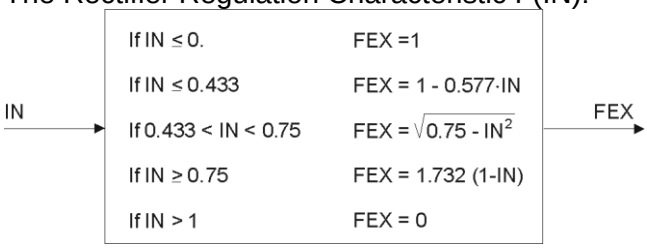
Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	PU	Maximum voltage regulator outputs
VAMIN	PU	Minimum voltage regulator outputs
KB	PU	Second stage regulator gain
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VFEMAX	PU	Exciter field current limit reference
KH	PU	Exciter field current feedback gain
VLR	PU	Maximum exciter field current
KL	PU	Exciter field current limiter gain
KF	PU	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KC	PU	Rectifier loading factor proportional to commutating reactance
KD	PU	Demagnetizing factor, a function of exciter alternator reactances
KE	PU	Exciter constant related to self-excited field
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

KB1	PU	Second stage regulator gain. It is exciter field current controller gain used as alternative to Kb to represent a variant of the model
KL1	PU	Coefficient to allow different usage of the model
KS	PU	Coefficient to allow different usage of the model-speed coefficient
HVGATE	Boolena	Indicates if HV gate is active
LVGATE	Boolena	Indicates if LV gate is active (LVgate)

Notes

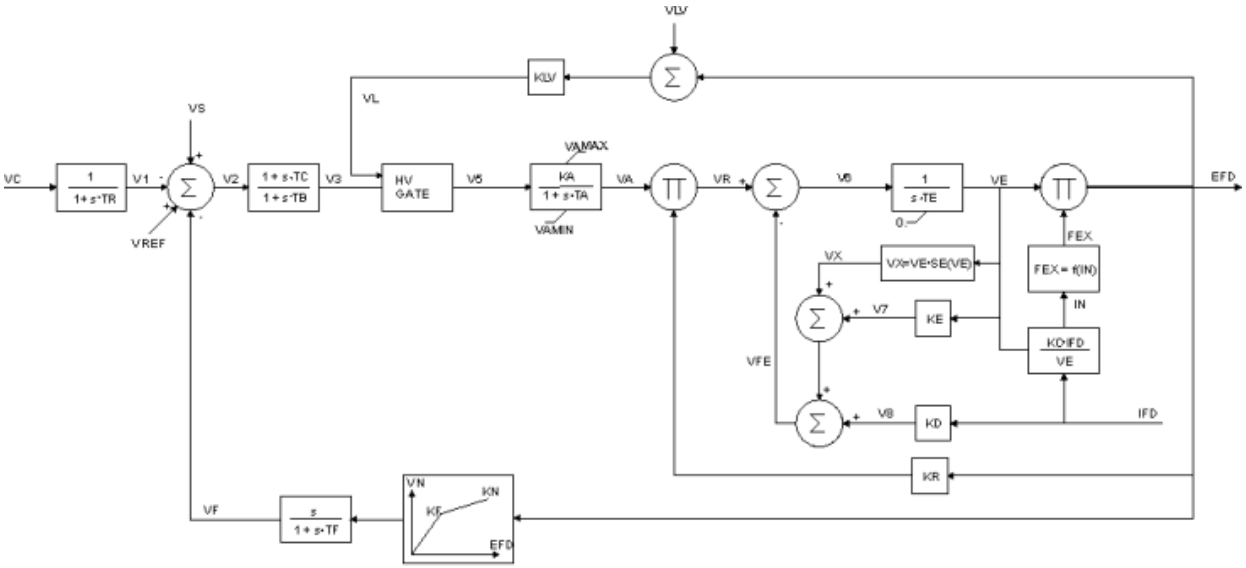
The Rectifier Regulation Characteristic F(IN):



Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC2A

EXCITER – EXAC3



VS = VPSS+VUEL+VOEL

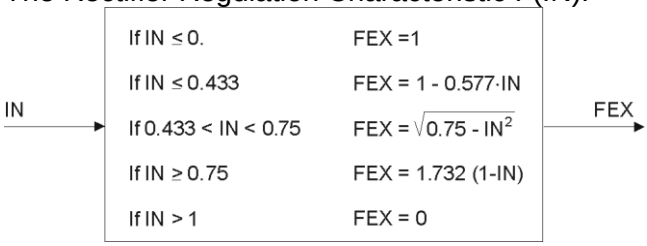
Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	PU	Maximum voltage regulator outputs
VAMIN	PU	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KR	PU	Constant associated with regulator and alternator field power supply
VLV	PU	Field voltage used in the minimum field voltage limiter loop
KLV	PU	Gain used in the minimum field voltage limiter loop
KF	PU	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KN	PU	Excitation control system stabilizer gain
EFDN	PU	Value of EFD at which feedback gain changes
KC	PU	Rectifier loading factor proportional to commutating reactance
KD	PU	Demagnetizing factor, a function of exciter alternator reactances
KE	PU	Exciter constant related to self-excited field
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined

SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

The Rectifier Regulation Characteristic F(IN):

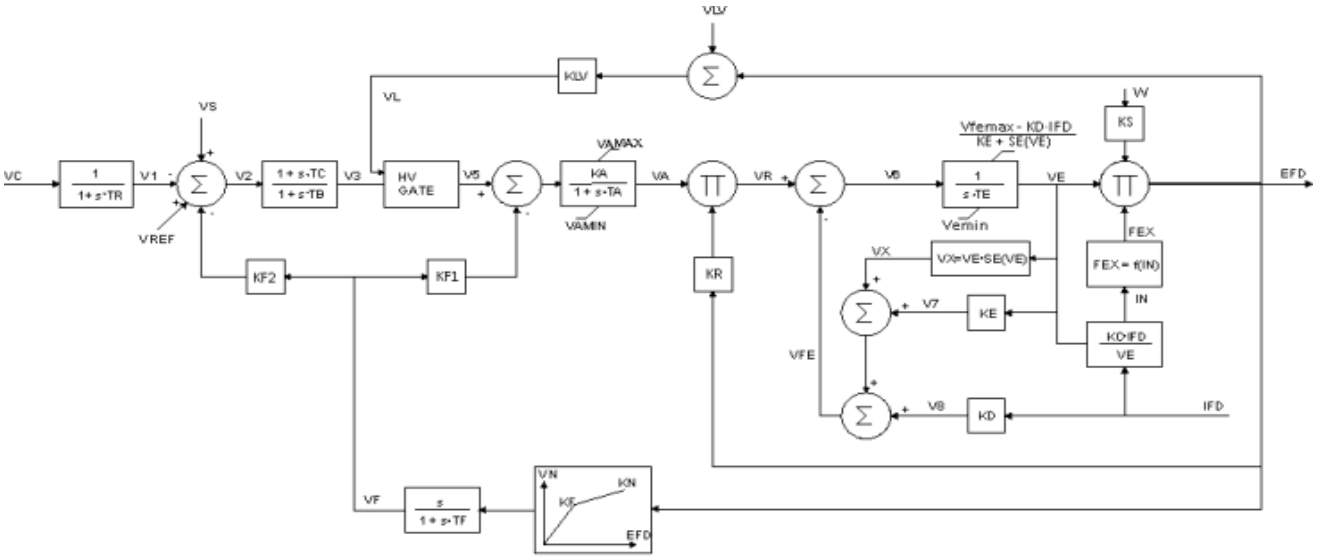


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – EXAC3A

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



..

VS = VPSS+VUEL+VOEL

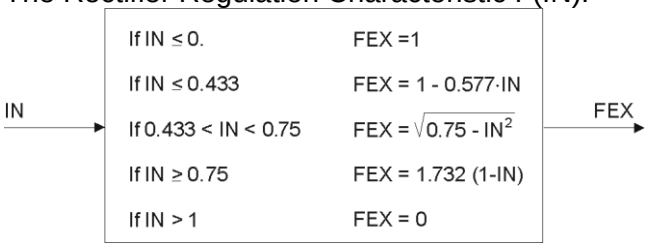
Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	PU	Maximum voltage regulator outputs
VAMIN	PU	Minimum voltage regulator outputs
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KR	PU	Constant associated with regulator and alternator field power supply
VLV	PU	Field voltage used in the minimum field voltage limiter loop
KLV	PU	Gain used in the minimum field voltage limiter loop
KF	PU	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
KN	PU	Excitation control system stabilizer gain
EFDN	PU	Value of EFD at which feedback gain changes
KC	PU	Rectifier loading factor proportional to commutating reactance
KD	PU	Demagnetizing factor, a function of exciter alternator reactances
KE	PU	Exciter constant related to self-excited field

VLV	PU	Field voltage used in the minimum field voltage limiter loop
KLV	PU	Gain used in the minimum field voltage limiter loop
VEMIN	PU	Minimum exciter voltage output
KF1	PU	Coefficient to allow different usage of the model
KF2	PU	Coefficient to allow different usage of the model
KS	PU	Coefficient to allow different usage of the model-speed coefficient
VFEMAX	PU	Exciter field current limit reference
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

The Rectifier Regulation Characteristic F(IN):

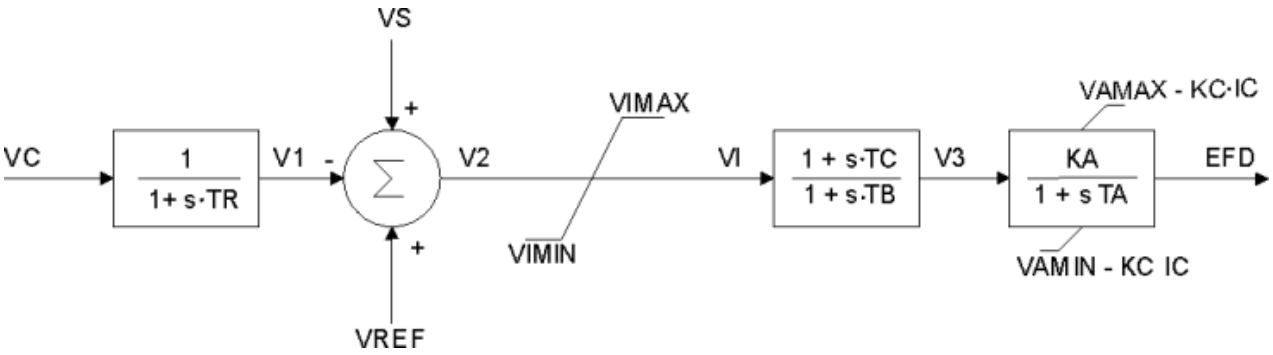


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC3A

EXCITER – EXAC4

IEEE Modified Type AC4A Excitation System model.



VS = VPSS+VUEL+VOEL

Parameters

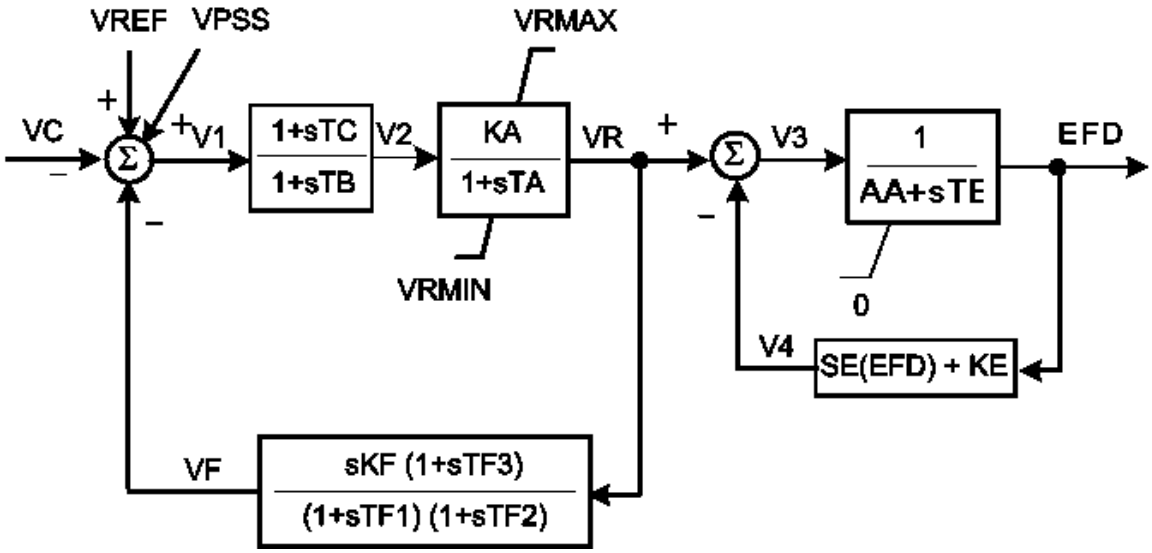
NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	PU	Maximum voltage regulator outputs
VIMIN	PU	Minimum voltage regulator outputs
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
KC	PU	Limit factor

Notes

Equivalent model in CIM/CGMES:
- ExcAC4A

EXCITER – EXAC5A

Modified type AC5A Excitation System



Parameters

NAME	Type	Description
AA	pu	Coefficient to allow different usage of the model
KA	pu	Voltage regulator gain
KE	Seconds	Exciter constant related to self-excited field
KF	pu	Excitation control system stabilizer gains
SE1	pu	Exciter saturation function value at the corresponding exciter voltage
SE2	pu	Exciter saturation function value at the corresponding exciter voltage
E1	pu	Exciter voltage at which exciter saturation is defined
E2	pu	Exciter voltage at which exciter saturation is defined
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
TE	Seconds	Exciter time constant, integration rate associated with exciter control
TF1	Seconds	Excitation control system stabilizer time constant
TF2	Seconds	Excitation control system stabilizer time constant
TF3	Seconds	Excitation control system stabilizer time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output

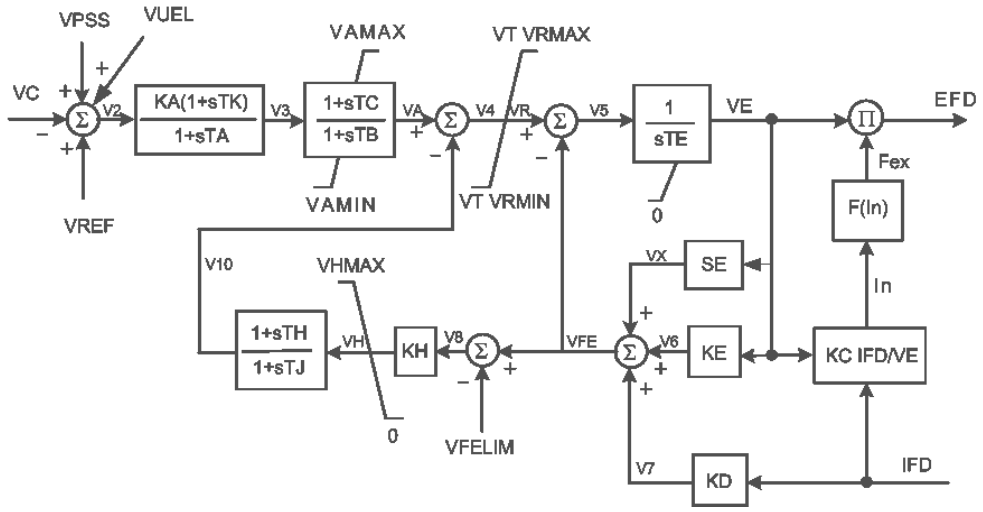
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC5A

EXCITER – EXCAC6A

Modified IEEE AC6A alternator-supplied rectifier excitation system



Parameters

NAME	Type	Description
TR	seconds	Filter time constant
KA	pu	Voltage regulator gain
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KE	pu	Exciter constant related to self-excited field
KH	pu	Exciter field current limiter gain
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, back of commutating reactance
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, back of commutating reactance
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
TE	Seconds	Exciter time constant, integration rate associated with exciter control
TH	Seconds	Exciter field current limiter time constant
TJ	Seconds	Exciter field current limiter time constant
TK	Seconds	Voltage regulator time constant
VAMAX	pu	Maximum voltage regulator output
VAMIN	pu	Minimum voltage regulator output

VFELIM	pu	Exciter field current limit reference
VHMAX	pu	Maximum field current limiter signal reference
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output

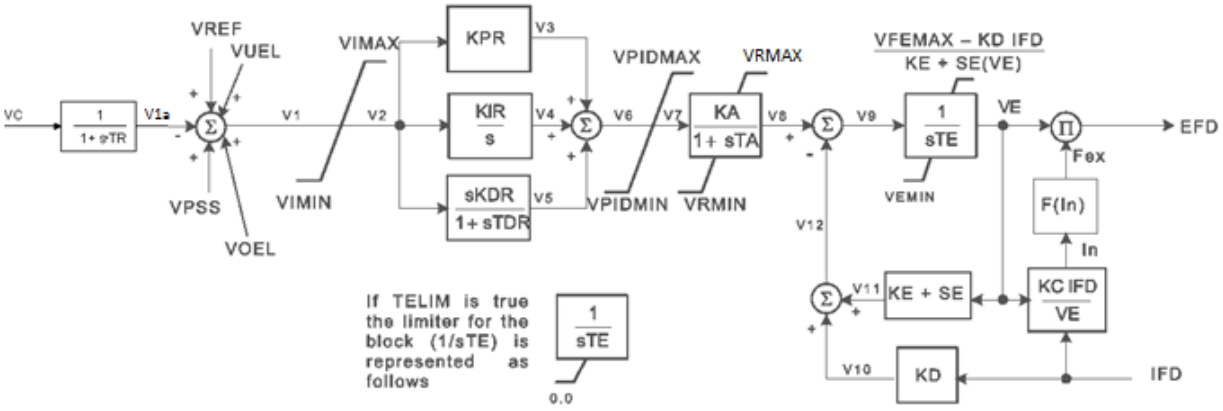
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC6A

EXCITER – EXAC8B

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



Parameters

NAME	Type	Description
INLIM	Boolean	Input limiter indicator, true = input limiter Vimax and Vimin is considered, false = input limiter Vimax and Vimin is not considered
KA	pu	Voltage regulator gain
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
KDR	pu	Voltage regulator derivative gain
KE	pu	Exciter constant related to self-excited field
KIR	pu	Voltage regulator integral gain
KPR	pu	Voltage regulator proportional gain
PIDLIM	Boolean	PID limiter indicator, true = input limiter VPIDIMAX and VPIDMIN are considered, false = input limiter VPIDIMAX and VPIDMIN are not considered
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, back of commutating reactance
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, back of commutating reactance
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
TA	Seconds	Voltage regulator time constant
TDR	Seconds	Lag time constant
TELIM	Boolean	Selector for the limiter on the block [1/sTe], See diagram (on the figure) for meaning of true and false
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VIMAX	pu	Input signal maximum

VIMIN	pu	Input signal minimum
VEMIN	pu	Minimum exciter voltage output
VFEMAX	pu	Exciter field current limit reference
VPIDMAX	pu	PID maximum controller output
VPIDMIN	pu	PID minimum controller output
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
VTMULT	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

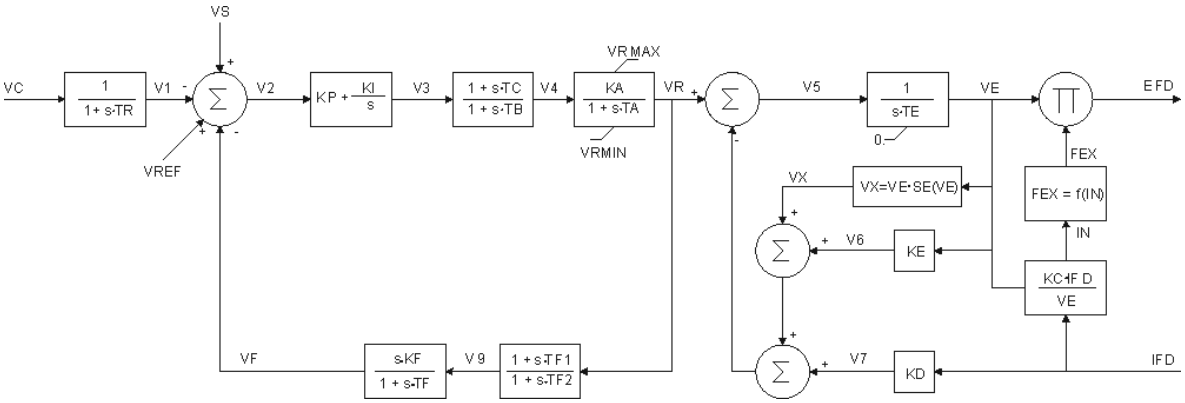
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAC8B

EXCITER - EXBAS

Basler Static Voltage Regulator Feeding dc or ac Rotating Exciter



VS = VPSS + VUEL +VOEL

Parameters

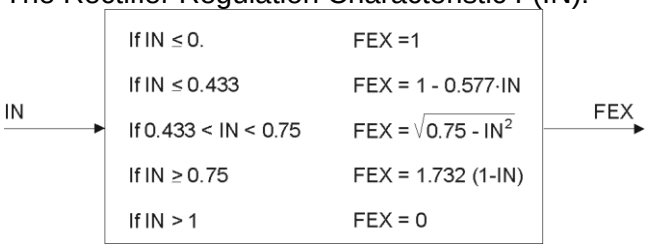
NAME	Type	Description
TR	Seconds	Filter time constant
KP	pu	Voltage regulator proportional gain
KI	pu	Voltage regulator integral gain
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KF	Seconds	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
TF1	Seconds	Excitation control system stabilizer time constant 2
TF2	Seconds	Excitation control system stabilizer time constant 3
KE	Seconds	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KC	pu	Rectifier loading factor proportional to commutating reactance
KD	pu	Demagnetizing factor, a function of exciter alternator reactances
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5	0 < TF2
0 < KP < 5	–1 ≤ KE ≤ 1
0 ≤ KI < 1.1	0.04 < TE < 10
10 < KA ≤ 4000	5 ≤ TF/KF ≤ 15 or 5 ≤ TF2/KF ≤ 15
0 < TA ≤ 10	KC ≤ 1
0 < TB < 20	KD ≤ 2
0 < TC < 20	0 ≤ E1
0.5 < VRMAX < 20	0 ≤ SE(E1) < 1.0
–20 < VRMIN < 0	E1 < E2
0.04 < TF < 1.5	SE(E1) < SE(E2)
0 < TF1	

Notes

The Rectifier Regulation Characteristic F(IN):

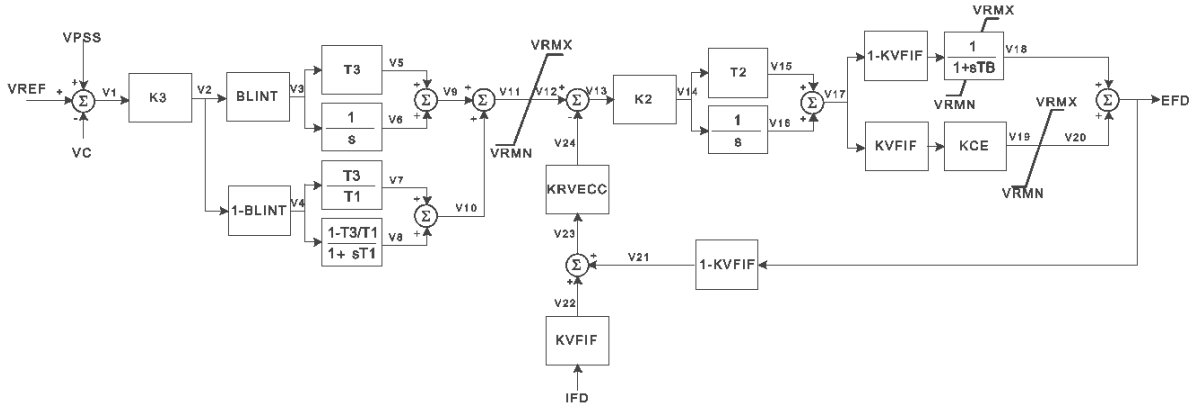


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – EXCANS

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



Parameters

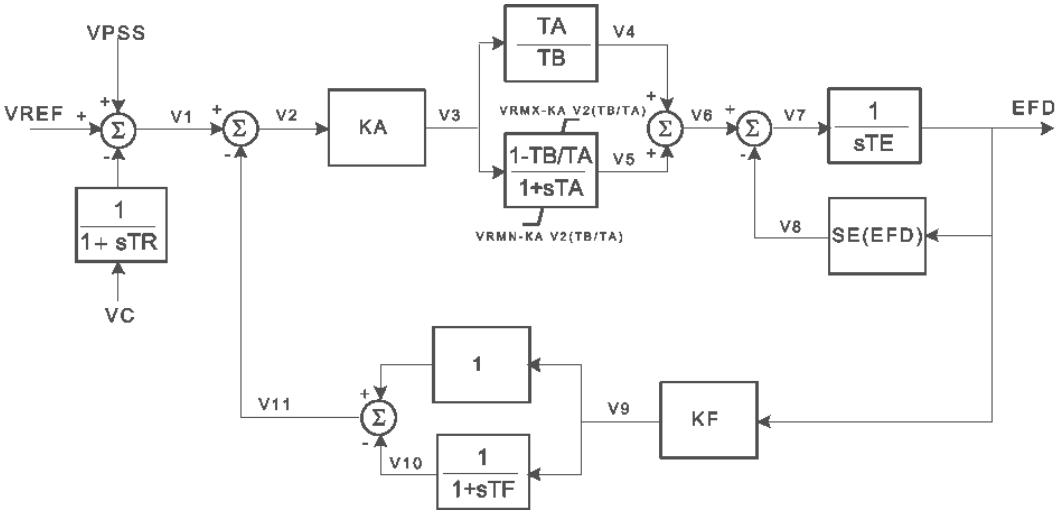
NAME	Type	Description
TB	Seconds	Time constant
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
K2	pu	Gain
K3	pu	Gain
KVFIF	Integer	Rate feedback signal flag 0 = output voltage of the exciter 1 = exciter field current
KRVECC	Integer	Feedback enabling 0 = Open loop control 1 = Closed loop control
KCE	pu	Ceiling factor
BLINT	Integer	Governor Control Flag 0 = lead-lag regulator 1 = proportional integral regulator
IFMN	pu	Not include in NEPLAN model, not clear in Entsoe-CIM/CGMES reference manual
IFMX	pu	Not include in NEPLAN model, not clear in Entsoe-CIM/CGMES reference manual
VRMN	pu	Minimum limit
VRMX	pu	Maximum limit

