

## Excitation System

Provide excitation system for synchronous machine and regulate its terminal voltage in generating mode

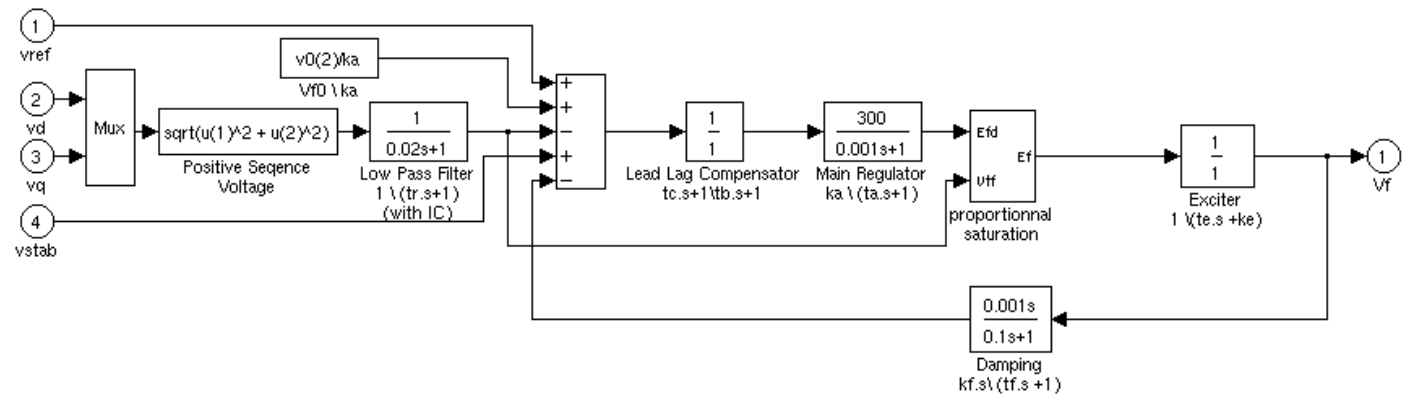
### Library

Machines

### Description



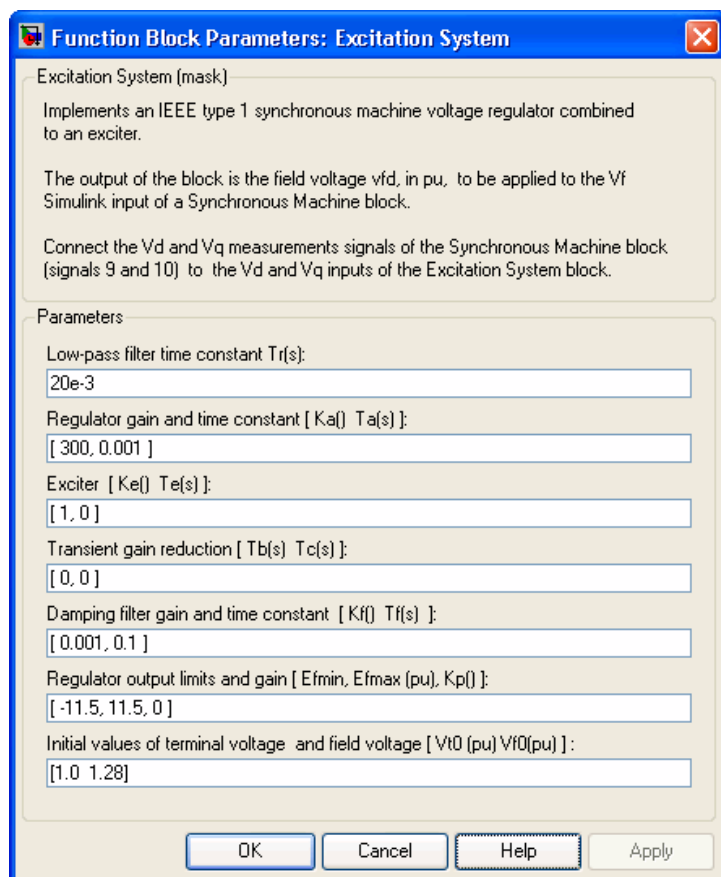
The Excitation System block is a Simulink system implementing a DC exciter described in [1], without the exciter's saturation function. The basic elements that form the Excitation System block are the voltage regulator and the exciter.



