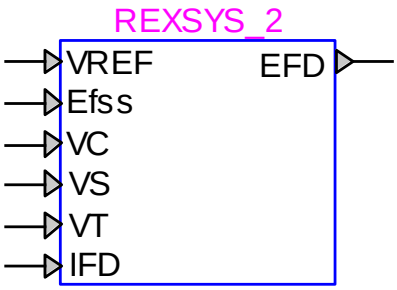
Exciters and Governors: Exciter REXSYS



Exciter REXSYS

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1 Description

This device is an implementation of General-Purpose Rotating Excitation System REXSYS Model. This device is implemented as described in [1]. Implementation details can be viewed by inspecting the subcircuit of this device.

1.1 Pins

This device has 7 pins:

Pin name	Type	Description	Units
VREF	Input	Reference voltage of the stator terminal voltage	pu
Efss	Input	Steady-state field voltage at t = 0, for initialization	pu
VC	Input	Terminal voltage of synchronous machine, transducer output	pu
VS	Input	Power System Stabilizer signal	pu
VT	Input	Terminal voltage of synchronous machine (magnitude)	pu
IFD	Input	Field current signal	pu
EFD	Output	Field voltage signal	pu

1.2 Parameters

The default set of parameters can be found in [1].

1.2.1 Data tab

The parameters on the Data tab are:

1. **Gain K_{VP}**: voltage regulator proportional gain
2. **Gain K_{VI}**: voltage regulator integral gain
3. **Maximum regulator input V_{IMAX}**: voltage regulator input limit
4. **Time constant T_A**: voltage regulator time constant
5. **Time constant T_{B1}**: voltage regulator time constant
6. **Time constant T_{C1}**: voltage regulator time constant
7. **Time constant T_{B2}**: voltage regulator time constant
8. **Time constant T_{C2}**: voltage regulator time constant
9. **Maximum regulator output V_{RMAX}**: maximum voltage controller output
10. **Minimum regulator output V_{RMIN}**: minimum voltage controller output
11. **Gain K_F**: rate feedback gain
12. **Time constant T_F**: rate feedback time constant
13. **Time constant T_{F1}**: rate feedback time constant
14. **Time constant T_{F2}**: rate feedback time constant
15. Feedback signal selector: see explanations below.

There are three possible selections for the Feedback signal selector option:

1. AVR output signal
2. IFE exciter field current
3. EFD exciter output voltage

1.2.2 Exciter tab

The parameters on the Exciter tab are:

1. **Gain K_{IP}**: field current regulator proportional gain
2. **Gain K_{II}**: field current regulator integral gain
3. **Time constant T_P**: field current bridge time constant
4. **Maximum exciter field current V_{FMAX}**: maximum exciter filed current
5. **Minimum exciter field current V_{FMIN}**: minimum exciter field current
6. **Gain K_H**: field voltage controller feedback gain
7. **Gain K_E**: exciter field proportional constant
8. **Time constant T_E**: exciter field time constant
9. **Gain K_C**: rectifier regulation factor
10. **Gain K_D**: exciter regulation factor
11. **Voltage V_{E1}**: exciter voltage point which is near the exciter ceiling voltage
12. **Voltage V_{E2}**: exciter voltage point which is near 75% of V_{E2}
13. **Saturation function output SE_{VE1}**: exciter saturation function value at V_{E1}
14. **Saturation function output SE_{VE2}**: exciter saturation function value at V_{E2}
15. **Gain F_{1IMF}**: limit type flag

The exciter saturation function is defined as

$$S_E = A_{EX} e^{B_{EX} E_{FD}} \tag{1}$$

which gives the approximation saturation for any E_{FD} (exciter output voltage). According to [2] (see pages 562 and 563), the coefficients A_{EX} and B_{EX} can be found from:

$$A_{EX} = \frac{S_{V_{E2}}^4}{S_{V_{E1}}^3} \tag{2}$$

$$B_{EX} = \frac{4}{V_{E1}} \ln\left(\frac{S_{V_{E1}}}{S_{V_{E2}}}\right) \tag{3}$$

In the literature [2] $V_{E1} = V_{E_{max}}$ and $V_{E2} = V_{E_{0.75\max}}$.

2 Initial conditions

The reference voltage VREF can be manually or automatically set by connecting or not connecting the input signal VREF, respectively. When VREF is not connected (the signal is zero), the reference voltage is internally found from the steady-state solution. When VREF is connected, its initial value must match the per unit steady-state voltage of the stator terminal voltage, since otherwise the generator voltage will not start at the actual steady-state.

3 References

[1] PSS®E MODEL LIBRARY PSS®E 32.0.5, Siemens Energy, Inc.

[2] P. M. Anderson and A. A. Fouad, “Power system control and stability”, second edition, IEEE Press, Wiley Interscience, 2003.