Notes

Equivalent model in CIM/CGMES:
- ExcANS

EXCITER – EXCAVR1

Italian excitation system corresponding to IEEE (1968) Type 1 Model. It represents exciter dynamo and electromechanical regulator.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TE	Seconds	Time constant
TA	Seconds	Time constant
TB	Seconds	Time constant
TF	Seconds	Feedback time consant
VRMN	pu	Minimum limit
VRMX	pu	Maximum limit
KA	pu	Gain
KF	pu	Feedback gain
E1	pu	Saturation parameter
SE1	pu	Saturation parameter
E2	pu	Saturation parameter
SE2	pu	Saturation parameter

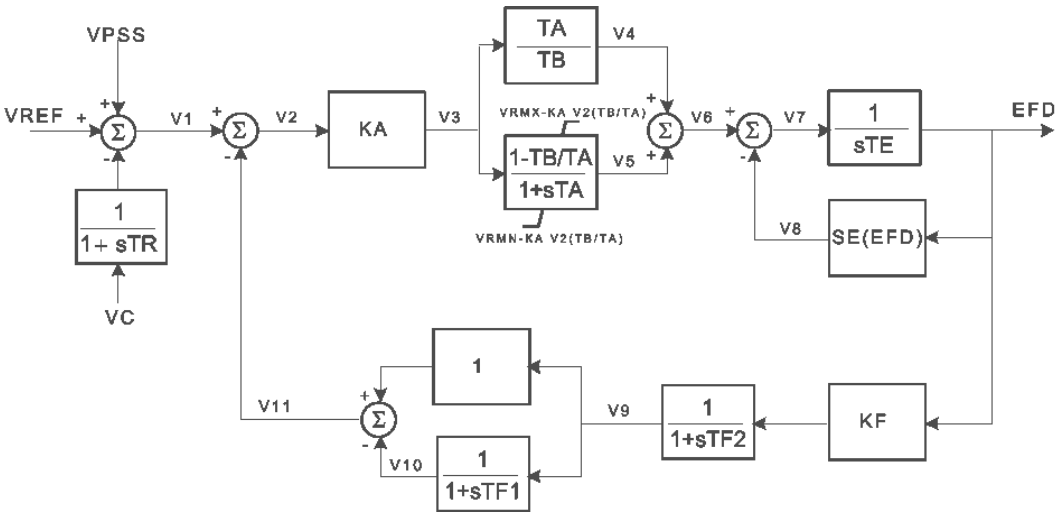
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAVR1

EXCITER – EXCAVR2

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



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TE	Seconds	Time constant
TB	Seconds	Time constant
TF1	Seconds	Feedback time consant
TF2	Seconds	Feedback time consant
VRMN	pu	Minimum limit
VRMX	pu	Maximum limit
KA	pu	Gain
KF	pu	Feedback gain
E1	pu	Saturation parameter
SE1	pu	Saturation parameter
E2	pu	Saturation parameter
SE2	pu	Saturation parameter

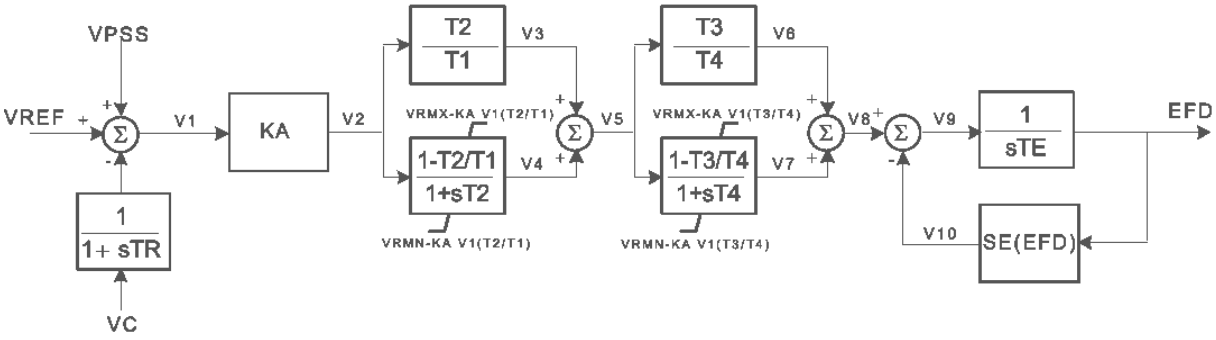
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAVR2

EXCITER – EXCAVR3

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



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TE	Seconds	Exciter time constant
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
T4	Seconds	Time constant
VRMN	pu	Minimum limit
VRMX	pu	Maximum limit
KA	pu	Gain
E1	pu	Saturation parameter
SE1	pu	Saturation parameter
E2	pu	Saturation parameter
SE2	pu	Saturation parameter

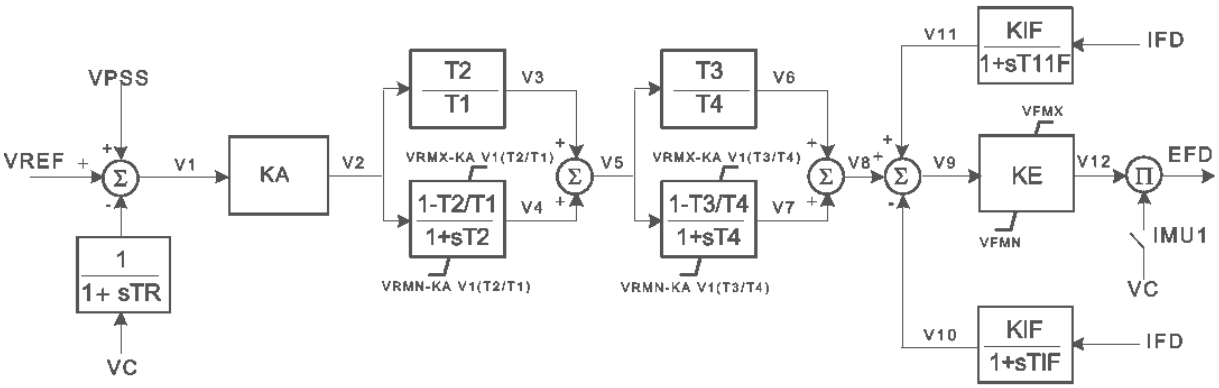
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAVR3

EXCITER – EXCAVR4

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



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
T1	Seconds	time constant
T2	Seconds	time constant
T3	Seconds	time constant
T4	Seconds	time constant
TIF	Seconds	Exciter current feedback time constant
T11F	Seconds	Exciter current feedback time constant
KA	pu	Gain
KE	pu	Exciter gain
KIF	pu	Exciter internal reactance
VRMN	pu	Minimum AVR output
VRMX	pu	Maximum AVR output
VFMIN	pu	Minimum exciter output
VFMAX	pu	Maximum exciter output
IMU1	Boolean	Output voltage dependency selector 0 = selector is not connected 1 = selector is connected

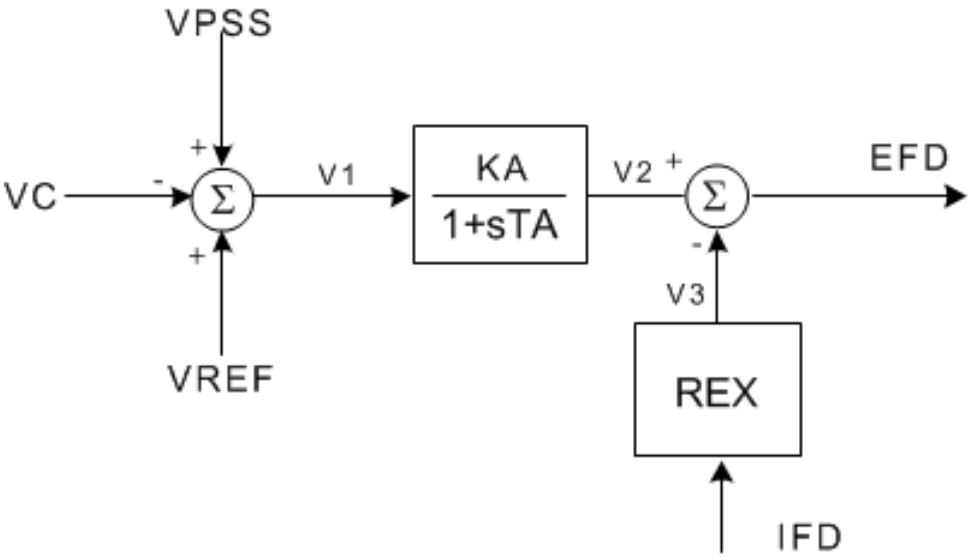
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcAVR4

EXCITER – EXCAVR5

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



Parameters

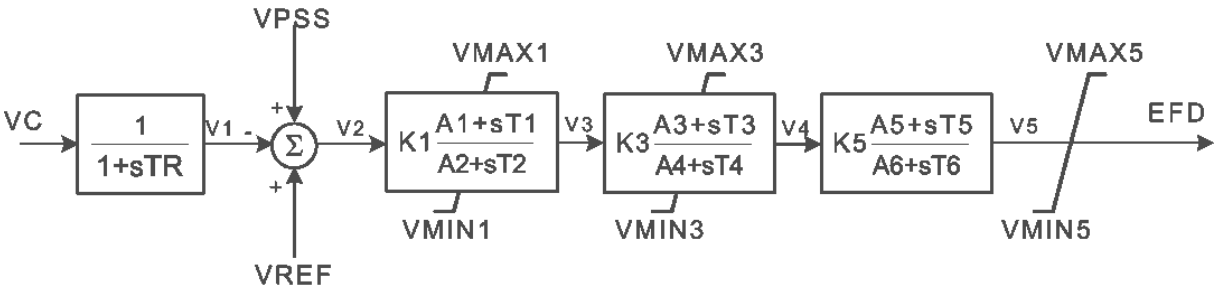
NAME	Type	Description
KA	pu	Gain
TA	Seconds	Time constant
REX	pu	Effective Output Resistance

Notes

Equivalent model in CIM/CGMES:
- ExcAVR5

EXCITER – EXCAVR7

IVO excitation system.



Parameters

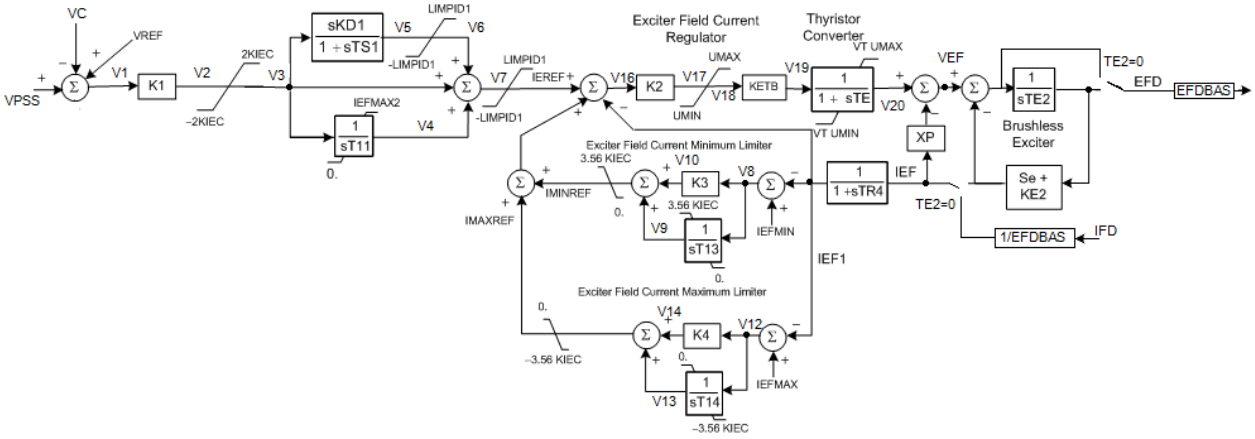
NAME	Type	Description
TR	Seconds	Filter time constant
T1	Seconds	Lead time constant
T2	Seconds	Lag time constant
T3	Seconds	Lead time constant
T4	Seconds	Lag time constant
T5	Seconds	Lead time constant
T6	Seconds	Lag time constant
VMIN1	pu	Lead-lag min. limit
VMAX1	pu	Lead-lag max. limit
VMIN3	pu	Lead-lag min. limit
VMAX3	pu	Lead-lag max. limit
VMIN5	pu	Lead-lag min. limit
VMAX5	pu	Lead-lag max. limit
K1	pu	Gain
K3	pu	Gain
K5	pu	Gain
A1	pu	Lead coefficient
A2	pu	Lag coefficient
A3	pu	Lead coefficient
A4	pu	Lag coefficient
A5	pu	Lead coefficient
A6	pu	Lag coefficient

Notes

Equivalent model in CIM/CGMES:
- ExcAVR7

EXCITER - ExcELIN2

Detailed Excitation System Model - 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.



Parameters

NAME	Type	Description
TR4	Seconds	Time constant
KE2	pu	Gain
TE2	Seconds	Time constant
EFDBAS	pu	Gain
K2	pu	Gain
K1	pu	Voltage regulator input gain
K1EC	pu	Voltage regulator input limit
KD1	pu	Voltage controller derivative gain
TB1	Seconds	Voltage controller derivative washout time constant
TI1	pu	Controller follow up dead band
LIMPID1	pu	Controller follow up gain
UMAX	pu	Limiter
UMIN	pu	Limiter
K3	pu	Gain
TI3	Seconds	Time constant
K4	pu	Gain
TI4	Seconds	Time constant
KETB	pu	Gain
TE	Seconds	Time constant
XP	pu	Excitation transformer effective reactance
IEFMAX1	pu	Limiter
IEFMAX2	pu	Minimum open circuit excitation voltage
IEFMIN	pu	Limiter
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined

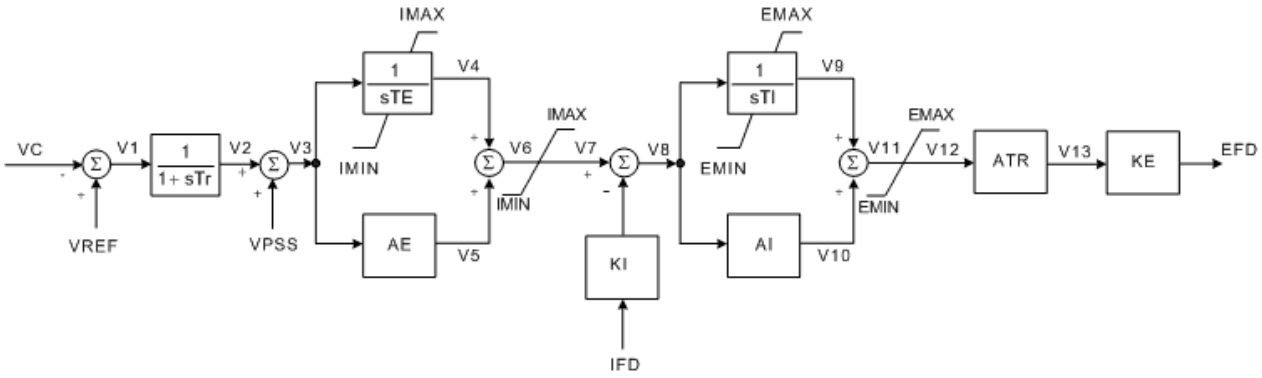
SE1	pu	Exciter saturation function value at the corresponding exciter voltage
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage

Notes

Equivalent model in CIM/CGMES:
- ExcELIN2

EXCITER - EXCHU

Hungarian Excitation System Model.



Parameters

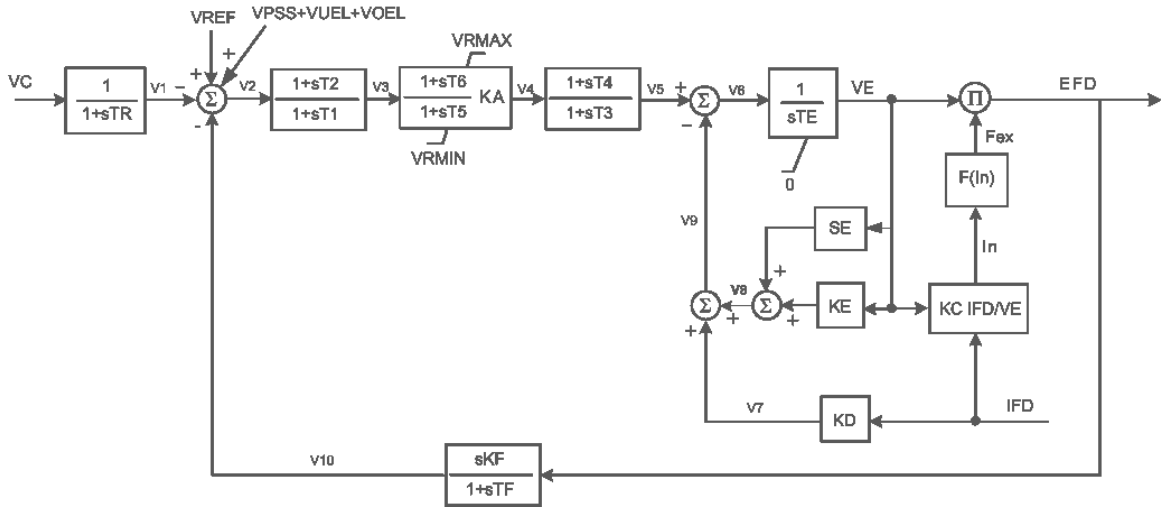
NAME	Type	Description
TR	Seconds	Filter time constant
TE	Seconds	Major loop PI tag integration time constant
IMIN	PU	Major loop PI tag output signal lower limit
IMAX	PU	Major loop PI tag output signal upper limit
AE	PU	Major loop PI tag gain factor
EMIN	PU	Field voltage control signal lower limit on AVR base
EMAX	PU	Field voltage control signal upper limit on AVR base
KI	PU	Current base conversion constant
AI	PU	Minor loop PI tag gain factor
TI	Seconds	Minor loop PI control tag integration time constant
ATR	PU	AVR constant
KE	PU	Voltage base conversion constant

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – EXCOEX3T

Modified IEEE Type ST1 Excitation System with semi-continuous and acting terminal voltage limiter.

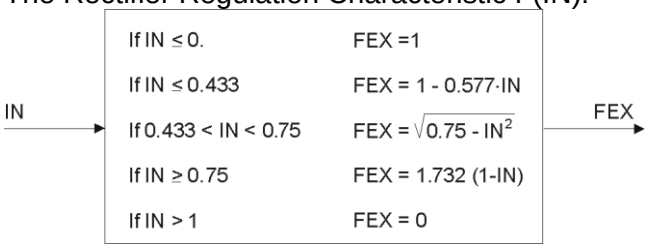


Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TE	Seconds	Integer time constant
TF	Seconds	Feedback time constant
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
T4	Seconds	Time constant
T5	Seconds	Time constant
T6	Seconds	Time constant
VRMIN	pu	Minimum limit
VRMAX	pu	Maximum limit
KE	pu	Saturation gain
KA	pu	Gain
KF	pu	Feedback gain
KD	pu	Field current gain
KC	pu	Statex gain
SE1	pu	Saturation parameter
E1	pu	Saturation parameter
SE2	pu	Saturation parameter
E2	pu	Saturation parameter

Notes

The Rectifier Regulation Characteristic F(IN):

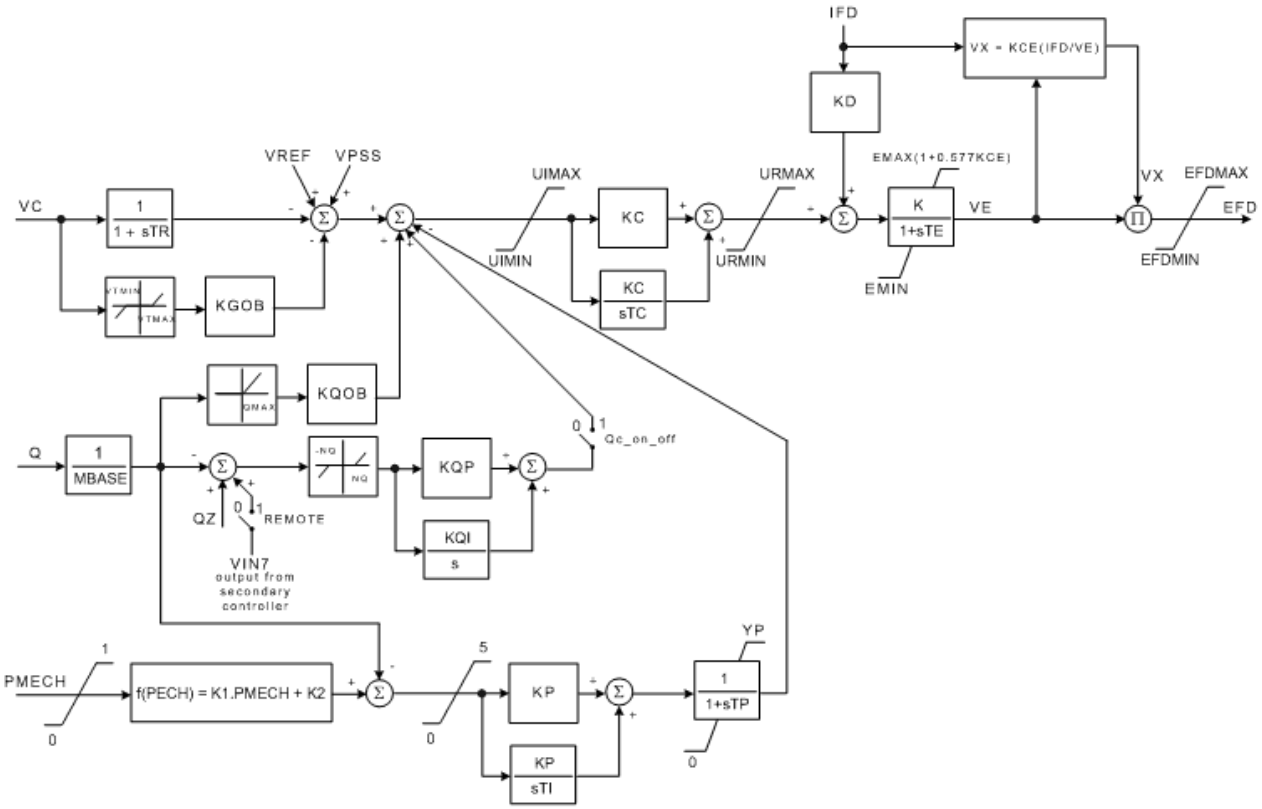


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcOEX3T

EXCITER - EXCSK

Slovakian Excitation System Model.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
K	PU	Gain
TE	Seconds	Time constant
EMIN	PU	Minimum field voltage output
EMAX	PU	Maximum field voltage output
KC	PU	PI controller gain
TC	Seconds	PI time constant
UIMIN	PU	Minimum error
UIMAX	PU	Maximum error
URMIN	PU	Minimum controller output
URMAX	PU	Maximum controller output
EFDMIN	PU	Field voltage clipping limit
EFDMAX	PU	Field voltage clipping limit
KCE	PU	Rectifier regulation factor
KD	PU	Exciter internal reactance
KP	PU	PI controller gain
TI	Seconds	PI controller phase lead time constant

K1	PU	Parameter of underexcitation limit
K2	PU	Parameter of underexcitation limit
YP	PU	Maximum output
VTMIN	PU	Minimum terminal voltage input
VTMAX	PU	Maximum terminal voltage input
KGOB	PU	P controller gain
KQOB	PU	Rate of rise of the reactive power
NQ	PU	Dead band of reactive power
KQP	PU	PI controller gain
KQI	PU	PI controller gain of integral component
QZ	PU	Desired value (setpoint) of reactive power
REMOTE	Boolean	Switch control 1 = Automatic calculation in model secondary controller model 0 = Manual set; desired value of reactive power QZ is required.
QC_ON_OFF	Boolean	Secondary voltage control state 1 = secondary voltage control is ON 0 = secondary voltage control is OFF.
TP	PU	Time constant

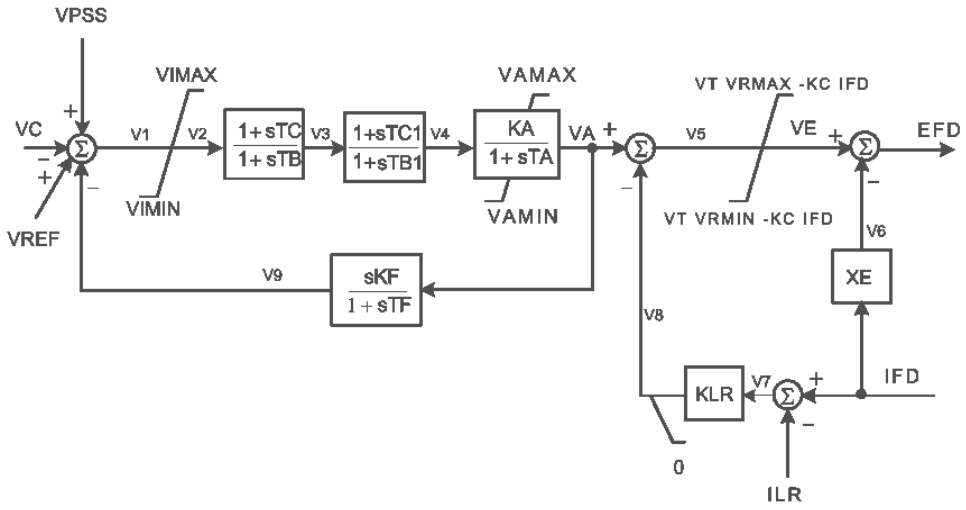
Notes

QMAX = K1*PMECH+K2

Equivalent model in CIM/CGMES:
- ExcSK

EXCITER - EXCST1A

Modification of an old IEEE ST1A static excitation system without overexcitation limiter (VOEL) and underexcitation limiter (VUEL).