The exciter is represented by the following transfer function between the exciter voltage Vfd and the regulator's output ef:

$$\frac{V_{fd}}{ef} = \frac{1}{Ke + sTe}$$

### Dialog Box and Parameters



**Function Block Parameters: Excitation System**

Excitation System (mask)

Implements an IEEE type 1 synchronous machine voltage regulator combined to an exciter.

The output of the block is the field voltage  $v_{fd}$ , in pu, to be applied to the  $V_f$  Simulink input of a Synchronous Machine block.

Connect the  $V_d$  and  $V_q$  measurements signals of the Synchronous Machine block (signals 9 and 10) to the  $V_d$  and  $V_q$  inputs of the Excitation System block.

Parameters

Low-pass filter time constant  $T_r$ (s):

Regulator gain and time constant [  $K_a()$   $T_a$ (s) ]:

Exciter [  $K_e()$   $T_e$ (s) ]:

Transient gain reduction [  $T_b$ (s)  $T_c$ (s) ]:

Damping filter gain and time constant [  $K_f()$   $T_f$ (s) ]:

Regulator output limits and gain [  $E_{fmin}$ ,  $E_{fmax}$  (pu),  $K_p()$  ]:

Initial values of terminal voltage and field voltage [  $V_{t0}$  (pu)  $V_{f0}$ (pu) ]:

OK Cancel Help Apply

**Low-pass filter time constant**

The time constant  $T_r$ , in seconds (s), of the first-order system that represents the stator terminal voltage transducer.

**Regulator gain and time constant**

The gain  $K_a$  and time constant  $T_a$ , in seconds (s), of the first-order system representing the main regulator.

**Exciter**

The gain  $K_e$  and time constant  $T_e$ , in seconds (s), of the first-order system representing the exciter.

**Transient gain reduction**

The time constants  $T_b$ , in seconds (s), and  $T_c$ , in seconds (s), of the first-order system representing a lead-lag compensator.

**Damping filter gain and time constant**

The gain  $K_f$  and time constant  $T_f$ , in seconds (s), of the first-order system representing a derivative feedback.

**Regulator output limits and gain**

Limits  $E_{fmin}$  and  $E_{fmax}$  are imposed on the output of the voltage regulator. The upper limit can be constant and equal to  $E_{fmax}$ , or variable and equal to the rectified stator terminal voltage  $V_{tf}$  times a proportional gain  $K_p$ . If  $K_p$  is set to 0, the former applies. If  $K_p$  is set to a positive value, the latter applies.

**Initial values of terminal voltage and field voltage**

The initial values of terminal voltage  $V_{t0}$  (pu) and field voltage  $V_{f0}$  (pu). When set correctly, they allow you to start the simulation in steady state. Initial terminal voltage should normally be set to 1 pu. Both  $V_{t0}$  and  $V_{f0}$  values are automatically updated by the load flow utility of the Powergui block.

**Example**

See the [Hydraulic Turbine and Governor](#) block.

**Inputs and Outputs**

$v_{ref}$

The desired value, in pu, of the stator terminal voltage.

$v_d$

$v_d$  component, in pu, of the terminal voltage.

$v_q$

$v_q$  component, in pu, of the terminal voltage.

$v_{stab}$

Connect this input to a power system stabilizer to provide additional stabilization of power system oscillations.

$V_f$ 

The field voltage, in pu, for the Synchronous Machine block.

## References

[1] "Recommended Practice for Excitation System Models for Power System Stability Studies," *IEEE Standard 421.5-1992*, August, 1992.

## See Also

[Generic Power System Stabilizer](#), [Hydraulic Turbine and Governor](#), [Multiband Power System Stabilizer](#), [Steam Turbine and Governor](#), [Synchronous Machine](#)

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Yes

No

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