Parameters

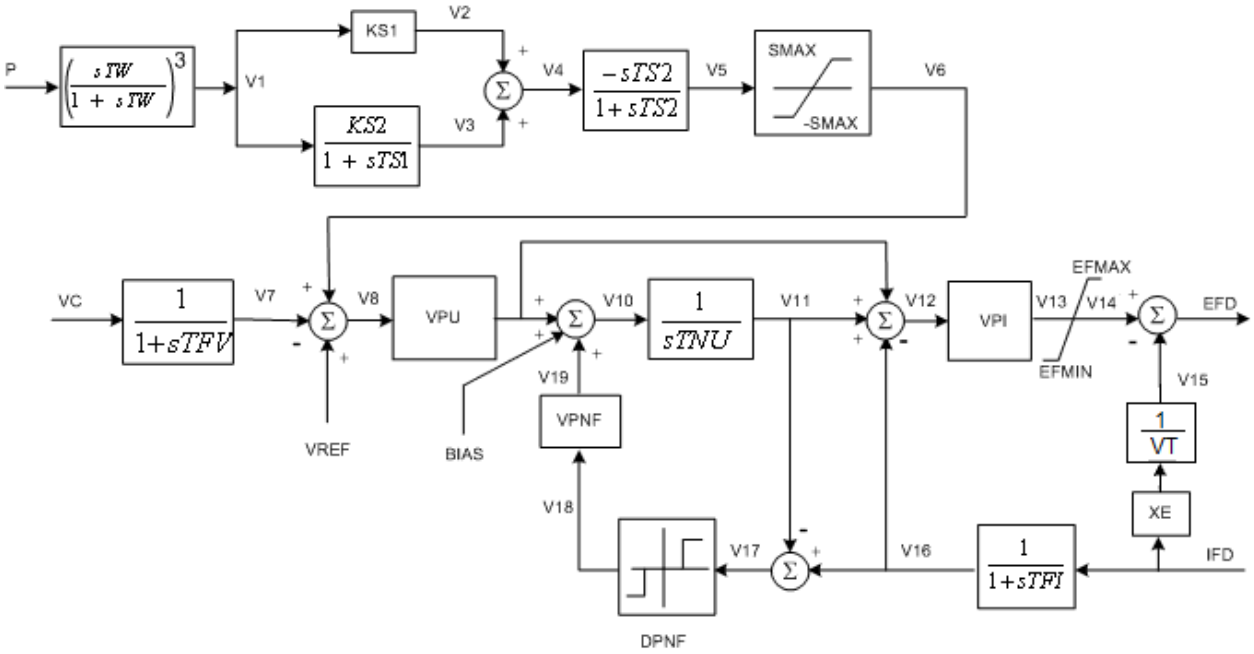
NAME	Type	Description
VIMAX	pu	Maximum voltage regulator input limit
VIMIN	pu	Minimum voltage regulator input limit
TC	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC1	Seconds	Voltage regulator time constant
TB1	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	pu	Maximum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
KC	pu	Rectifier loading factor proportional to commutating reactance
KLR	pu	Exciter output current limiter gain
ILR	pu	Exciter output current limit reference
XE	pu	Excitation xfmr effective reactance
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant

Notes

Equivalent model in CIM/CGMES:
- ExcST1A

EXCITER – EXELI

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.



Parameters

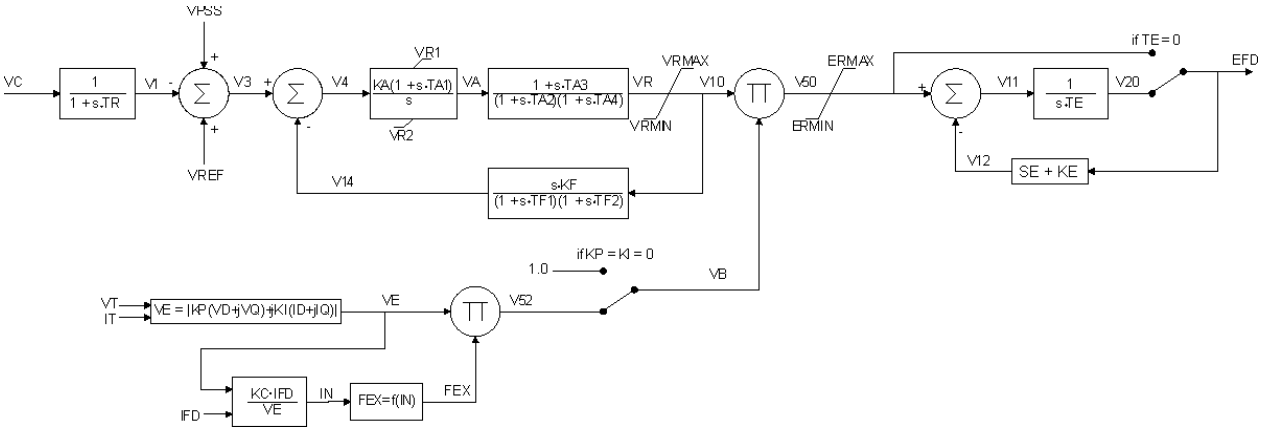
NAME	Type	Description
TR	Seconds	Filter time constant
TFV	Seconds	Voltage transducer time constant
TFI	Seconds	Current transducer time constant
TNU	Seconds	Controller reset time constant
VPU	PU	Voltage controller proportional gain
VPI	PU	Current controller gain
VPNF	PU	Controller follow up gain
DPNF	PU	Controller follow up dead band
EFDMIN	PU	Minimum open circuit excitation voltage
EFDMAX	PU	Maximum open circuit excitation voltage
XE	PU	Excitation transformer effective reactance
TW	Seconds	Stabilizer parameters
KS1	PU	Stabilizer Gain 1
KS2	PU	Stabilizer Gain 2
TS1	Seconds	Stabilizer Phase Lag Time Constant
TS2	Seconds	Stabilizer Filter Time Constant
SMAX	PU	Stabilizer Limit Output

Notes

Equivalent model in CIM/CGMES:
- ExcELIN1

EXCITER - EXPIC1

Proportional/integral excitation system model.



Parameters

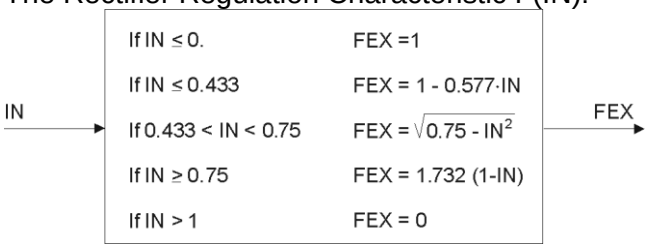
NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	PI controller gain
TA	Seconds	PI controller time constant
VR1	PU	PI maximum limit
VR2	PU	PI minimum limit
TA2	Seconds	Voltage regulator time constant
TA3	Seconds	Voltage regulator time constant
TA4	Seconds	Voltage regulator time constant
VRMAX	PU	Voltage regulator maximum limit
VRMIN	PU	Voltage regulator minmum limit
KF	PU	Rate feedback gain
TF1	Seconds	Rate feedback time constant
TF2	Seconds	Rate feedback time constant
EFMAX	PU	Exciter maximum limit
EFMIN	PU	Exciter minmum limit
KE	PU	Exciter constant
TE	Seconds	Exciter time constant
KP	PU	Potential source gain
KI	PU	Current source gain
KC	PU	Exciter regulation factor
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 < TR < 0.5	0 ≤ KC < 2
1 < KA < 500	0 ≤ KE ≤ 1
0 < TA1 < 10	1 < EFDMAX < 10
0.5 < VR1 < 10.0	-6 < EFDMIN ≤ -0,5
-6 < VR2 < -0.5	1 ≤ VRMAX ≤ 15
0 < Te < 2	-6 < VRMIN ≤ 0
0 ≤ KF < 0.3	0 < E1
0.04 < TF1 < 15	0 ≤ SE(E1) < 1
5 ≤ TF1/KF ≤ 25	SE(E1) < SE(E2)
0 ≤ KP < 5	E1 < E2
0 ≤ KI ≤ 1.1	0 ≤ TF2 < 5

Notes

The Rectifier Regulation Characteristic F(IN):

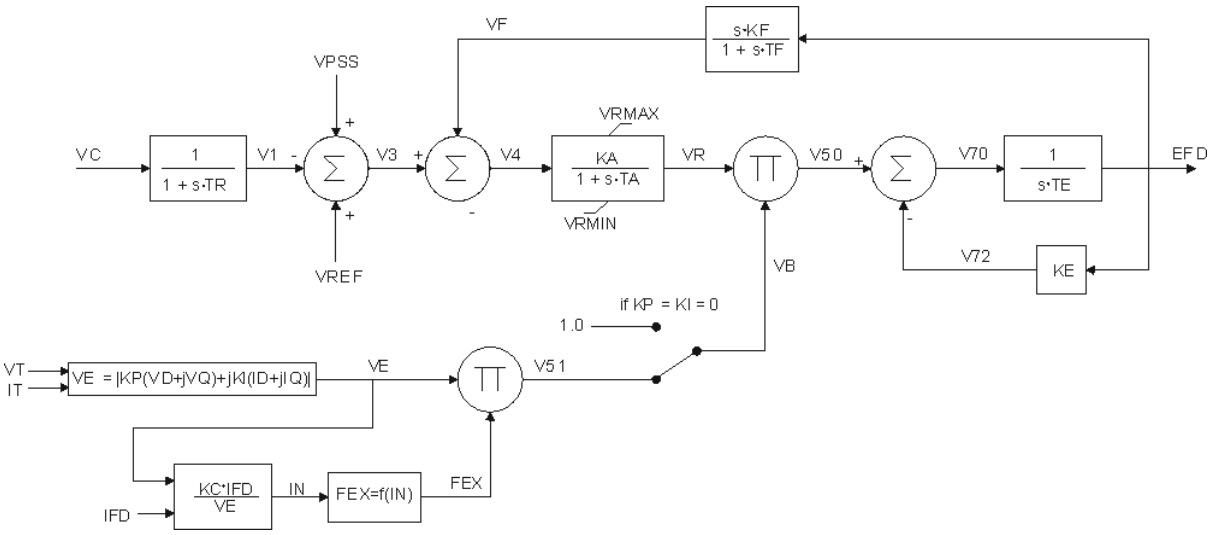


Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcPIC

EXCITER - EXST2A

Modified IEEE Type ST2 Excitation System.



Parameters

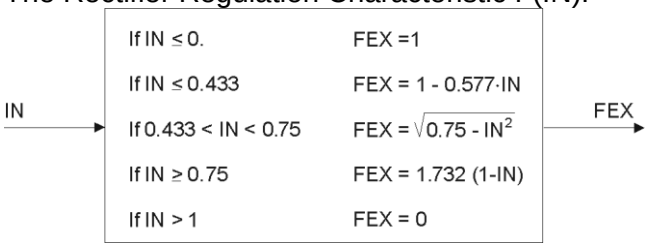
NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
KP	pu	Potential circuit gain coefficient
KI	pu	Potential circuit gain coefficient
KC	pu	Rectifier loading factor proportional to commutating reactance
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
EFDMAX	pu	Maximum field voltage

Parameters Range:

0 < TR < 0.5
10 < KA < 1000
0 < TA < 1
0.5 < VRMAX < 1.5
- 1.5 ≤ VRMIN < 0.5
0 < KE ≤ 1
0.04 < TE < 2
0 < KF < 0.3
0.04 < TF < 1.5
5 ≤ TF/ KF ≤ 20
KP = 1.19
0 ≤ KI ≤ 8.0
0 < KC < 2

Notes

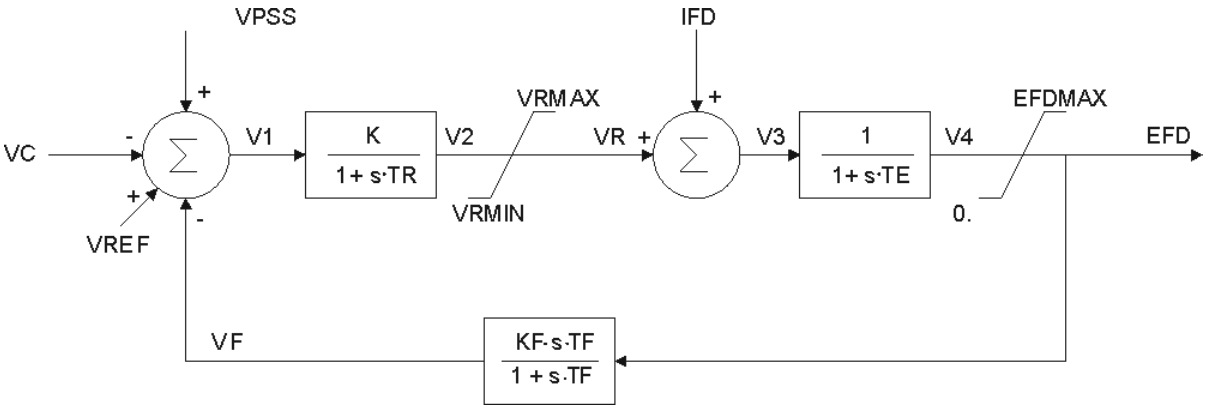
The Rectifier Regulation Characteristic F(IN):



Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - FREADC

Thyristor controlled DC exciter from ASEA.



Parameters

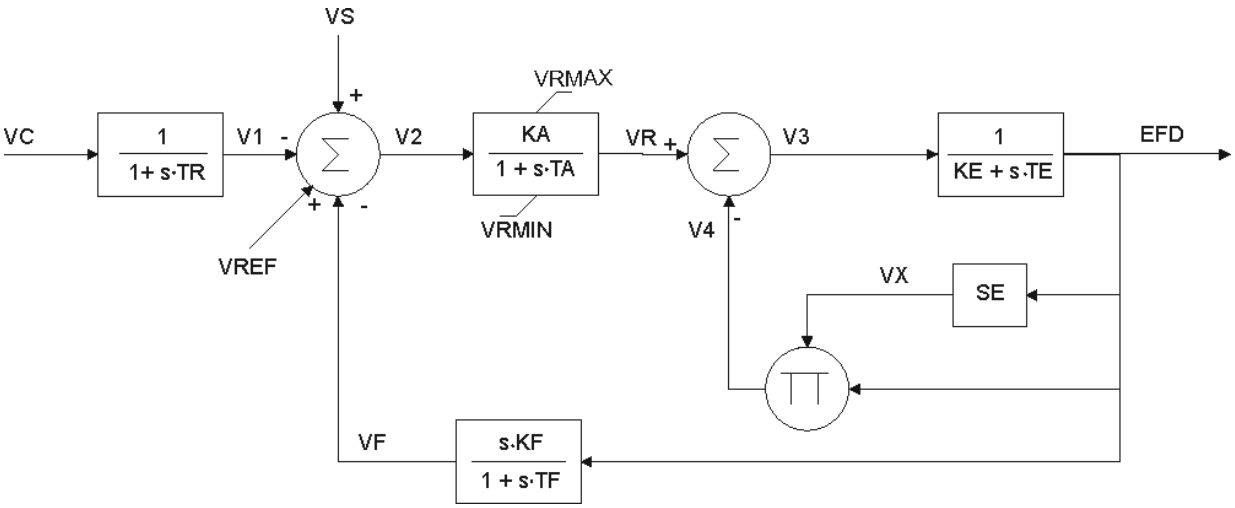
NAME	Type	Description
K	Seconds	Gain
TR	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
TE	Second	Time constant
EFDMAX	PU	Maximum field voltage output
KF	PU	Feedback gain
TF	Second	Feedback time constant

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - IEEET1

IEEE Type 1 Excitation System



VS = VPSS + VUEL + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Regulator gain
TA	Seconds	Regulator time constant
VRMIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Feedback gain
TF	Seconds	Feedback time constant
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0 \le TR < 0.5$
$10 < KA < 500$
$0 \le TA < 1$
$0.5 < VRMAX < 10$
$-10 < VRMIN < 0$
$-1 \le KE \le 1$
$0.04 < TE < 1$
$0 < KF < 0.3$
$0.04 < TF < 1.5$
$5 \le TF/KF \le 15$

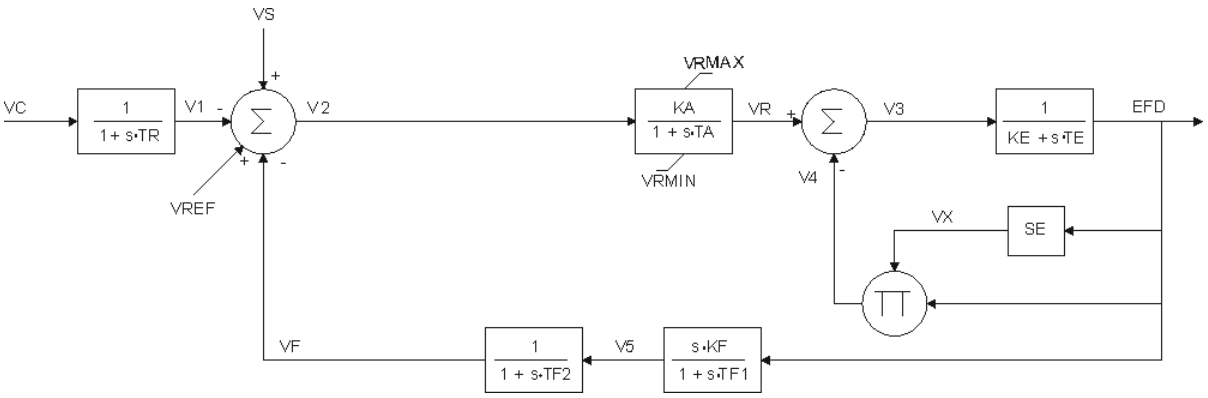
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - IEEET2

IEEE Type 2 Excitation System



VS = VPSS + VUEL + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Regulator gain
TA	Seconds	Regulator time constant
VRMIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Feedback gain
TF1	Seconds	Feedback time constant 1
TF2	Seconds	Feedback time constant 2
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0 \le TR < 0.5$
$10 < KA < 500$
$0 \le TA < 1$
$0.5 < VRMAX < 10$
$-10 < VRMIN < 0$
$0.04 < TF2 < 1.5$
$-1 \le KE \le 1$
$0.04 < TE < 1$
$0 < KF < 0.3$
$0.04 < TF1 < 1.5$
$5 \le TF1/KF \le 15$

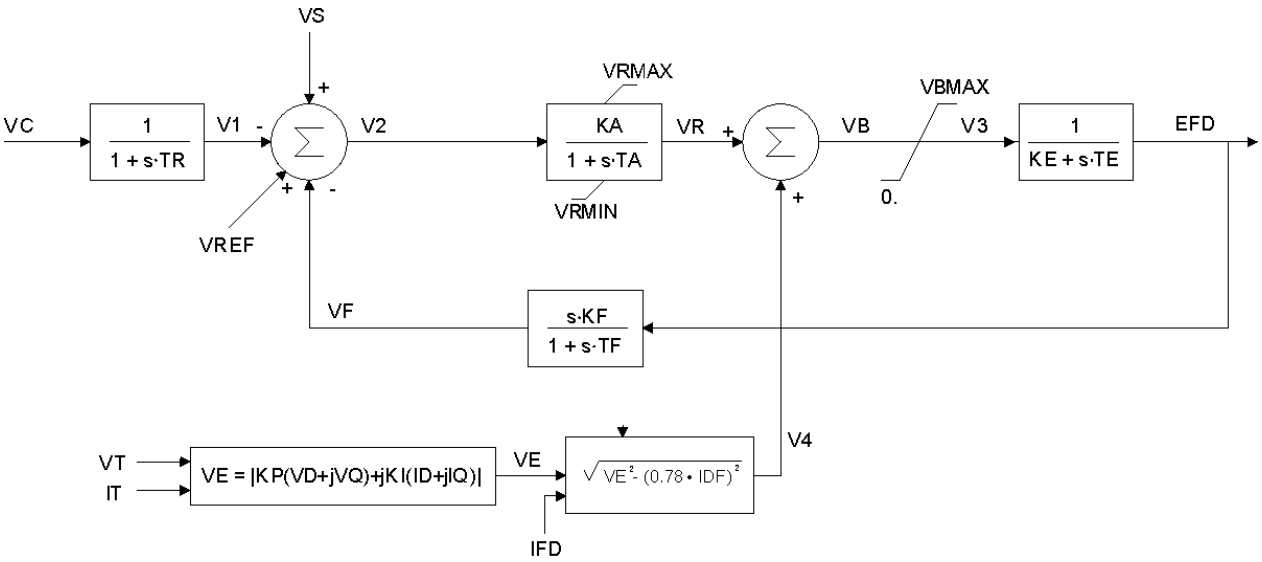
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - IEEET3

IEEE Type 3 Excitation System



VS = VPSS + VUEL + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
VBAX	PU	Available exciter voltage limiter
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
KP	PU	Potential circuit gain coefficient
KI	PU	Potential circuit gain coefficient

Parameters Range:

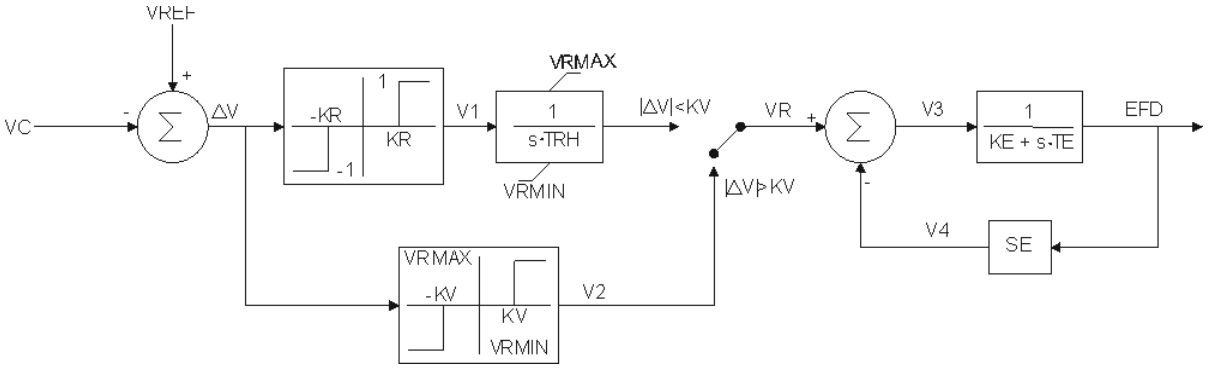
0 ≤ TR < 0.5
10 < KA < 200
0 ≤ TA < 1
0.5 < VRMAX < 1.5
-1.5 < VRMIN < -0.5
0.04 < TE < 2
0 < KF < 0.3
0.04 < TF < 1.5
5 ≤ TF/KF ! 15
KP = 1.19
0.9 < KI < 1.1
1.0 < VBMAX < 4.0
0 < KE ≤ 1.0

Notes

Equivalent model in CIM/CGMES:
- ExcDC3A1

EXCITER - IEEET4

IEEE Type 4 Excitation System



Parameters

NAME	Type	Description
KR	PU	Fast raise/lower contact setting
TRH	Seconds	Rheostat travel time
KV	PU	Fast raise/lower contact setting
VRMIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0.01 < KR < 0.05$ $\quad$ $0.04 < TE < 1.0$

$2.0 < TRH < 100$ $\quad$ $-1.0 < KE < 0.10$

$0.02 < KV < 0.10$ $\quad$ $0 \leq E1$

$KR < KV$ $\quad$ $0 \leq SE(E1) < 1$

$2.0 < VRMAX < 10.0$ $\quad$ $E1 < E2$

$0 \leq VRMIN < 2.0$ $\quad$ $SE(E1) < SE(E2)$

Notes

The signal V1 is calculated according to the value of ΔV, as follows:

If -KR < ΔV < KR	then	V1 = 0
If $\Delta V \leq$ -KR	then	V1 = -1
If $\Delta V \geq$ KR	then	V1 = 1

The signal V2 is calculated according to the value of ΔV, as follows:

If -KV < ΔV < KV	then	V2 = 0
If $\Delta V \leq$ -KV	then	V2 = VRMIN
If $\Delta V \geq$ KV	then	V2 = VRMAX

Note:

1) If VRMAX is zero, the model will compute a new value of it.
   a) If KE is zero or negative, VRMAX will just allow the exciter to reach an output voltage of E2 i.e.: VRMAX = SE(E2) × E2
   b) If KE is positive, VRMAX will just allow the exciter to reach an output voltage of E2 with the specified value of KE,
   i.e.: VRMAX = (SE (E2) + KE) × E2
   In either case above, VRMIN is then set to –VRMAX.

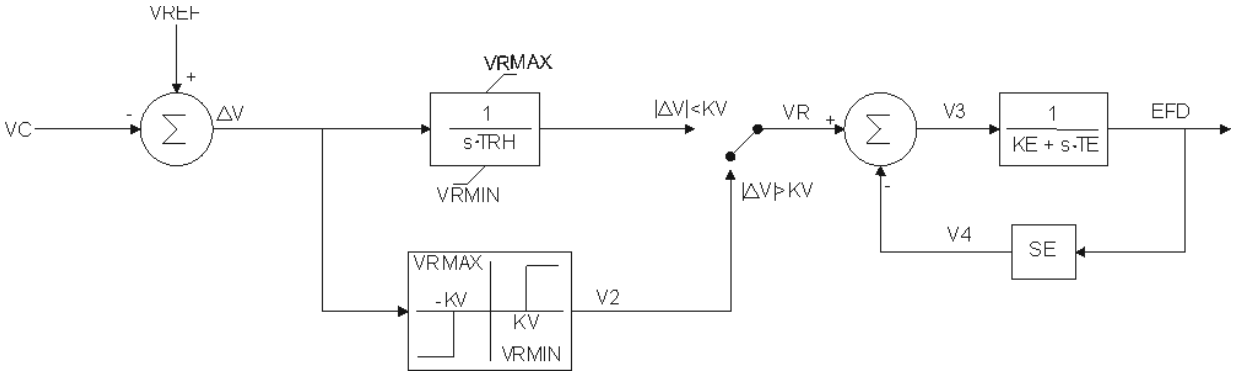
2) If KE is zero, the model will set a new value of KE.
   KE is set to the value that will require a voltage regulator output of (VRMAX /10) to maintain the present value of excitation voltage, UF, i.e.:
   KE =VRMAX/(10 UF) - SE (UF)

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – IEEET5

Modified IEEE Type 5 Excitation System



Parameters

NAME	Type	Description
TRH	Seconds	Rheostat travel time
KV	PU	Fast raise/lower contact setting
VRMIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0.01 < KR < 0.05
2.0 < TRH < 100
0.02 < KV < 0.10
KR < KV
2.0 < VRMAX < 10.0
0 ≤ VRMIN < 2.0
0.04 < TE < 1.0
-1.0 < KE < 0.10
0 ≤ E1
0 ≤ SE(E1) < 1
E1 < E2
SE(E1) < SE(E2)

Notes

The signal V2 is calculated according to the value of ΔV, as follows:

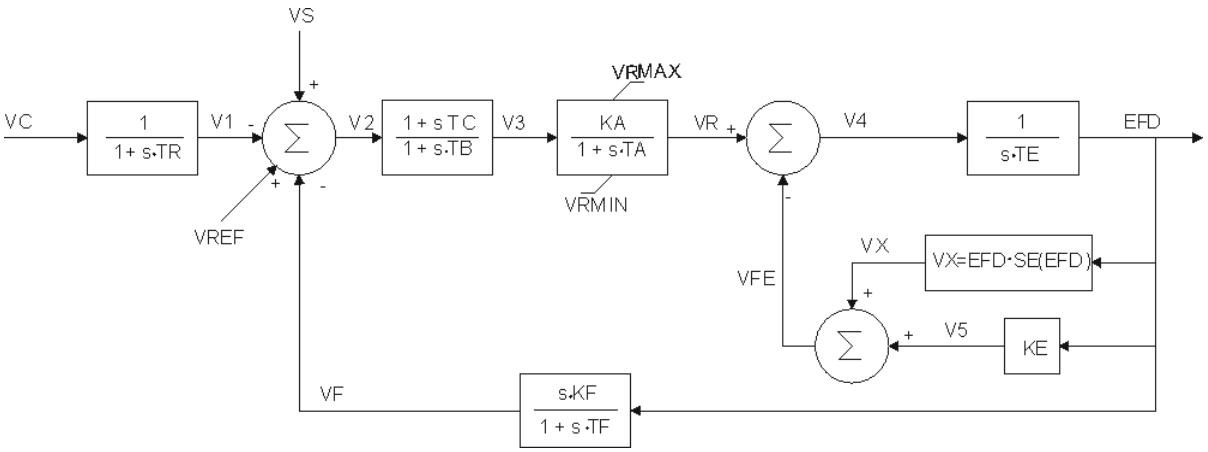
If $-KV < \Delta V < KV$	then	V2 = 0
If $\Delta V \leq -KV$	then	V2 = VRMIN
If $\Delta V \geq KV$	then	V2 = VRMAX

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – IEEEX1

IEEE Type 1 Excitation System



VS = VPSS+VOEL+VUEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TB	Seconds	Time constant
TC	Seconds	Time constant
KA	Pu	Gain
TA	Seconds	Time constant
VRMAX	Pu	Limiter
VRMIN	Pu	Limiter
TE	Seconds	Time constant
KE	Pu	Gain
KF	Pu	Gain
TF	Seconds	Time constant
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

$0 \le TR < 0.5$
$10 < KA < 500$
$0 \le TA < 1$
$0.5 < VRMAX < 10$
$-10 < VRMIN < 0$
$-1 \le KE \le 1$
$0.04 < TE < 1$
$0 < KF < 0.3$
$0.04 < TF < 1.5$
$5 \le TF/KF \le 15$

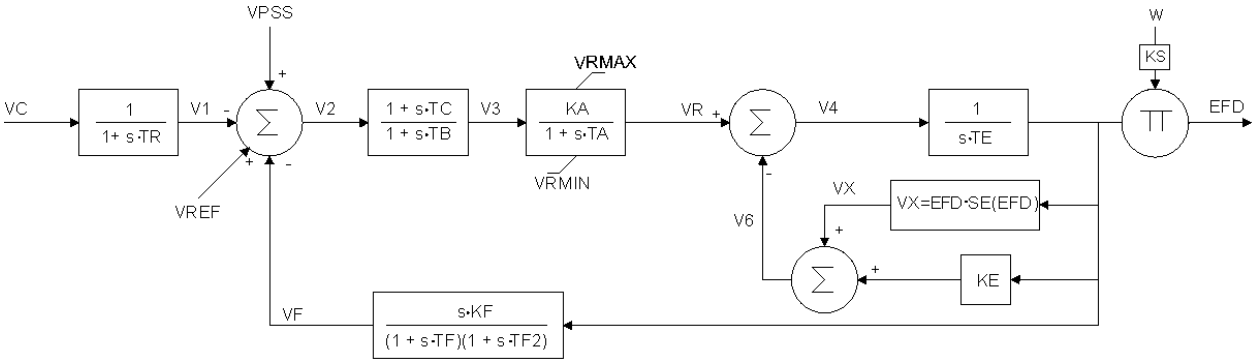
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – IEEEX2

1979 IEEE Type 2 Excitation System Model. Also the IEEET2-exciter can be modeled with the IEEEX2-exciter. In that case the constants TB and TC are set to equal 0.0.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Excitation control system stabilizer gain
TF1	Seconds	Excitation control system stabilizer time constant
TF2	Seconds	Excitation control system stabilizer time constant
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0 ≤ TR < 0.5	-1 ≤ KE ≤ 1
10 < KA < 500	0.04 < TE < 1
0 ≤ TA < 1	0 < KF < 0.3
0.5 < VRMAX < 10	0.04 < TF < 1.5
-10 < VRMIN < 0	5 ≤ TF/KF ≤ 15
0.04 < TF2 < 1.5	5 ≤ TFN/KF ≤ 15

Where:

TFN = TF if S2 ≤ S
TFN = TF2 if S ≤ S2
S = |1 - TF/TE|
S2 = |1 - TF2/TE|

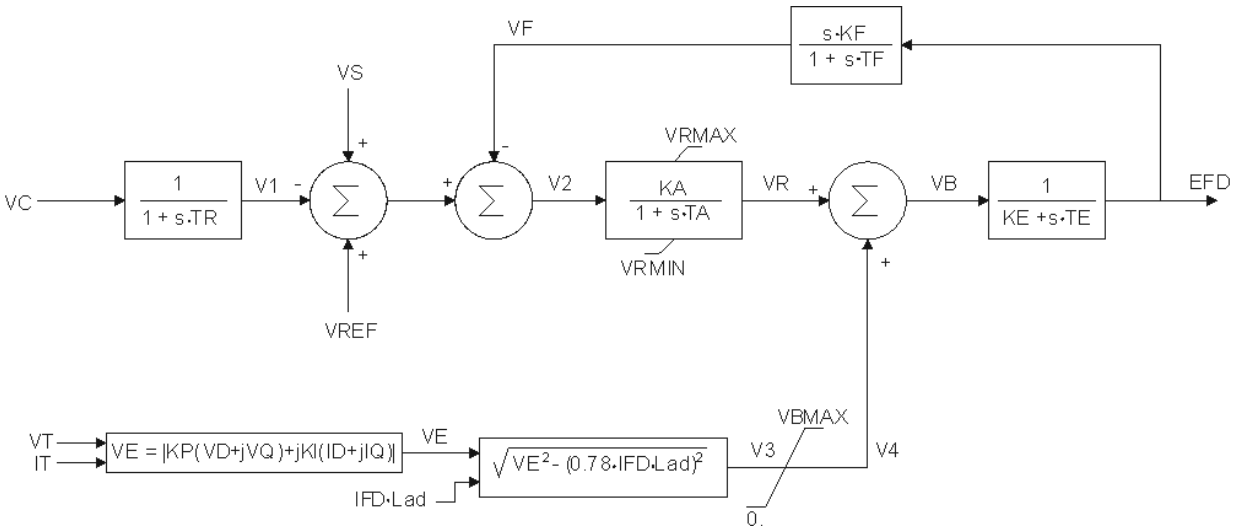
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcDC2A

EXCITER – IEEEX3

IEEE Type 3 Excitation System Model.



VS = VPSS+VOEL+VUEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
VBMAX	PU	Maximum value of siganl V4
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Excitation control system stabilizer gain
TF	Seconds	Excitation control system stabilizer time constant
KP	PU	Potential circuit gain coefficient
KI	PU	Courent circuit gain coefficient

Parameters Range:

0 ≤ TR < 0.5
10 < KA < 200
0 ≤ TA < 1
0.5 < VRMAX < 1.5
-1.5 < VRMIN < -0.5
0.04 < TE < 2
0 < KF < 0.3
0.04 < TF < 1.5
5 ≤ TF/KF ! 15
KP = 1.19
0.9 < KI < 1.1
1.0 < VBMAX < 4.0
0 < KE ≤ 1.0

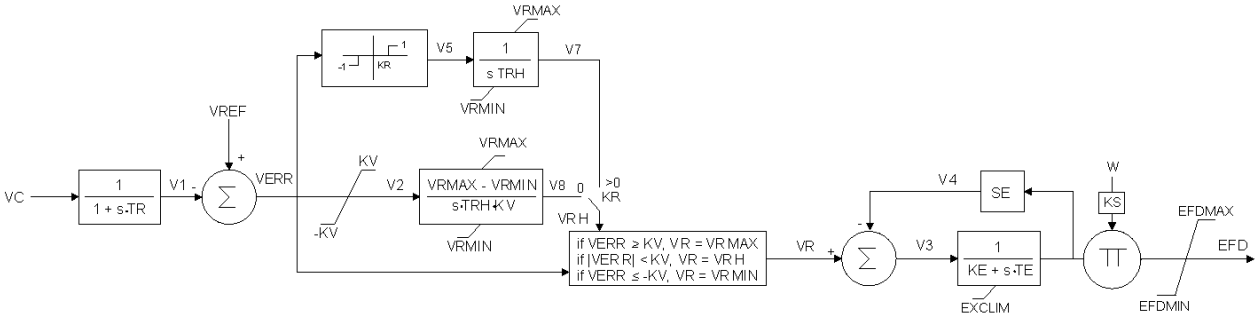
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - IEEEX4

IEEE Type 4 Excitation System



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TRH	Pu	Rheostat travel time
KV	Pu	Fast raise/lower contact setting
VRMAX	Pu	Maximum voltage regulator output
VRMIN	Pu	Minimum voltage regulator output
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KE	Pu	Exciter constant related to self-excited field
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	pu	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Parameters Range:

0.01 < KR < 0.05
2.0 < TRH < 100
0.02 < KV < 0.10
KR < KV
2.0 < VRMAX < 10.0
0 ≤ VRMIN < 2.0
0.04 < TE < 1.0
-1.0 < KE < 0.10
0 ≤ E1
0 ≤ SE(E1) < 1
E1 < E2
SE(E1) < SE(E2)

Notes

1) If VRMAX is zero, the model will compute a new value of it.
a) If KE is zero or negative, VRMAX will just allow the exciter to reach an output voltage of E2 i.e.: VRMAX = SE(E2) × E2
b) If KE is positive, VRMAX will just allow the exciter to reach an output

voltage of E2 with the specified value of KE,
i.e.: VRMAX = (SE (E2) + KE) × E2
In either case above, VRMIN is then set to –VRMAX.

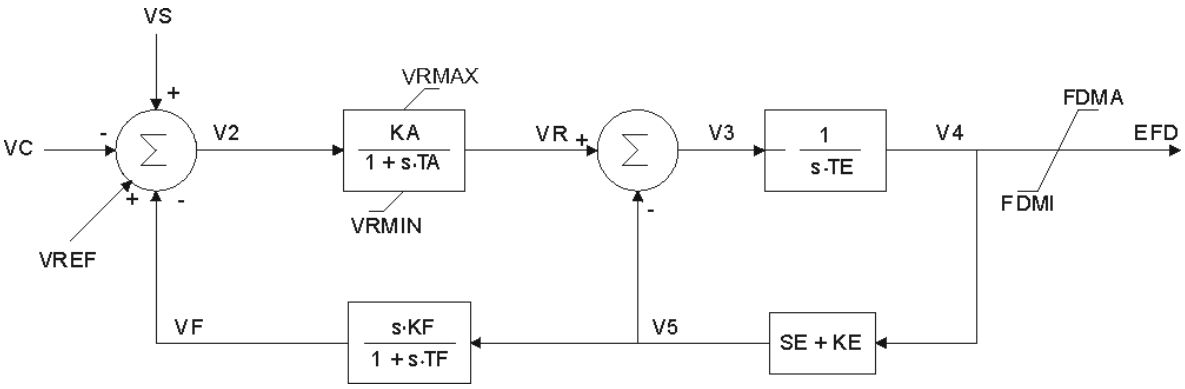
2) If KE is zero, the model will set a new value of KE.
KE is set to the value that will require a voltage regulator output of
(VRMAX /10) to maintain the present value of excitation voltage, UF, i.e.:
KE =VRMAX/(10 UF) - SE (UF)

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcDC3A (only valid with kr = 0 in CIM/CGMES)

EXCITER - IEET1A

Modified IEEE Type 1 Excitation System



VS = VPSS+VUEL+VOEL

Parameters

NAME	Type	Description
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
FDMI	pu	Minimum field voltage
FDMA	pu	Maximum field voltage
E1	pu	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	pu	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
SEMAX	pu	Exciter saturation function value at the corresponding exciter voltage, FDMA, back of commutating reactance

Parameters Range:

$0 \le TR < 0.5$	$-1 \le KE \le 1$
$10 < KA < 500$	$0.04 < TE < 1$
$0 \le TA < 1$	$0 < KF < 0.3$
$0.5 < VRMAX < 10$	$0.04 < TF < 1.5$
$-10 < VRMIN < 0$	$5 \le TF/KF \le 15$

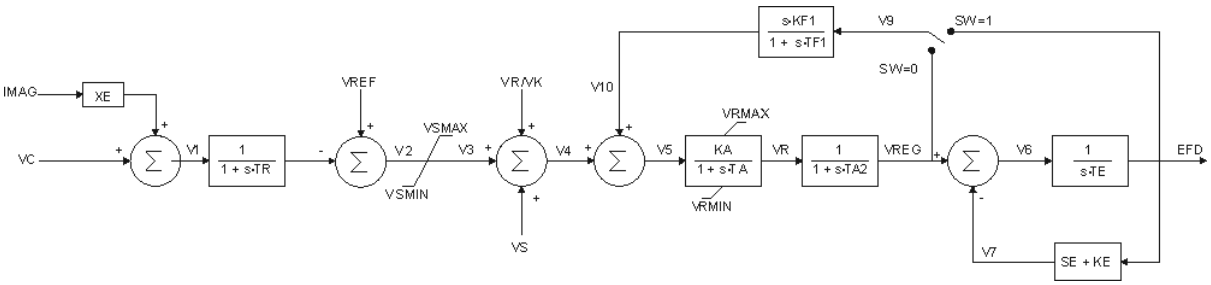
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - IEET1B

Modified IEEE Type 1 Excitation System



VS = VPSS + VUEL + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
XE	PU	Excitation transformer effective reactance
SW	Integer	Swtich control (see block diagram) 0 = feedback from VREG 1 = feedback from EFD
VSMAX		Maximum voltage regulator output
VSMIN		Minimum voltage regulator output
KA		Voltage regulator gain
TA1		Voltage regulator time constant
VRMAX		Maximum voltage regulator output
VRMIN		Minimum voltage regulator output
TA2		Lag time constant
KF1		Excitation control system stabilizer gains
TF1		Excitation control system stabilizer time constant
KE		Exciter constant related to self-excited field
TE		Exciter time constant, integration rate associated with exciter control
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

Notes

VR/KA is calculated during the initiating and is constant thereafter.

1) If VRMAX is zero, the model will compute a new value of it.
a) If KE is zero or negative, VRMAX will just allow the exciter to reach an output voltage of E2 i.e.: VRMAX = SE(E2) × E2
b) If KE is positive, VRMAX will just allow the exciter to reach an output voltage of E2 with the specified value of KE,
i.e.: VRMAX = (SE (E2) + KE) × E2
In either case above, VRMIN is then set to –VRMAX.

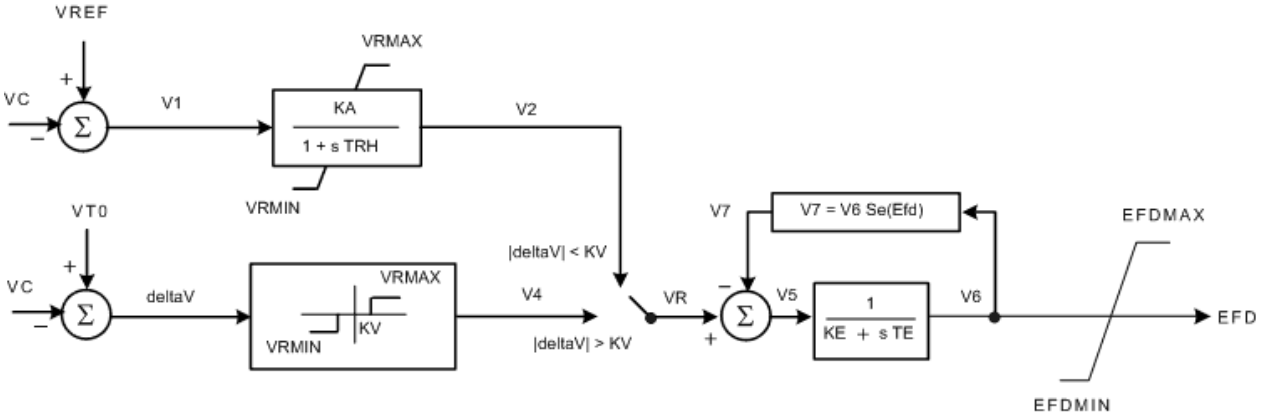
2) If KE is zero, the model will set a new value of KE.
KE is set to the value that will require a voltage regulator output of (VRMAX /10) to maintain the present value of excitation voltage, UF, i.e.:
KE =VRMAX/(10 UF) - SE (UF)

$$IMAG = \sqrt{ID^2 + IQ^2}$$

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – IEET5A



Parameters

NAME	Type	Description
KA	PU	Regulator gain
TRH	Seconds	Rheostat travel time
KV	PU	Fast raise/lower contact setting
VRMIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
EFDMIN	PU	Minimum field voltage
EFDMAX	PU	Maximum field voltage
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

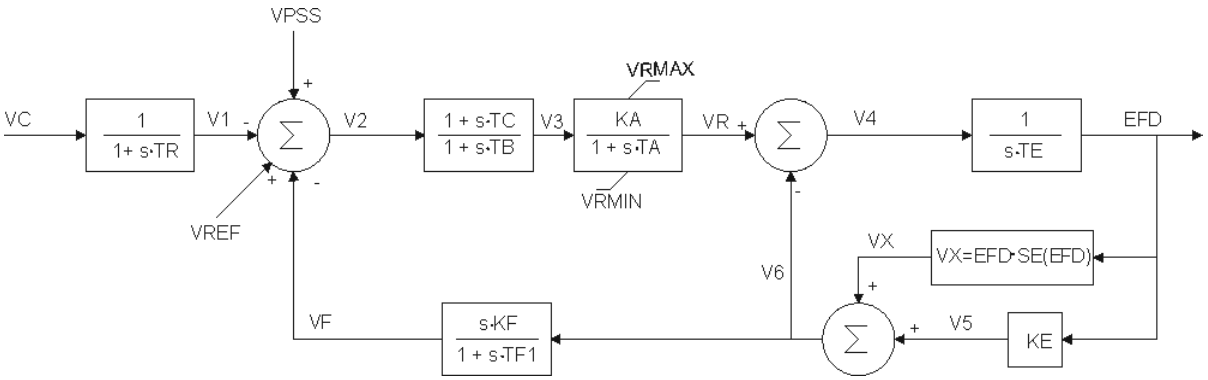
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – IEEX2A

IEEE Type 2 Excitation System Model



VS = VPSS+VOEL+VUEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
VRMIN	PU	Minimum voltage regulator output
VRMAX	PU	Maximum voltage regulator output
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
KF	PU	Excitation control system stabilizer gain
TF1	Seconds	Excitation control system stabilizer time constant
TE	PU	Exciter time constant, integration rate associated with exciter control
KE	PU	Exciter constant related to self-excited field
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance

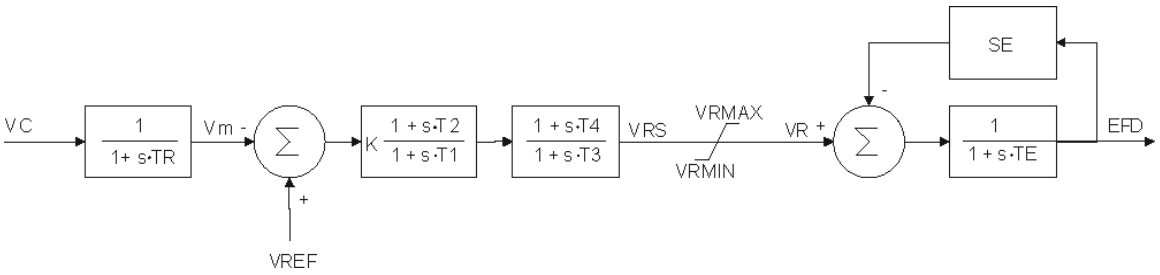
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES Model

EXCITER – PSAT Type1

IEEE model 1 (PSAT)



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
K	PU	Gain
T1	Seconds	Time constant
T2	Seconds	Time constant
T3	Seconds	Time constant
T4	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
TE	Seconds	Time constant
AE	PU	Saturation parameter (see note)
BE	PU	Saturation parameter (see note)

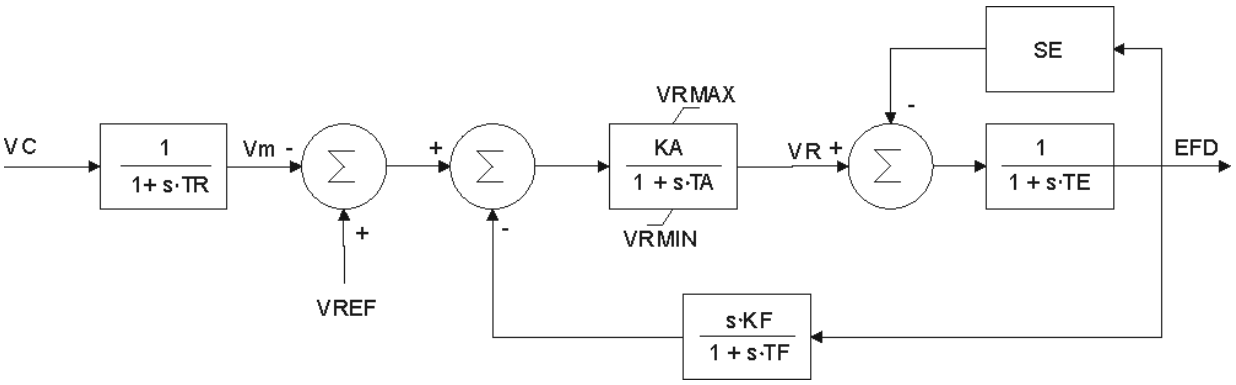
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – PSAT Type2

IEEE model 2 (PSAT)



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
TE	Seconds	Time constant
AE	PU	Saturation parameter (see note)
BE	PU	Saturation parameter (see note)
KF	PU	Feedback gain
TF	Seconds	Feedback time constant

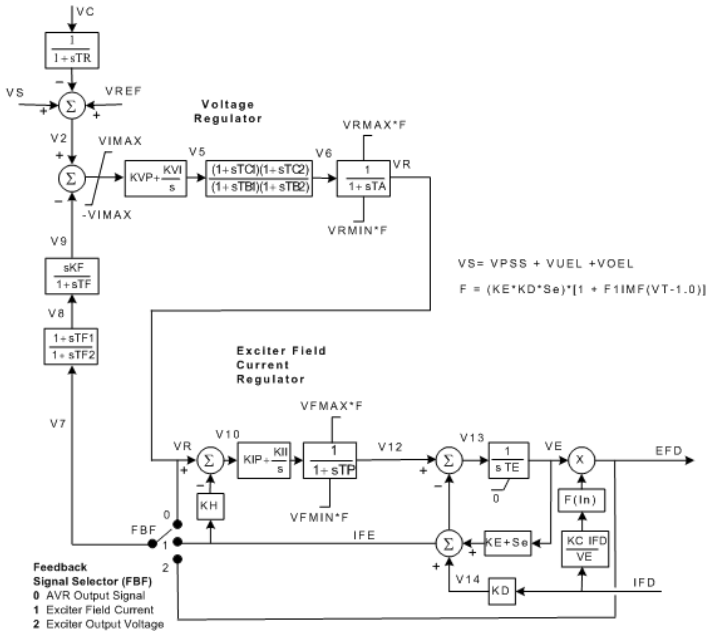
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - REXSYS

General Purpose Rotating Excitation System Model.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KVP	PU	Voltage Regulator Proportional Gain
KVI	PU	Voltage Regulator Integral Gain
VIMAX	PU	Voltage Regulator Input Limit
TA	Seconds	Voltage Regulator time constant
TB1	Seconds	Time constant
TC1	Seconds	Time constant
TB2	Seconds	Time constant
TC2	Seconds	Time constant
VRMIN	PU	Minimum controller output
VRMAX	PU	Maximum controller output
KF	PU	Rate feedback gain
TF	Seconds	Rate feedback time constant
TF1	Seconds	Rate feedback time constant
TF2	Seconds	Rate feedback time constant
FBF*	enum	Rate feedback signal flag (Fbf). Typical Value = fieldCurrent
KIP	PU	Field Current Regulator Proportional Gain
KII	PU	Field Current Regulator Integral Gain
TP	Seconds	Field current Bridge time constant
VFMIN	PU	Minimum Exciter Field Current

VFMAX	PU	Maximum Exciter Field Current
KH	PU	Field voltage controller feedback
KE	PU	Exciter field proportional constant
TE	Seconds	Exciter field time constant
KC	PU	Rectifier regulation factor
KD	PU	Exciter regulation factor
E1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, E1, back of commutating reactance
E2	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, E2, back of commutating reactance
F1IMF	PU	Limit type flag

* Description pag. 17

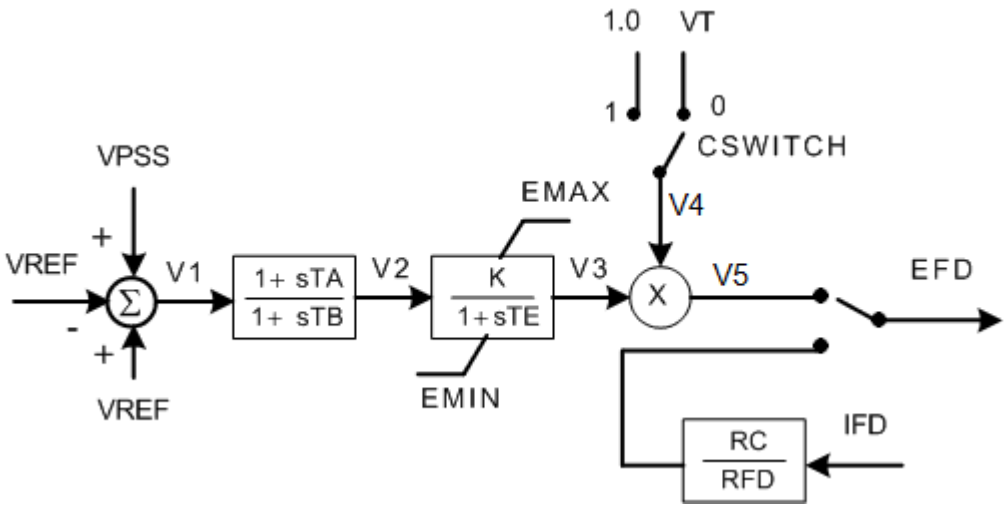
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- ExcREXS

EXCITER - SCRX

Simple excitation system model representing generic characteristics of many excitation systems.



Parameters

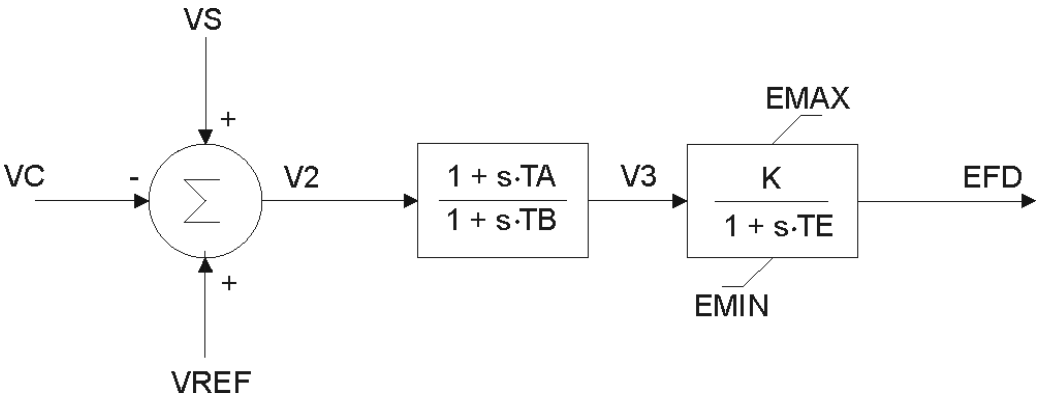
NAME	Type	Description
TATB	Float	Ta/Tb - gain reduction ratio of lead-lag element
TB	Seconds	Time constant
K	PU	Gain
TE	Seconds	Time constant
EMIN	PU	Minimum field voltage output
EMAX	PU	Maximum field voltage output
RCRFD	Float	Rc/Rfd - ratio of field discharge resistance to field winding resistance
CSWITCH	Boolean	Power source switch 0 = input is set to 1 1 = input is set as generator terminal voltage.

Notes

Equivalent model in CIM/CGMES:
- ExcSCRX

EXCITER – SEXS

Simplified Excitation system



VS = VPSS + VOEL +VUEL

Parameters

NAME	Type	Description
TA	Seconds	Time Constant
TB	Seconds	Time Constant
K	PU	Gain
TE	Seconds	Time Constant
EMAX	PU	Limiter
EMIN	PU	Limiter

Parameters Range:

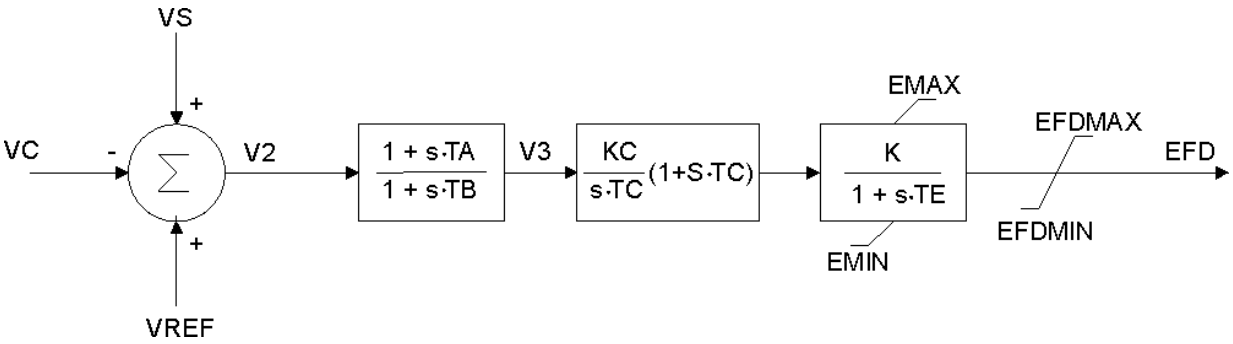
0.05 < TA/TB < 1
5 < TB < 20
20 < K ≤ 100
0 ≤ TE < 0.5
5 ≤ K × TA/TB ≤ 15
EMIN = 0
3 ≤ EMAX ≤ 6

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – SEXS 2005

Simplified Excitation system, version 2005



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TATAB	Float	Ta/Tb - gain reduction ratio of lead-lag element
TB	Seconds	Time constant
KC	PU	PI controller gain
TC	Seconds	PI time constant
K	PU	Gain
TE	Seconds	Time constant
EMIN	PU	Minimum field voltage output
EMAX	PU	Maximum field voltage output
EFDMIN	PU	Field voltage clipping minimum limit
EFDMAX	PU	Field voltage clipping maximum limit

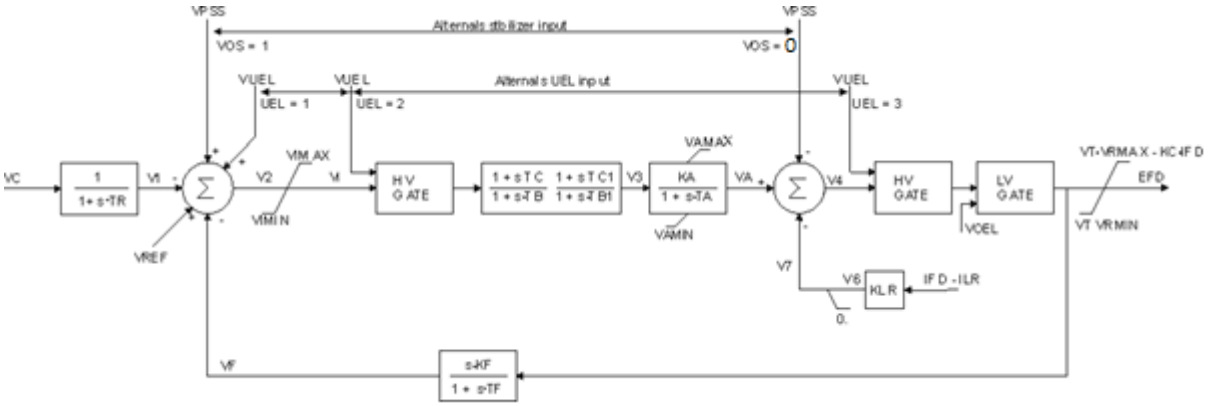
Notes

Same remarks as the SEXS model

Equivalent model in CIM/CGMES:
- ExcSEXS

EXCITER - ST1A

IEEE Type ST1A Excitation System



Parameters

NAME	Type	Description
VOS	Boolean	Selector of the Power System Stabilizer input. (see block diagram) 1 = PSS input (VPSS) added to error signal 0 = PSS input (VPSS) added to voltage regulator output.
UEL	enum	Selector of the connection of the UEL input. (see block diagram) 0 = ignore VUEL signal 1 = VUEL input added to error signal. 2 = VUEL input HV gate with error signal 3 = VUEL input HV gate with volt. reg. output
TR	Seconds	Filter time constant
VIMAX	pu	Maximum voltage regulator input limit
VIMIN	pu	Minimum voltage regulator input limit
TB	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
TC1	Seconds	Voltage regulator time constant
TB1	Seconds	Voltage regulator time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VAMAX	pu	Maximum voltage regulator output limit
VAMIN	pu	Minimum voltage regulator output limit
KLR	pu	Exciter output current limiter gain
ILR	pu	Exciter output current limit reference
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
VRMAX	pu	Maximum voltage regulator output limit
VRMIN	pu	Minimum voltage regulator output limit

KC	pu	Rectifier loading factor proportional to commutating reactance

Parameters Range:

0 < TR < 0.1	3 ≤ VAMAX ≤ 8
0 < VIMAX ≤ 0.2	-8 < VAMIN ≤ -3
-0.3 < VIMIN ≤ 0	3 ≤ VRMAX ≤ 8
0 < TC < 10.0	-8 ≤ VRMIN ≤ -3
0.04 < TB < 20	0 ≤ KC < 0.3
0 ≤ TC1 < 10	0 < KF ≤ 0.3
0.04 < TB1 < 20	0.3 < TF ≤ 1.5
5 ≤ KA × TC/TB ≤ 15	0 < KLR ≤ 5.0
50 < KA ≤ 1000	0 < ILR ≤ 5.0
0.04 < TA < 0.5	

Notes

VOS
A switch that controls where the inputs signal VS is subtracted to the exciter. The parameter SWS sets which system stabilizer that calculates the value of VS.

VOS = 1 The input signal VS is subtracted to the sum with the output signal V2.
VOS = 2 The input signal VS is subtracted to the sum with the output signal V4.

If no system stabilizer is associated, i.e., SWS = 0, the parameter VOS is ignored. Default = 1

UEL
A switch that controls where the input signal VU is injected to the exciter. The parameter SWU sets which under excitation limiter that calculates the value of VU.

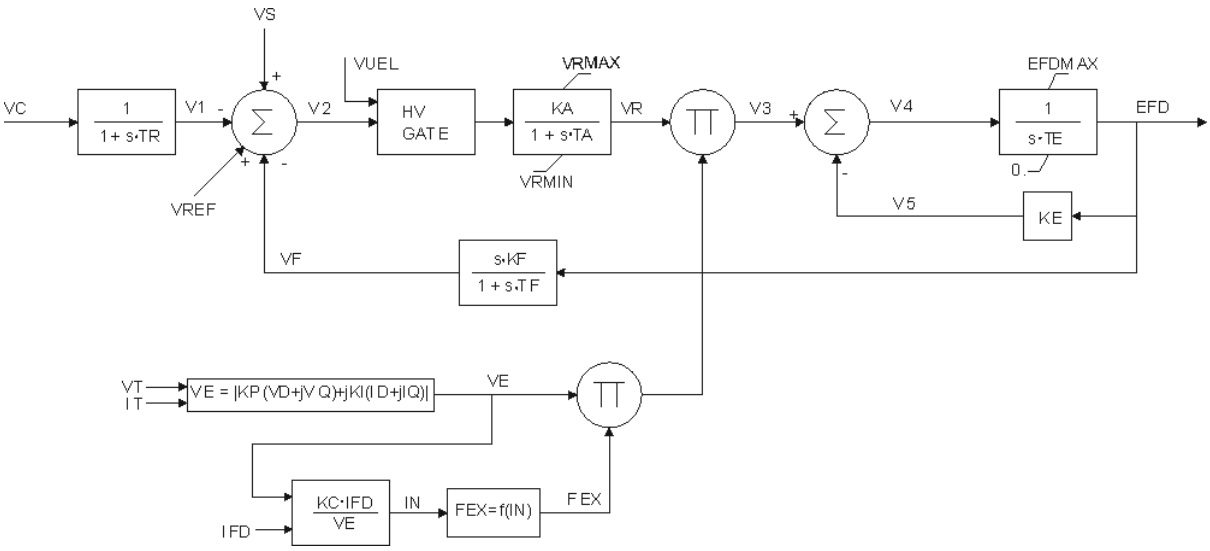
UEL = 1 The input signal VU is added to the sum with the output signal V2.
UEL = 2 The input signal VU is one of the input signals to the left HV-gate.
UEL = 3 The input signal VU is one of the input signals to the right HV-gate.

If no under excitation limiter is associated, i.e., SWU = 0, the parameter UEL is ignored. Default = 1

Equivalent model in CIM/CGMES:
- ExcIEEEST1A

EXCITER - ST2A

IEEE Type ST2A Excitation System



VS = VPSS + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
KP	pu	Potential circuit gain coefficient
KI	pu	Potential circuit gain coefficient
KC	pu	Rectifier loading factor proportional to commutating reactance
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
UFMAX	pu	Maximum field voltage
UEL	Boolean	UEL input, 1 = VUEL input added to HV Gate. 0 = VUEL input added to error signal.

Parameters Range:

0 < TR < 0.5
10 < KA < 1000
0 < TA < 1
0.5 < VRMAX < 1.5
0 < KF < 0.3
0.04 < TF < 1.5
5 ≤ TF/ KF ≤ 20
KP = 1.19

- 1.5 < VRMIN < 0.5
0 < KE ≤ 1
0.04 < TE < 2

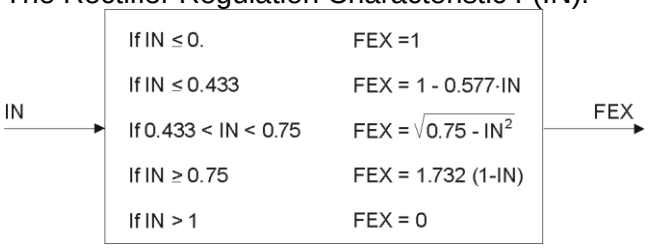
0 ≤ KI ≤ 8.0
0 < KC < 2
1 < EFDMAX < 10

Notes

VT and IT definition:

VT	The bus voltage, p.u. (= VD + jVQ)
IT	The stator current, p.u. (= ID + jIQ)

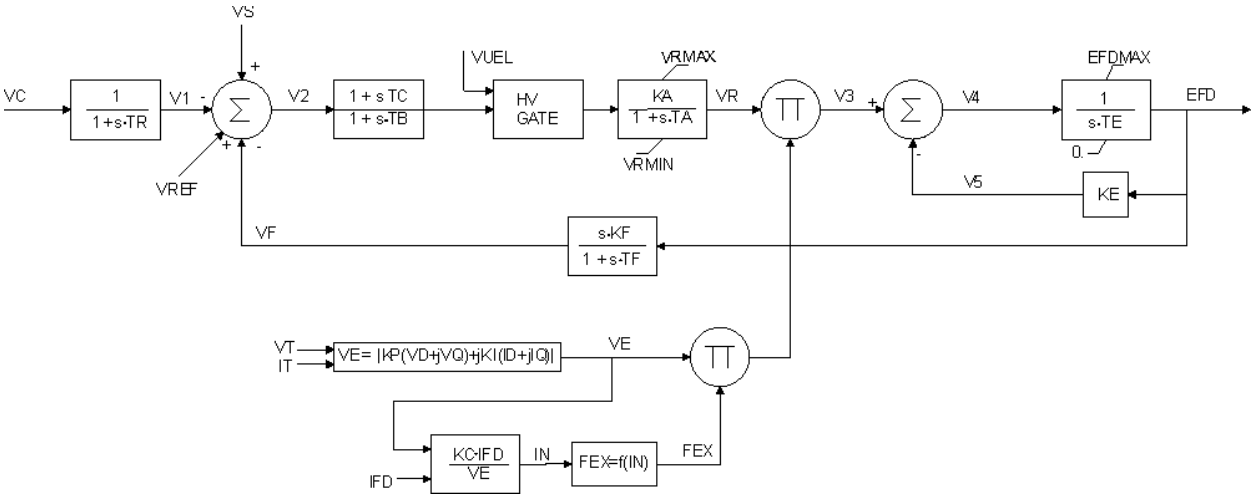
The Rectifier Regulation Characteristic F(IN):



Equivalent model in CIM/CGMES:
ExcIEEEST2A

EXCITER - ST2A 2005

ST2A Excitation System, Entsoe-CIM/CGMES modified model



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KA	pu	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
TC	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
VRMAX	pu	Maximum voltage regulator outputs
VRMIN	pu	Minimum voltage regulator outputs
KP	pu	Potential circuit gain coefficient
KI	pu	Potential circuit gain coefficient
KC	pu	Rectifier loading factor proportional to commutating reactance
KE	pu	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	pu	Excitation control system stabilizer gains
TF	Seconds	Excitation control system stabilizer time constant
UFMAX	pu	Maximum field voltage
UEL	Boolean	UEL input, 1 = VUEL input added to HV Gate. 0 = VUEL input added to error signal.

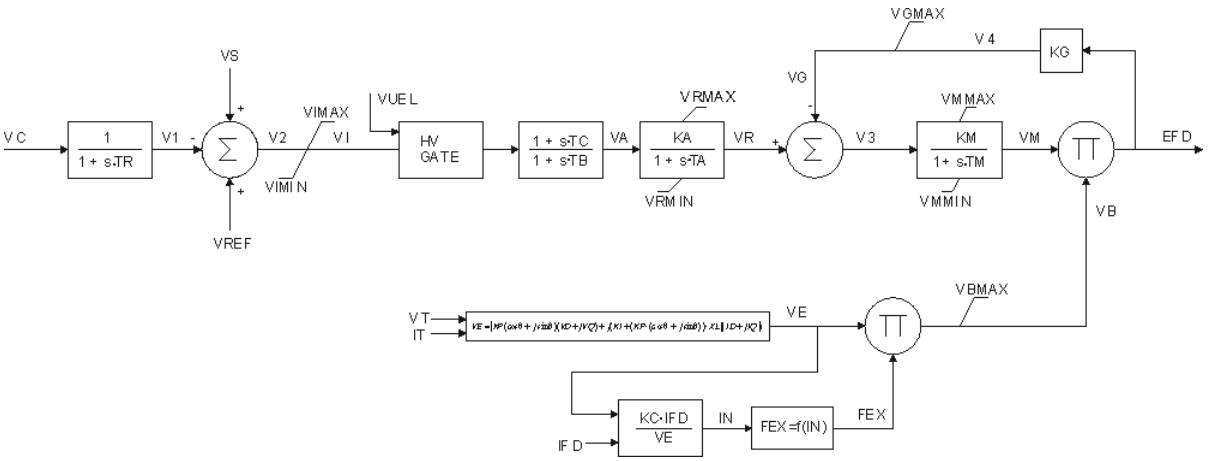
Notes

Same remarks as the ESST2A model

Equivalent model in CIM/CGMES:
- ExcST2A

EXCITER - ST3A

IEEE Type ST3A Excitation System



VS = VPSS + VOEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	PU	Maximum voltage regulator input limit
VIMIN	PU	Minimum voltage regulator input limit
TC	Seconds	Voltage regulator time constant
TB	Seconds	Voltage regulator time constant
KA	PU	Voltage regulator gain
TA	Seconds	Voltage regulator time constant
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
KG	PU	Feedback gain constant of the inner loop field regulator
VGMAX	PU	Maximum inner loop feedback voltage
KM	PU	Forward gain constant of the inner loop field regulator
TM	Seconds	Forward time constant of inner loop field regulator
VMMAX	PU	Maximum inner loop output
VMMIN	PU	Minimum inner loop output
KP	PU	Potential circuit gain coefficient
KI	PU	Potential circuit gain coefficient
VBMAX	PU	Maximum excitation voltage
KC	PU	Rectifier loading factor proportional to commutating reactance
XL	PU	Reactance associated with potential source

Parameters Range:

0 < TR < 0.5
0 < V1MAX < 1
- 1 < V1MIN < 0
0 < TC < 20
1 < UEMAX < 20
0 ≤ KG < 1.1
0 < VGMAX < 20
1 < KP < 10

0.04 < TB < 20
0 < KA ≤ 200
0 < TA < 1.0
0.5 < VRMAX ≤ 10
-10 ≤ VRMIN < 0.5
0 ≤ TM < 1.0
0 < KM < 1000

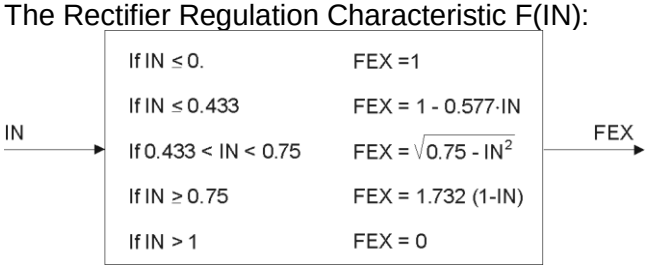
0 ≤ KI ≤ 1.1
0 ≤ KC < 1
0 < VBMAX < 20
0 < XL < 0.5
-90 < TETA < 90
-1.5 < VMMIN < 0.5
0.5 < VMMAX ≤ 1.5

Notes

VT and IT definition:

VT	The bus voltage, p.u. (= VD + jVQ)
IT	The stator current, p.u. (= ID + jIQ)

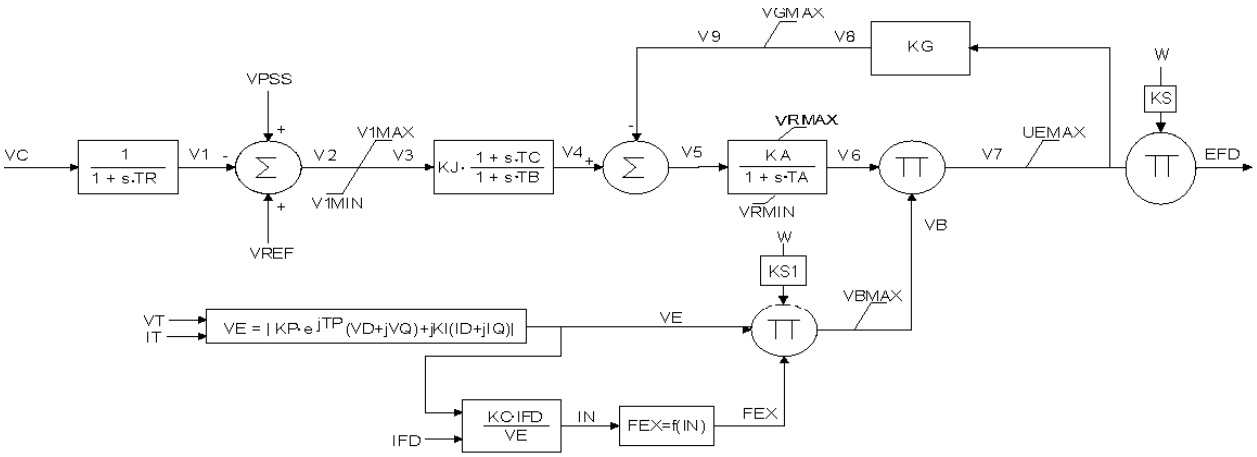
The Rectifier Regulation Characteristic F(IN):



Equivalent model in CIM/CGMES:
- ExcIEEEST3A

EXCITER - ST3

Excitation system with DC commutator exciter.



Parameters

NAME	Type	Description
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD
TR	Seconds	Filter time constant
TC	Seconds	Regulator time constant
TB	Seconds	Regulator time constant
KJ		Regulator gain
KA	PU	Regulator gain
TA	Seconds	Regulator time constant
KP	PU	Potential circuit gain coefficient
KI	PU	Courent circuit gain coefficient
KC	PU	Rectifier loading factor proportional to commutating reactance
KG	PU	Exciter constant related to self-excited field
TP	degree	Only used in SIMPOW model, with dynamic simulator the angle value is automaticaly coupled with the machne.
XL	PU	Excitation control system stabilizer gains
UEMAX	PU	Maximum voltage regulator outputs
VGMAX	PU	Minimum voltage regulator outputs
V1MAX	PU	Maximum voltage regulator outputs
V1MIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
VBMAX	PU	Maximum voltage regulator outputs

Parameters Range:

0 < TR < 0.5
0 < V1MAX < 1
- 1 < V1MIN < 0
1 < UEMAX < 20
0 ≤ KG < 1.1
0 < VGMAX < 20

0 < TC < 20
0.04 < TB < 20
0 < KA ≤ 200
0 < TA < 1.0
0.5 < VRMAX ≤ 10
-10 ≤ VRMIN < 0.5

1 < KP < 10
0 ≤ KI ≤ 1.1
0 ≤ KC < 1
0 < VBMAX < 20
0 < XL < 0.5

Notes

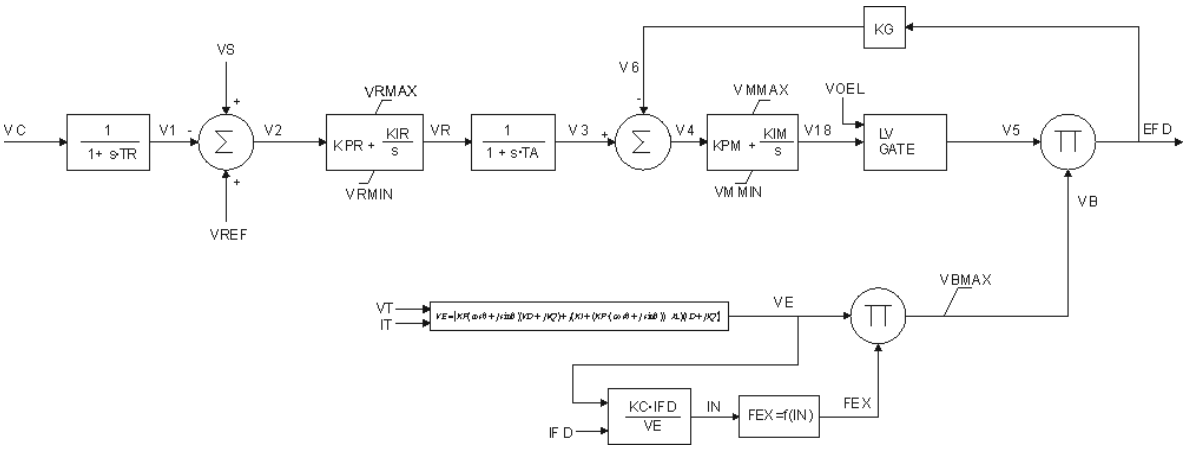
VT and IT definition:

VT	The bus voltage, p.u. (= VD + jVQ)
IT	The stator current, p.u. (= ID + jIQ)

Equivalent model in CIM/CGMES:
- ExcST3A

EXCITER - ST4B

IEEE Type ST4B Potential or Compounded Source-Controlled Rectifier Exciter



VS = VPSS + VUEL

Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KPR	PU	Voltage regulator proportional gain
KIR	PU	Voltage regulator integral gain
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
TA	Seconds	Voltage regulator time constant
KPM	PU	Voltage regulator proportional gain output
KIM	PU	Voltage regulator integral gain output
VMMAX	PU	Maximum inner loop output
VMMIN	PU	Minimum inner loop output
KG	PU	Feedback gain constant of the inner loop field regulator
KP	PU	Potential circuit gain coefficient
KI	PU	Potential circuit gain coefficient
VBMAX	PU	Maximum excitation voltage
KC	PU	Rectifier loading factor proportional to commutating reactance
XL	PU	Reactance associated with potential source

Parameters Range:

$0 < TR < 0.5$
$0 \le KPR \le 75$
$0 \le KIR \le 75$
$0.8 \le VRMAX \le 10$
$-6 \le VRMIN \le 0$
$0 < TA < 1$
$0 \le KPM \le 1.2$
$-118.8 \le VMMIN \le 0$
$0 \le KG < 1.1$
$1 \le KP < 10$
$0 \le KI \le 1.1$
$1 < VBMAX < 20$
$0 \le KC < 1$
$0 \le XL < 0.5$

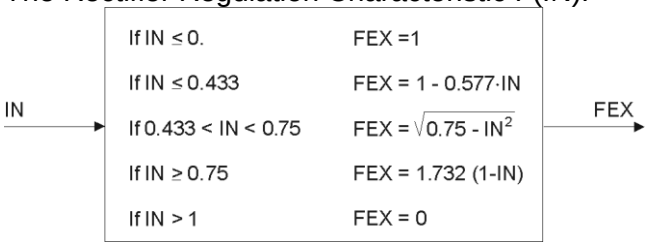
0 ≤ KIM ≤ 18 -90 <THETA < 90
0.8 ≤ VMMAX ≤ 118

Notes

VT and IT definition:

VT	The bus voltage, p.u. (= VD + jVQ)
IT	The stator current, p.u. (= ID + jIQ)

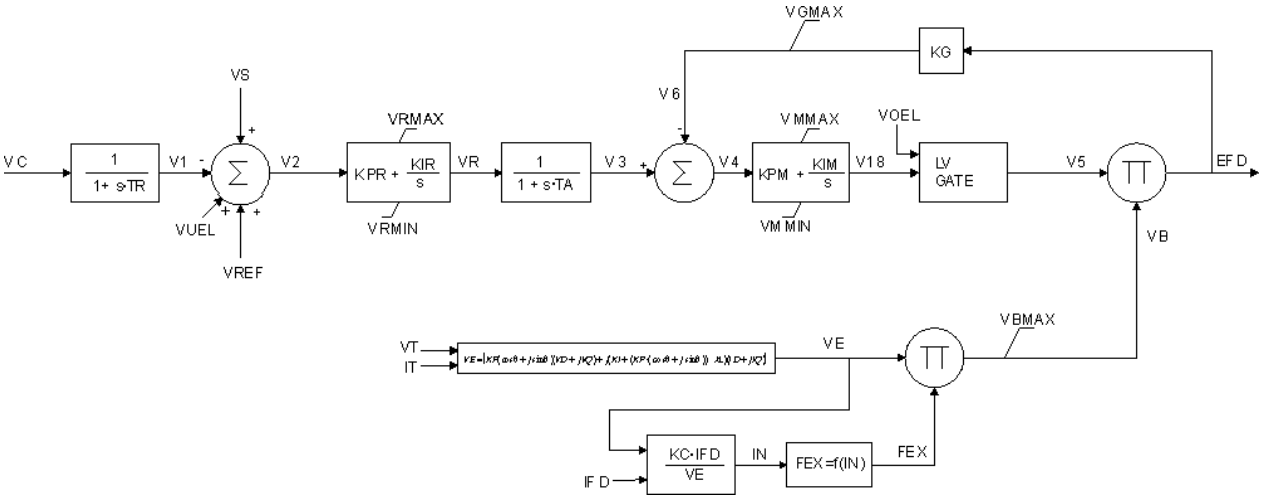
The Rectifier Regulation Characteristic F(IN):



Equivalent model in CIM/CGMES:
- ExcIEEEST4B

EXCITER - ST4B 2005

ST4B Potential or Compounded Source-Controlled Rectifier, Entsoe-CIM/CGMES modified.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KPR	PU	Voltage regulator proportional gain
KIR	PU	Voltage regulator integral gain
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
TA	Seconds	Voltage regulator time constant
KPM	PU	Voltage regulator proportional gain output
KIM	PU	Voltage regulator integral gain output
VMMAX	PU	Maximum inner loop output
VMMIN	PU	Minimum inner loop output
KG	PU	Feedback gain constant of the inner loop field regulator
VGMAX	PU	Maximum inner loop feedback voltage
KP	PU	Potential circuit gain coefficient
KI	PU	Potential circuit gain coefficient
VBMAX	PU	Maximum excitation voltage
KC	PU	Rectifier loading factor proportional to commutating reactance
XL	PU	Reactance associated with potential source

Parameters Range:

0 < TR < 0.5
0 ≤ KPR ≤ 75
0 ≤ KIR ≤ 75
0.8 ≤ VRMAX ≤ 10
-6 ≤ VRMIN ≤ 0
0 < TA < 1
0 ≤ KPM ≤ 1.2
-118.8 ≤ VMMIN ≤ 0
0 ≤ KG < 1.1
1 ≤ KP < 10
0 ≤ KI ≤ 1.1
1 < VBMAX < 20
0 ≤ KC < 1
0 ≤ XL < 0.5

0 ≤ KIM ≤ 18
0.8 ≤ VMMAX ≤ 118

-90 <THETA < 90

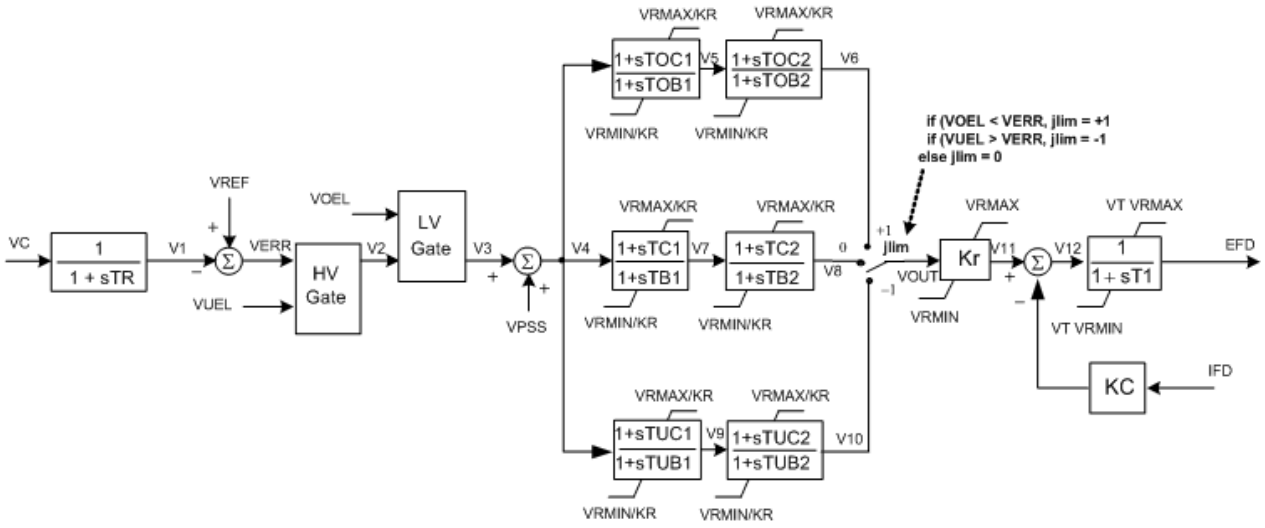
Notes

Same remarks as the ESST4B model

Equivalent model in CIM/CGMES:
- ExcST4B

EXCITER – ST5B

IEEE Type ST5B Excitation System



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC1	Seconds	Regulator time constant
TB1	Seconds	Regulator time constant
TC2	Seconds	Regulator time constant
TB2	Seconds	Regulator time constant
KR	PU	Regulator gain
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
T1	Seconds	Firing circuit time constant
KC	PU	Rectifier regulation factor
TUC1	Seconds	UEL time constant
TUB1	Seconds	UEL time constant
TUC2	Seconds	UEL time constant
TUB2	Seconds	UEL time constant
TOC1	Seconds	OEL time constant
TOB1	Seconds	OEL time constant
TOC2	Seconds	OEL time constant
TOB2	Seconds	OEL time constant

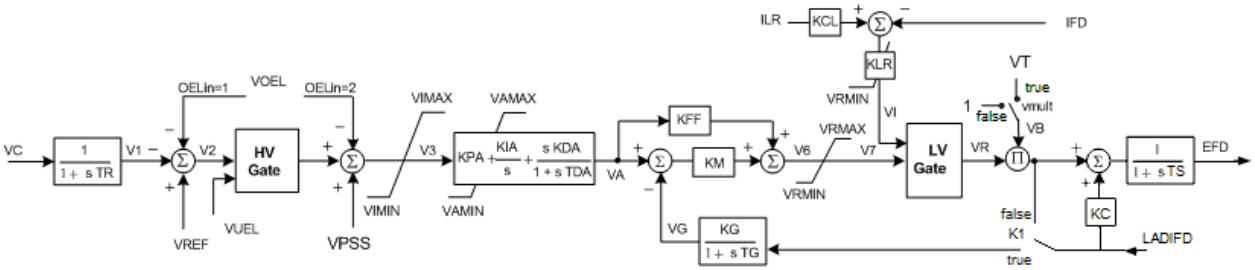
Notes

VOUT = V6 if VOEL < VERR
VOUT = V10 if VUEL > VERR
VOUT = V8 in other cases

Equivalent model in CIM/CGMES:
- ExcIEEEST5B

EXCITER – ST6B

Type ST6B Excitation System, Entsoe-CIM/CGMES modified.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
KPA	PU	Voltage regulator proportional gain
KIA	PU	Voltage regulator integral gain
KDA	PU	Voltage regulator derivative gain
TDA	Seconds	Voltage regulator derivative time constant
VAMAX	PU	Maximum voltage regulator output
VAMIN	PU	Minimum voltage regulator output
KFF	PU	Pre-control gain constant of the inner loop field regulator
KM	PU	Forward gain constant of the inner loop field regulator
KCI	PU	Exciter output current limit adjustment
KLR	PU	Exciter output current limiter gain
ILR	PU	Exciter output current limit reference
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
KG	PU	Feedback gain constant of the inner loop field regulator
TG	Seconds	Feedback time constant of inner loop field voltage regulator
VIMIN	PU	Maximum voltage regulator output
VIMAX	PU	Minimum voltage regulator output
XC	PU	Excitation source reactance
TS	Seconds	Rectifier firing tme constant
K1	Boolean	Feedback selector 0= EFD feedback 1= IFD feedback
OEL*	enum	OEL input selector (OELin). Typical Value = noOELinput
VMULT	Boolean	Output multiplication factor 0 = output signal multiplied by 1 1 = output signal multiplied by VT

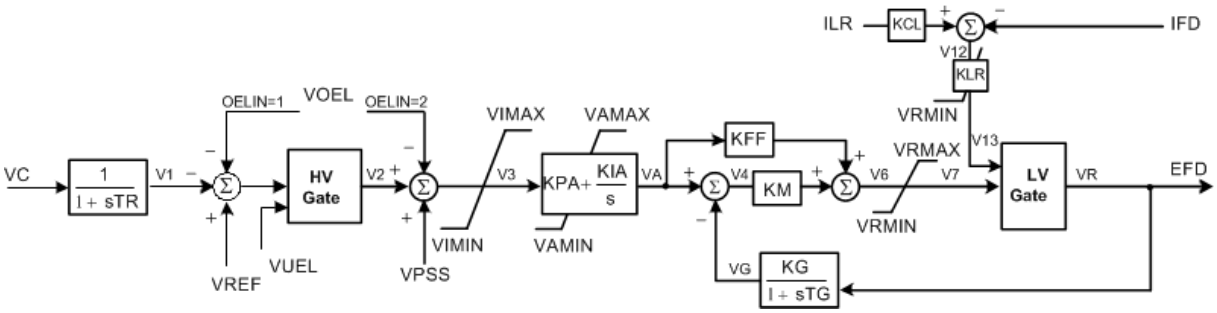
* Description pag. 17

Notes

Equivalent model in CIM/CGMES:
- ExcST6B

EXCITER – ST6B CIM/CGMES

IEEE ST6B static excitation system with PID controller and optional inner feedbacks loop (Entsoe-CIM/CGMES model).



Parameters

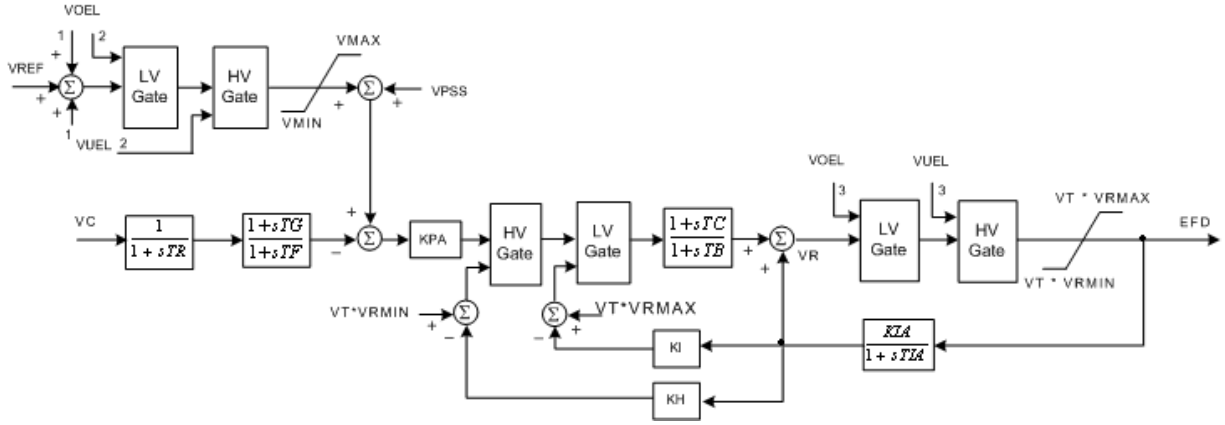
NAME	Type	Description
TR	Seconds	Filter time constant
OEL	enum	* OEL input selector (OELin). Typical Value = noOELinpu
VIMAX	pu	Maximum voltage regulator output
VIMIN	pu	Minimum voltage regulator output
KPA	pu	Voltage regulator proportional gain
KIA	pu	Voltage regulator integral gain
VAMAX	pu	Maximum voltage regulator output
VAMIN	pu	Minimum voltage regulator output
KFF	pu	Pre-control gain constant of the inner loop field regulator
KM	pu	Forward gain constant of the inner loop field regulator
VRMAX	pu	Maximum voltage regulator output
VRMIN	pu	Minimum voltage regulator output
ILR	pu	Exciter output current limit reference
KCI	pu	Exciter output current limit adjustment
KLR	pu	Exciter output current limiter gain
KG	pu	Feedback gain constant of the inner loop field regulator
TAG	Seconds	Feedback time constant of inner loop field voltage regulator

Notes

Equivalent model in CIM/CGMES:
- ExcIEEEST6B

EXCITER – ST7B

IEEE Type ST7B Excitation System



Parameters

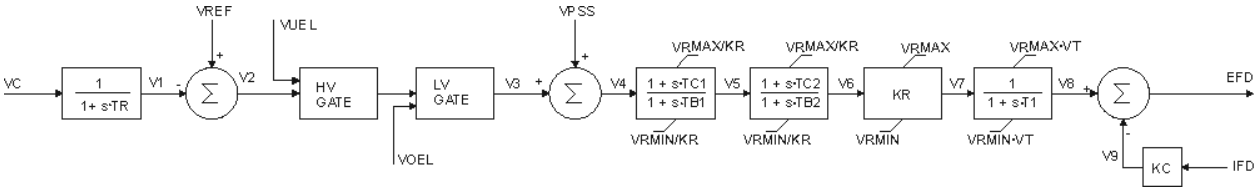
NAME	Type	Description
TR	Seconds	Filter time constant
TG	Seconds	Feedback time constant of inner loop field voltage regulator
TF	Seconds	Excitation control system stabilizer time constant
VMIN	PU	Minimum voltage regulator output
VMAX	PU	Maximum voltage regulator output
KPA	PU	Voltage regulator proportional gain
VRMIN	PU	Minimum voltage regulator output
VRMAX	PU	Maximum voltage regulator output
KH	PU	High-value gate feedback gain
KL	PU	Low-value gate feedback gain
TC	PU	Regulator lead time constant
TB	Seconds	Regulator lag time constant
KIA	PU	Voltage regulator integral gain
TIA	Seconds	Feedback time constant
OEL	enum	OEL input selector (OELin). Typical Value = noOELinput
UEL	enum	UEL input selector (UELin). Typical Value = noUELinput

Notes

Equivalent model in CIM/CGMES:
- ExcIEEEST7B

EXCITER - URST5T

IEEE Proposed/Modified Type ST5B Excitation System



Parameters

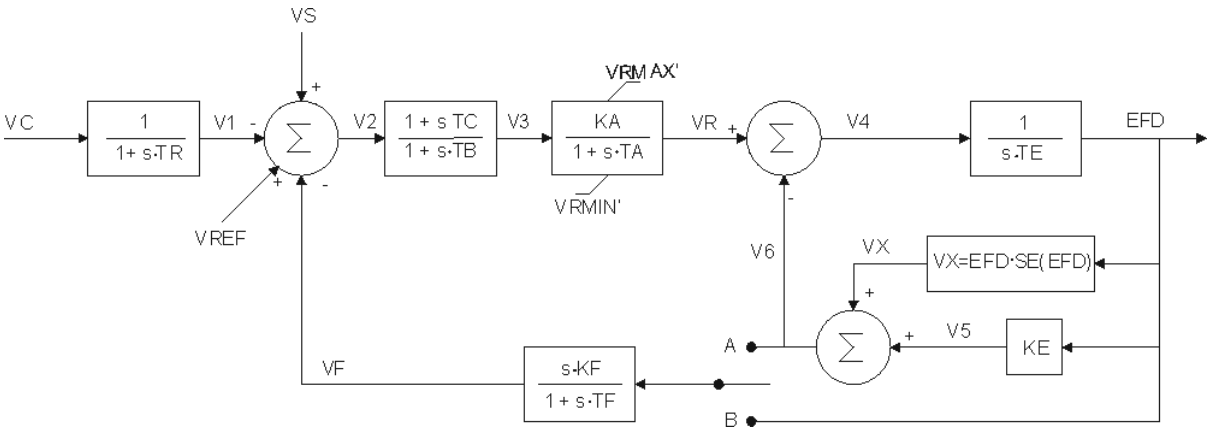
NAME	Type	Description
TR	Seconds	Filter time constant
TC1	Seconds	Regulator time constant
TB1	Seconds	Regulator time constant
TC2	Seconds	Regulator time constant
TB2	Seconds	Regulator time constant
KR	PU	Regulator constant gain
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
T1	Seconds	Regulator time constant
KC	PU	Rectifier regulation factor

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - TYPE 1

Excitation system with DC commutator exciter.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
SW2	Boolean	Switch Control (see block diagram): 0 = Switch B is closed 1 = Switch A is closed
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VRR	PU	Initial value of VR. Signal. (see block diagram) -If VR is given, then in the initiation of the exciter parameter KE is calculated during the initialization. -If VR is not given then parameter KE must be given.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Rate feedback gain
TF	Seconds	Rate feedback time constant
UEMAX	PU	Maximum controller output
UEMIN	PU	Minimum controller output

VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance

Notes

If VRMAX and VRMIN equal 0:

- VRMAX = (KE + SEMAX) · UEMAX
- VRMIN = (KE + SEMIN) · UEMIN

If UEMAX equal 0:

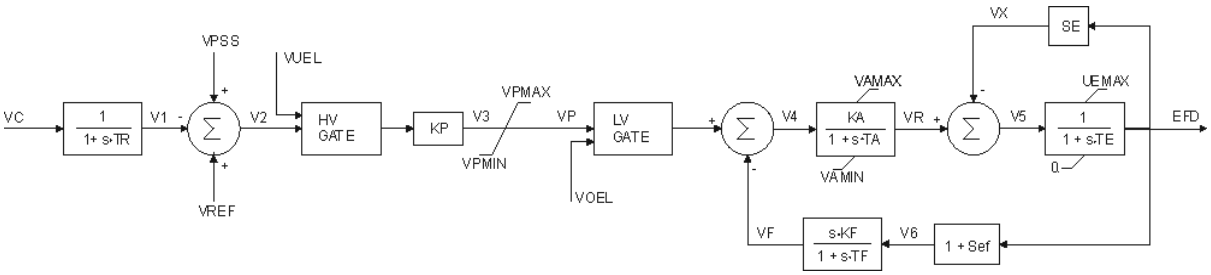
- UEMAX = VRMAX / (KE+SEMAX)

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - TYPE 12

Excitation system with alternator rectifier exciter.



Parameters

NAME	Type	Description
SWF	Integer	Schitch control: 1 = "Sef" Saturation function = 0 2 = "Sef" Saturation function = SE
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
TE	Seconds	Exciter time constant, integration rate associated with exciter control
KF	PU	Rate feedback gain
TF	Seconds	Rate feedback time constant
KP	PU	Gain
VPMAX	PU	Maximum controller output
VPMIN	PU	Minimum controller output
UEMAX	PU	Maximum field voltage
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance

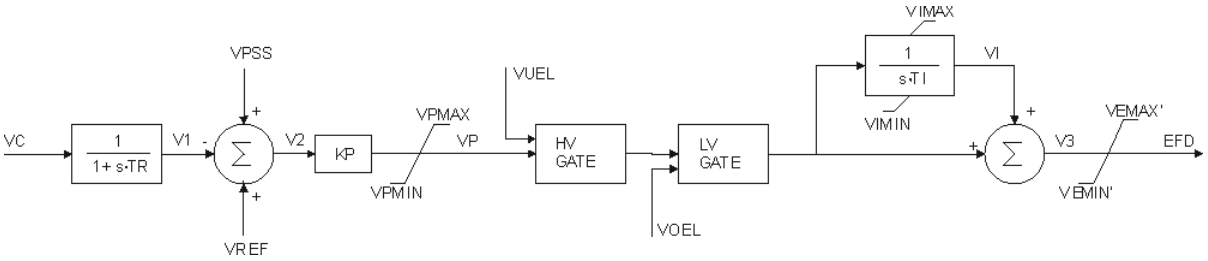
Notes

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - TYPE 15

The ASEA excitation system with potential source controlled rectifier exciter.



Parameters

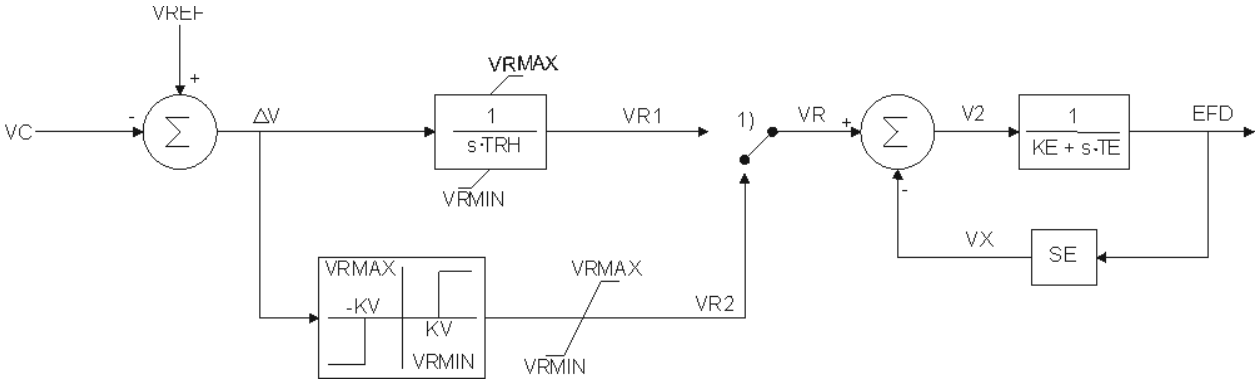
NAME	Type	Description
SWPS	Boolenr	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
KP	PU	Gain
VPMAX	PU	Maximum controller output
VPMIN	PU	Minimum controller output
UEB	PU	Only used in SIMPOW. (See Manual)
UID	PU	Only used in SIMPOW. (See Manual)
TI	Second	Intergral time constant
VIMAX	PU	Maximum controller output
VIMIN	PU	Minimum controller output
UEMAX	PU	Maximum controller output
UEMIN	PU	Minimum controller output

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER - TYPE 4

Excitation system with DC generator commutator exciter and non-continuously acting regulators.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
TRH	Second	Rheostat travel time
KV	PU	Fast raise/lower contact setting
KE	PU	Exciter constant related to self-excited field
TE	Second	Exciter time constant, integration rate associated with exciter control
UEMAX	PU	Maximum voltage regulator output
UEMIN	PU	Minimum voltage regulator output
VRMAX	PU	Maximum voltage regulator output
VRMIN	PU	Minimum voltage regulator output
SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance

Notes

If VRMAX and VRMIN equal 0:

- VRMAX = (KE + SEMAX) · UEMAX
- VRMIN = (KE + SEMIN) · UEMIN

If UEMAX equal 0:

- UEMAX = VRMAX / (KE+SEMAX)

1) Actioneering circuit (see block diagram)

If VR2 = 0	VR = VR1
If VR2 ≠ 0	VR = VR2

The signal VR2 is calculated according to the value of ΔV, as follows:

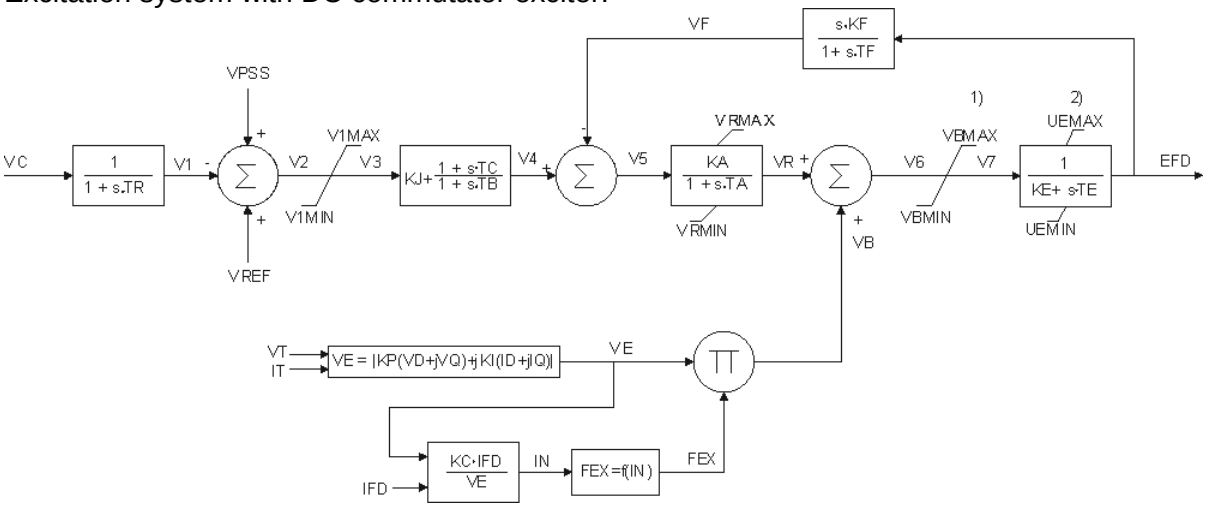
If -KV < ΔV < KV then V2 = 0
If ΔV ≤ -KV then V2 = VRMIN
If ΔV ≥ KV then V2 = VRMAX

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – Type ST2

Excitation system with DC commutator exciter.



Parameters

NAME	Type	Description
SW	Boolean	Defaut value = 0 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal VR1 is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal VR1 is at limit).
SW1	Boolean	0 = Limit UEMAX/UEMIN is valid 1= Limit VBMAX/VBMIN is valid
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD
TR	Seconds	Filter time constant
TC	Seconds	Regulator time constant
TB	Seconds	Regulator time constant
KJ		Regulator gain
KA	PU	Regulator gain
TA	Seconds	Regulator time constant
KP	PU	Potential circuit gain coefficient
KI	PU	Potential circuit gain coefficient
KC	PU	Rectifier loading factor proportional to commutating reactance
KE	PU	Exciter constant related to self-excited field
TE	PU	Exciter time constant, integration rate associated with exciter control
KF	PU	Excitation control system stabilizer gains
TF	PU	Excitation control system stabilizer time constant
UEMAX	PU	Maximum voltage regulator outputs
UEMIN	PU	Minimum voltage regulator outputs
V1MAX	PU	Maximum voltage regulator outputs

V1MIN	PU	Minimum voltage regulator outputs
VRMAX	PU	Maximum voltage regulator outputs
VRMIN	PU	Minimum voltage regulator outputs
VBMAX	PU	Maximum voltage regulator outputs
VBMIN	PU	Minimum voltage regulator outputs

Notes

VT and IT definition:

VT	The bus voltage, p.u. (= VD + jVQ)
IT	The stator current, p.u. (= ID + jIQ)

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER – Type ST3 (SCRX MODIFIED)

For this exciter, please take in consideration the information about the model EXCITER ST3.

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type W

A sinusoidal variation as a function of time with arbitrary amplitude and frequency is superimposed on the initial field voltage EFD_0.

$$EFD = EFD_0 + \sum_{i=1}^{i=N} \left(A_i \cdot \sin\left(2 \cdot \pi \cdot F_i \cdot t + FI_i\right)\right)$$

Parameters

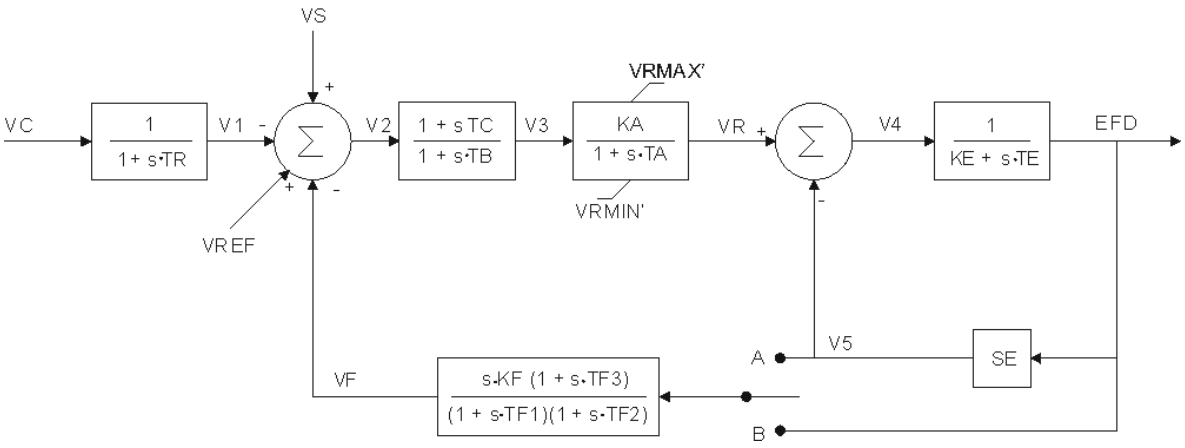
NAME	Type	Description
N	Integer	See above equation. (In Neplan Nmax = 10)
A	PU	Amplitude. N values must be given
F	Hz	Frequency Hz. N values must be given.
FI	degrees	Angle. N values must be given.

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WA

Excitation system involving field controlled DC exciters, or field-controlled rotating alternator-rectifiers, with or without self-excitation.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
SW2	Boolean	Switch Control (see block diagram): 0 = Switch B is closed 1 = Switch A is closed
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
TB	Seconds	Time constant
TC	Seconds	Time constant
VR	PU	Initial value of VR signal in p.u. See block diagram. -IF VR or KE is set to zero: KE will automatically be calculated, such that the initial conditions are fulfilled with given value for VR. -Otherwise, if both values are different from zero, the initial value for VR will automatically be calculated, such that the initial conditions are fulfilled with given value for KE.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control

UEMAX	PU	Maximum field voltage
UEMIN	PU	Minimum field voltage
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance
KF	PU	Feedback gain
TF1	Seconds	Feedback Time constant
TF2	Seconds	Feedback Time constant
TF3	Seconds	Feedback Time constant

Notes

If VRMAX and VRMIN equal 0:

- VRMAX = (KE + SEMAX) · UEMAX
- VRMIN = (KE + SEMIN) · UEMIN

If UEMAX equal 0:

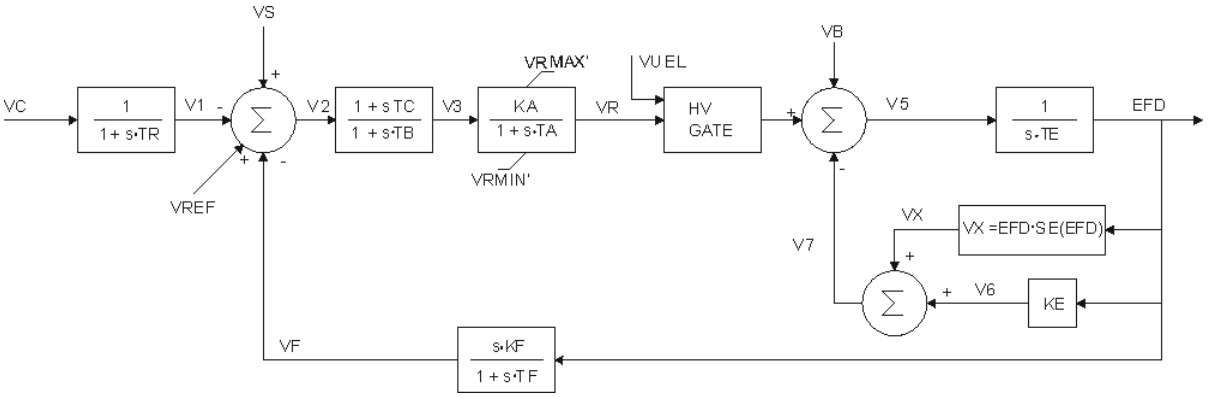
- UEMAX = VRMAX / (KE+SEMAX)

Saturation:
See the paragraph Saturation in exciter controller.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WB

Excitation system involving field controlled DC exciters with continuously acting regulators whose output limits may be chosen to be dependent on synchronous machine terminal voltage.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
TB	Seconds	Time constant
TC	Seconds	Time constant
VB	PU	Initial value of VB signal in p.u. See block diagram. -IF VB or KE is set to zero: KE will automatically be calculated, such that the initial conditions are fulfilled with given value for VB. -Otherwise, if both values are different from zero, the initial value for VB will automatically be calculated, such that the initial conditions are fulfilled with given value for KE.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
UEMAX	PU	Maximum field voltage
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output

SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance
KF	PU	Feedback gain
TF	Seconds	Feedback Time constant

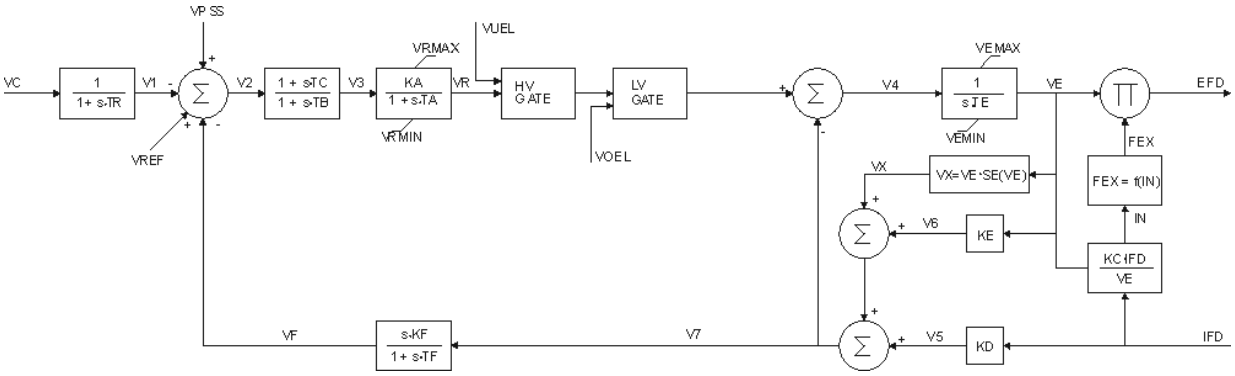
Notes

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WC

Excitation system with alternator rectifier exciter.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VR	PU	Initial value of the VR signal. p.u. If VR is given ,the parameter KE is calculated so that the initial conditions are fulfilled. If VRR is NOT given, then KE may be given.
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VEMAX	PU	Maximum controller output
VEMIN	PU	Minimum controller output
KF	PU	Feedback gain
TF	Seconds	Feedback Time constant
KC	PU	Demagnetizing factor, a function of exciter alternator reactances
KD	PU	Exciter constant related to self-excited field
VE1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Exciter saturation function value at the corresponding exciter voltage, VE1, back of commutating reactance
SE2	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of VE1, back of commutating reactance
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD

Notes

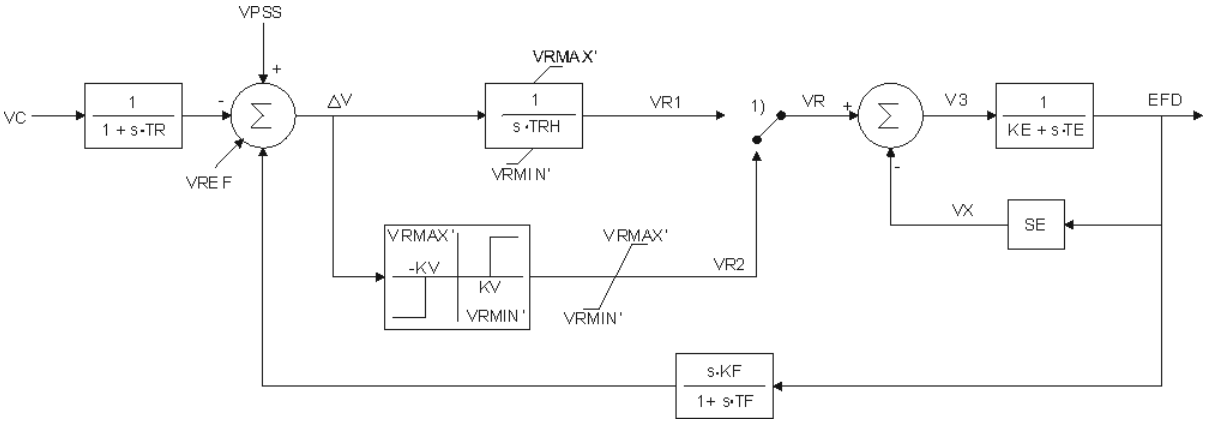
FEX :
See the paragraph General/ Rectifier Regulation Characteristic according to FMOD.

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WD

Excitation system involving DC-generator-commutator exciters, with or without self-excitation, and with a separate field incorporating a motor operated rheostat for slowly correcting small errors and field contacts which force more rapid response to large errors.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
TRH	Seconds	Rheostat travel time
KV	PU	Fast raise/lower contact setting
VR	PU	Initial value of VR signal in p.u. See block diagram. IF VR or KE is set to zero: KE will automatically be calculated, such that the initial conditions are fulfilled with given value for VR. Otherwise, if both values are different from zero, the initial value for VR will automatically be calculated, such that the initial conditions are fulfilled with given value for KE.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
UEMAX	PU	Maximum field voltage
UEMIN	PU	Minimum field voltage
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output

SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance
SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance
KF	PU	Feedback gain
TF	Seconds	Feedback Time constant

Notes

1) Auctioneering circuit (See block diagram)

If VR2 = 0	VR = VR1
If VR2 ≠ 0	VR = VR2

The signal VR2 is calculated according to the value of ΔV, as follows:

If -KV < ΔV < KV then VR2 = 0
If ΔV ≤ -KV then VR2 = VRMIN
If ΔV ≥ KV then VR2 = VRMAX

Note:

If VRMAX and VRMIN equal 0:

- VRMAX = (KE + SEMAX) · UEMAX
- VRMIN = (KE + SEMIN) · UEMIN

If UEMAX equal 0:

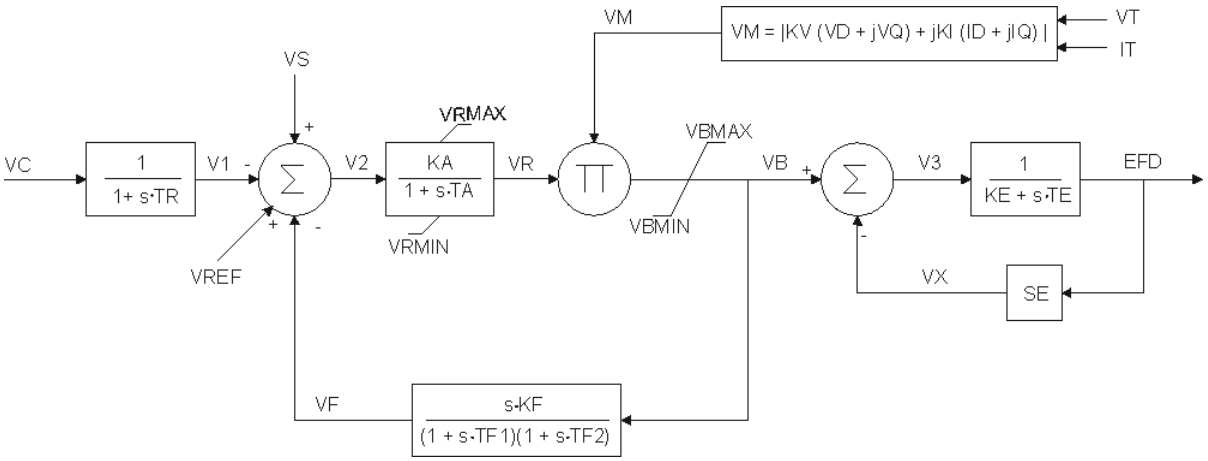
- UEMAX = VRMAX / (KE+SEMAX)

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WE

Excitation system involving compound source controlled rectifier exciters.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KV	PU	Voltage gain
KI	PU	Current gain
VBMAX	PU	Maximum controller output
VBMIN	PU	Minimum controller output
VB	PU	Initial value of VB signal in p.u. See block diagram. IF VB or KE is set to zero: KE will automatically be calculated, such that the initial conditions are fulfilled with given value for VB. Otherwise, if both values are different from zero, the initial value for VB will automatically be calculated, such that the initial conditions are fulfilled with given value for KE.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
SEMAX	PU	Saturation Se at VE = VBMAX / (KE+SEMAX)
SE75	PU	Saturation Se at VE = 0.75 · VBMAX / (KE+SEMAX)

KF	PU	Feedback gain
TF1	Seconds	Feedback Time constant
TF2	Seconds	Feedback Time constant

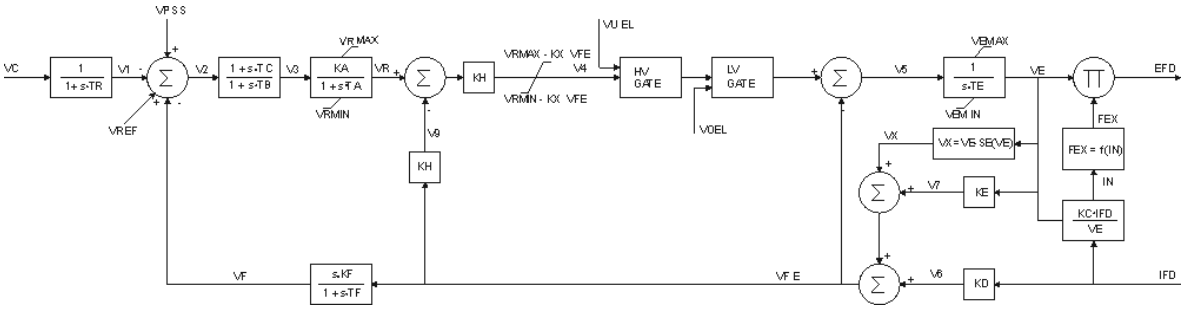
Notes

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WF

High initial response excitation system with non-controlled rectifier.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VAMAX	PU	Maximum controller output
VAMIN	PU	Minimum controller output
VR	PU	Initial value of the VR signal. p.u. If VR is given ,the parameter KE is calculated so that the initial conditions are fulfilled. If VRR is NOT given, then KE may be given.
KH	PU	Gain
KX	PU	Limiter gain
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VEMIN	PU	Minimum controller output
KL	PU	Factor for VEMAX calculation (see note)
KB	PU	Factor for VEMAX calculation (see note)
VLR	PU	Factor for VEMAX calculation (see note)
KF	PU	Feedback gain
TF	Seconds	Feedback Time constant
KC	PU	Demagnetizing factor, a function of exciter alternator reactances
KD	PU	Exciter constant related to self-excited field
VE1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Saturation Se at VE = VE1
SE2	PU	Saturation Se at VE = 0.75·VE1
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD

Notes

VEMAX: $$VEMAX = \frac{VLR \cdot KL \cdot KB}{(1 + KL \cdot KB)(KE + SE)} - \frac{KD \cdot IFD}{KE + SE}$$

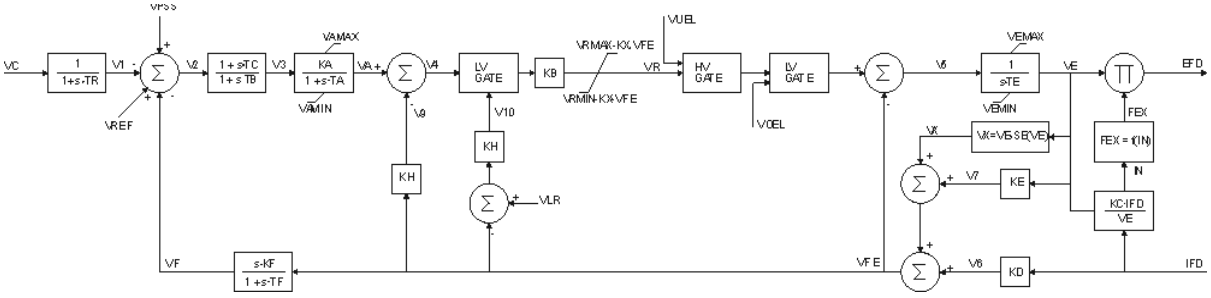
FEX :
See the paragraph General/Rectifier Regulation Characteristic according to FMOD.

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WFA

High initial response excitation system with non-controlled rectifier.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VAMAX	PU	Maximum controller output
VAMIN	PU	Minimum controller output
VR	PU	Initial value of the VR signal. p.u. If VR is given ,the parameter KE is calculated so that the initial conditions are fulfilled. If VRR is NOT given, then KE may be given.
KH	PU	Feedback gain
KX	PU	Limiter gain
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VEMAX	PU	Maximum controller output
VEMIN	PU	Minimum controller output
KL	PU	Feedback gain
KB	PU	Gain
VLR	PU	Voltage limiter
KF	PU	Feedback gain
TF	Seconds	Feedback Time constant
KC	PU	Demagnetizing factor, a function of exciter alternator reactances
KD	PU	Exciter constant related to self-excited field
VE1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Saturation Se at VE = VE1
SE2	PU	Saturation Se at VE = 0.75·VE1

FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD

Notes

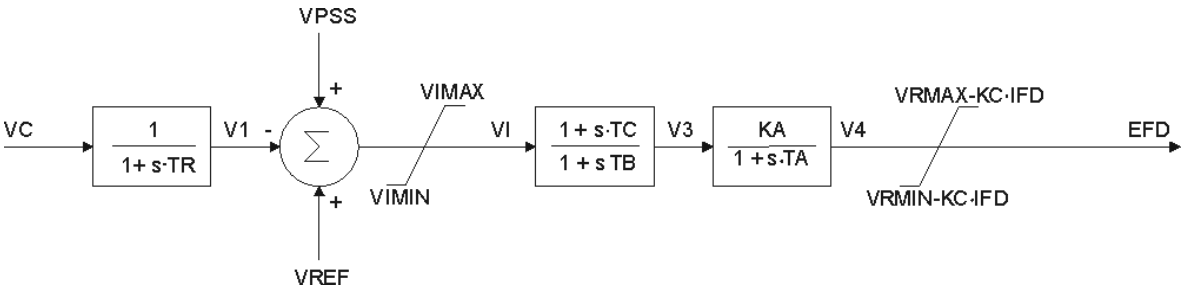
Saturation:
See the paragraph Saturation in exciter controller

FEX :
See the paragraph General/Rectifier Regulation Characteristic according to FMOD.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WG

Excitation system with alternator supplied controlled rectifier exciter.



Parameters

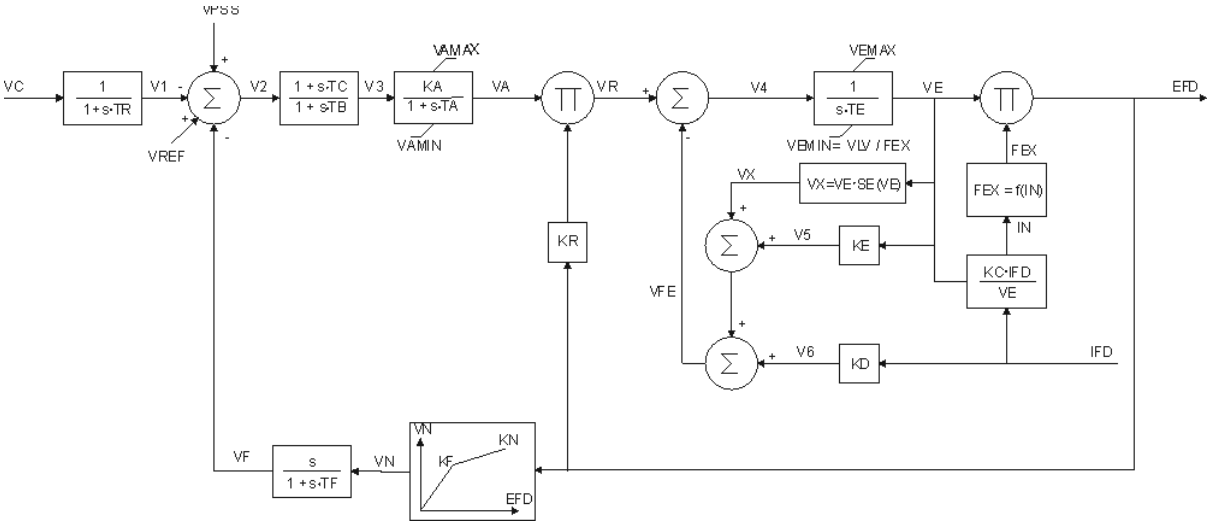
NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	PU	Maximum controller output
VIMIN	PU	Minimum controller output
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KC	PU	Limiter gain

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WH

Excitation system with alternator rectifier exciter.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VAMAX	PU	Maximum controller output
VAMIN	PU	Minimum controller output
VR	PU	Initial value of the VR signal. p.u. If VR is given ,the parameter KE is calculated so that the initial conditions are fulfilled. If VRR is NOT given, then KE may be given.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VEMAX	PU	Maximum controller output
VLV	PU	Voltage limiter
KR	PU	Feedback gain
EFDN	PU	Field voltage limit for feedback change
KF	PU	Feedback gain 1
KN	PU	Feedback gain 2
TF	Seconds	Feedback Time constant
KLV	PU	Only used in SIMPOW. Simpow Manual is not clear about the use of this parameter
KC	PU	Demagnetizing factor, a function of exciter alternator reactances
KD	PU	Exciter constant related to self-excited field

VE1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Saturation Se at VE = VE1
SE2	PU	Saturation Se at VE = 0.75·VE1
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD

Notes

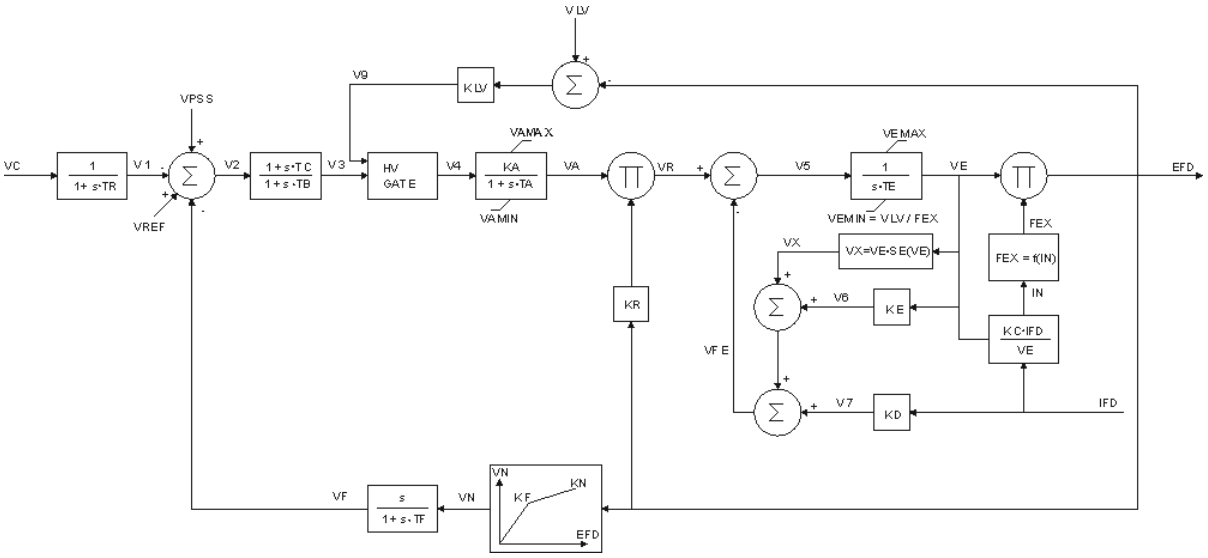
Saturation:
See the paragraph Saturation in exciter controller

FEX :
See the paragraph General/Rectifier Regulation Characteristic according to FMOD.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WHA

Excitation system with alternator rectifier exciter.



Parameters

NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VAMAX	PU	Maximum controller output
VAMIN	PU	Minimum controller output
VR	PU	Initial value of the VR signal. p.u. If VR is given ,the parameter KE is calculated so that the initial conditions are fulfilled. If VRR is NOT given, then KE may be given.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
VEMAX	PU	Maximum controller output
VEMIN	PU	Minimum controller output
VLV	PU	Voltage limiter
KLV	PU	Feedback gain
KR	PU	Feedback gain
EFDN	PU	Field voltage limit for feedback change
KF	PU	Feedback gain 1
KN	PU	Feedback gain 2
TF	Seconds	Feedback Time constant
KC	PU	Demagnetizing factor, a function of exciter alternator reactances
KD	PU	Exciter constant related to self-excited field

VE1	PU	Exciter alternator output voltages back of commutating reactance at which saturation is defined
SE1	PU	Saturation Se at VE = VE1
SE2	PU	Saturation Se at VE = 0.75·VE1
FMOD	Integer	See the paragraph General/Rectifier Regulation Characteristic according to FMOD

Notes

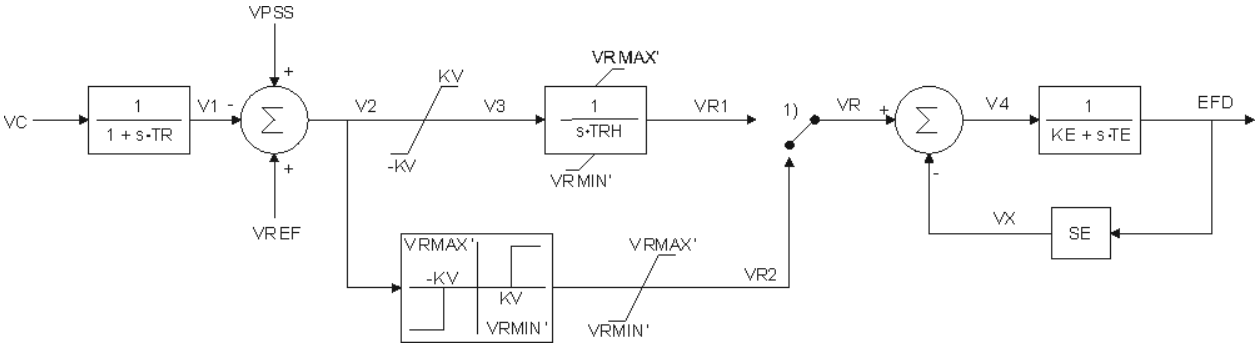
Saturation:
See the paragraph Saturation in exciter controller

FEX :
See the paragraph General/Rectifier Regulation Characteristic according to FMOD.

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WI

Excitation system involving DC-generator-commutator exciters, with or without self-excitation, and with a separate field incorporating a motor operated rheostat for slowly correcting small errors and field contacts which force more rapid response to large errors.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
TRH	Seconds	Rheostat travel time
KV	PU	Fast raise/lower contact setting
VR	PU	Initial value of VR signal in p.u. See block diagram. IF VR or KE is set to zero: KE will automatically be calculated, such that the initial conditions are fulfilled with given value for VR. Otherwise, if both values are different from zero, the initial value for VR will automatically be calculated, such that the initial conditions are fulfilled with given value for KE.
KE	PU	Exciter constant related to self-excited field
TE	Seconds	Exciter time constant, integration rate associated with exciter control
UEMAX	PU	Maximum voltage regulator output
UEMIN	PU	Minimum voltage regulator output
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
SEMAX	PU	Exciter saturation function value at the corresponding exciter voltage, UEMAX, back of commutating reactance

SE75	PU	Exciter saturation function value at the corresponding exciter voltage, 75% of UEMAX, back of commutating reactance

Notes

1) Auctioneering circuit (see block diagram)

If VR2 = 0	VR = VR1
If VR2 ≠ 0	VR = VR2

The signal VR2 is calculated according to the value of ΔV, as follows:

If -KV < ΔV < KV then VR2 = 0
If ΔV ≤ -KV then VR2 = VRMIN
If ΔV ≥ KV then VR2 = VRMAX

If VRMAX and VRMIN equal 0:

- VRMAX = (KE + SEMAX) · UEMAX
- VRMIN = (KE + SEMIN) · UEMIN

If UEMAX equal 0:

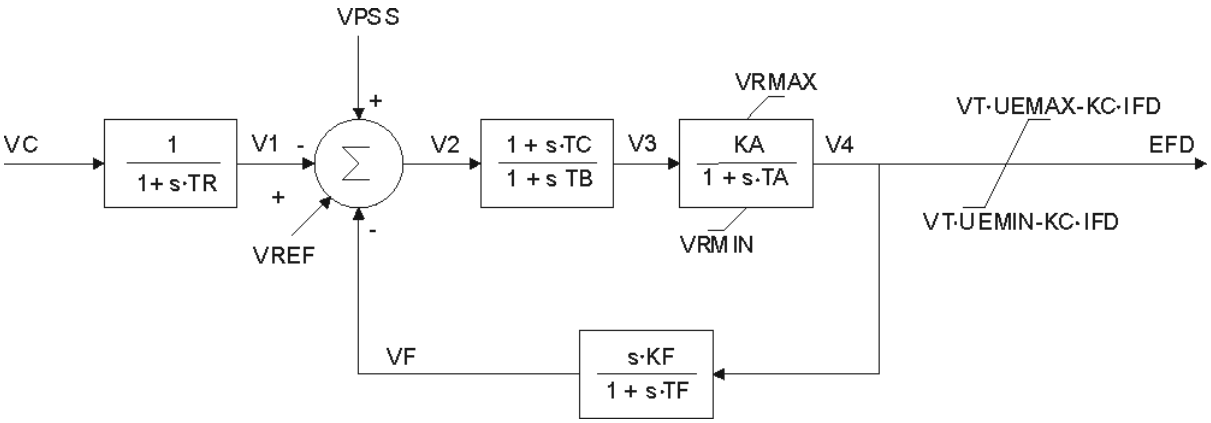
- UEMAX = VRMAX / (KE+SEMAX)

Saturation:
See the paragraph Saturation in exciter controller

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WJ

Excitation system with potential source controlled rectifier exciter.



Parameters

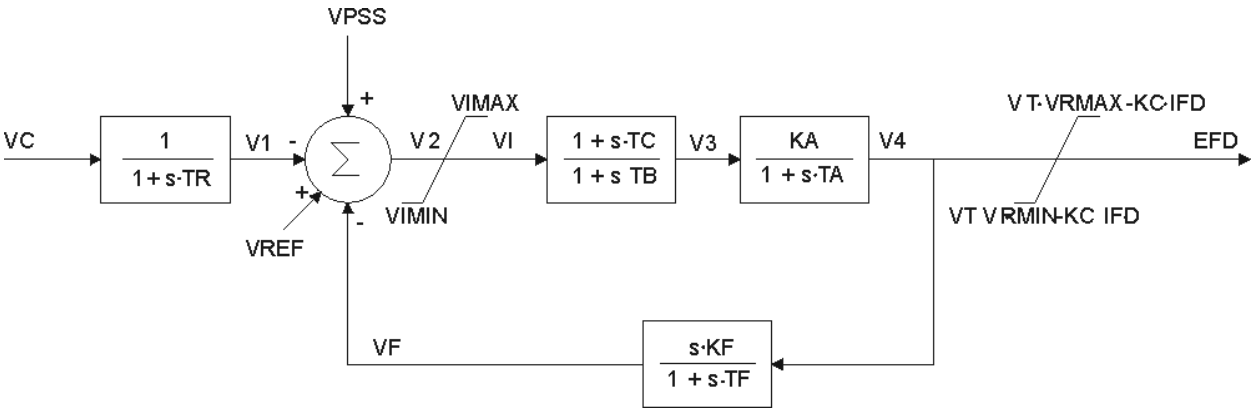
NAME	Type	Description
TR	Seconds	Filter time constant
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KF	PU	Feedback gain
TF	Seconds	Feedback time constant
UEMAX	PU	Maximum controller output
UEMIN	PU	Minimum controller output
KC	PU	Limiter gain

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WK

Excitation system with potential source controlled rectifier exciter.



Parameters

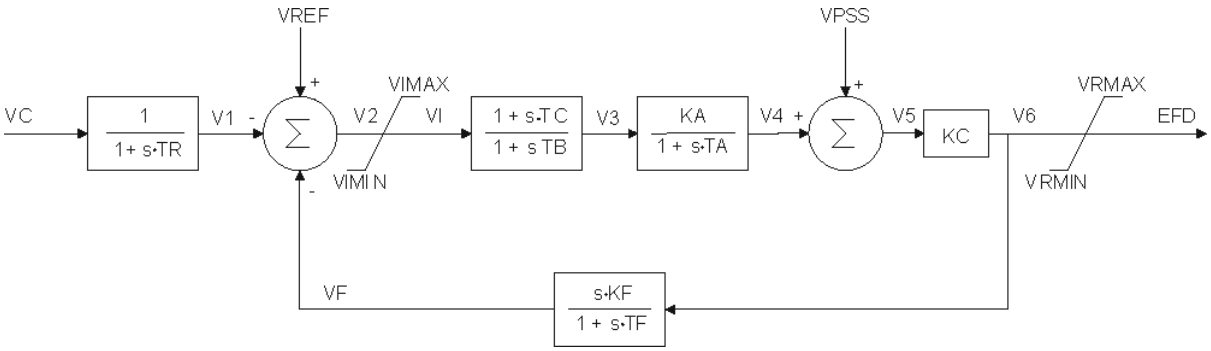
NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	PU	Maximum controller output
VIMIN	PU	Minimum controller output
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
KF	PU	Feedback gain
TF	Seconds	Feedback time constant
UEMAX	PU	Maximum controller output
UEMIN	PU	Minimum controller output
KC	PU	Limiter gain

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WKA

Excitation system with potential source controlled rectifier exciter.



Parameters

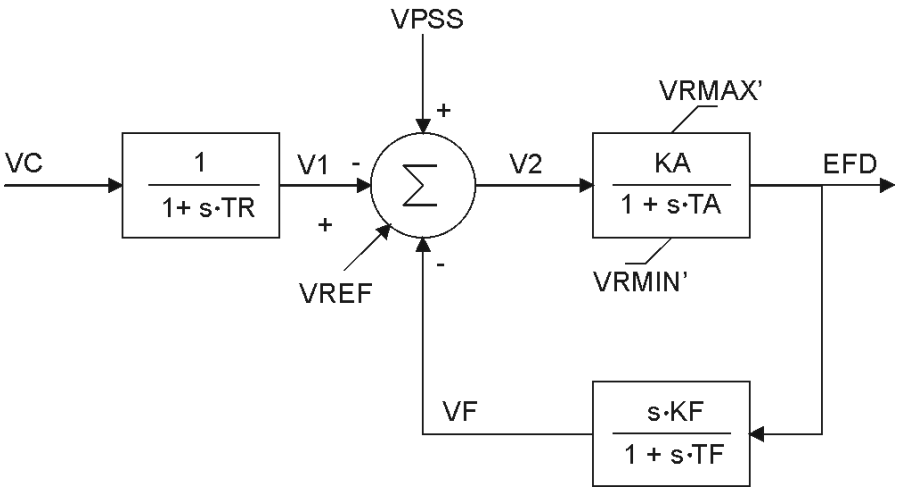
NAME	Type	Description
TR	Seconds	Filter time constant
VIMAX	PU	Maximum controller output
VIMIN	PU	Minimum controller output
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
KC	PU	Output gain
KF	PU	Feedback gain
TF	Seconds	Feedback time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WP

Excitation system involving controlled-rectifier exciters energized from a potential source only.



Parameters

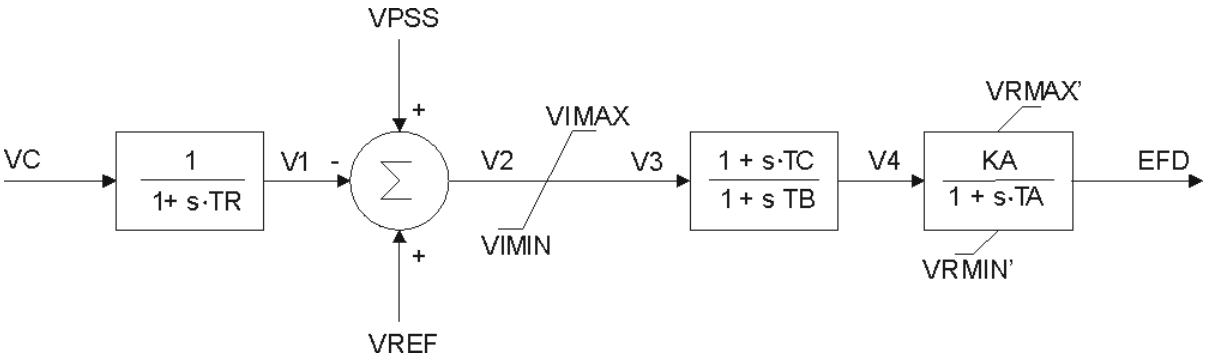
NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output
KF	PU	Feedback gain
TF	Seconds	Feedback time constant

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model

EXCITER– Type WQ

Excitation system where stabilization is accomplished by means of a forward-path lead-lag transfer function rather than by a damping feedback loop.



Parameters

NAME	Type	Description
SW	Boolean	Switch Control: 0 = The regulator is of non-windup type (i.e. the internal signals in the regulator are also limited when the output signal EFD is at limit). 1 = The regulator is of windup type (i.e. the internal signals are not limited when the output signal UF is at limit).
SW1	Boolean	Switch Control: 0 = VRMAX'=VRMAX / VRMIN' =VRMIN 1 = VRMAX'=VRMAX · VT / VRMIN' =VRMIN · VT
TR	Seconds	Filter time constant
VIMAX	PU	Maximum controller output
VIMIN	PU	Minimum controller output
TC	Seconds	Time constant
TB	Seconds	Time constant
KA	PU	Gain
TA	Seconds	Time constant
VRMAX	PU	Maximum controller output
VRMIN	PU	Minimum controller output

Notes

Equivalent model in CIM/CGMES:
- No CIM/CGMES model