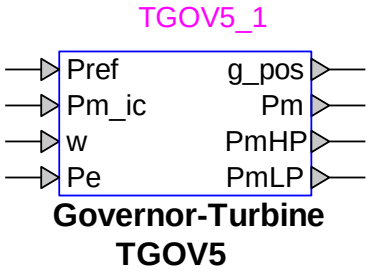
Exciters and Governors: Governor-Turbine TGOV5



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1 Description

This device is an implementation of a general model for turbine and governor TGOV5. 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 8 pins:

Pin name	Type	Description	Units
Pref	Input	Power reference from load controller LCBF1	pu
Pm_ic	Input	Steady-state mechanical power at t = 0, for initialization	pu
w	Input	Mechanical speed	pu
Pe	Input	Electrical power	pu
g_pos	Output	Gate position	pu
Pm	Output	Turbine mechanical power	pu
PmHP	Output	High pressure mechanical power	pu
PmLP	Output	Low pressure mechanical power	pu

1.2 Parameters

The default set of parameters are obtained from [2].

1.2.1 Governor tab

The parameters on the Governor tab are:

1. **Governor gain K**: Governor gain
2. **Lag time constant T_1**: governor lag time constant
3. **Lead time constant T_2**: governor lead time constant
4. **Time constant T_3**: valve positioner time constant
5. **Coefficient K_9**: the adjustment to the pressure drop coefficient as a function of drum pressure
6. **Coefficient K_{10}**: gain of anticipation signal from main stream flow
7. **Coefficient K_{11}**: gain of anticipation signal from load demand
8. **Coefficient K_{12}**: gain for pressure error bias
9. **Coefficient K_{13}**: gain between MW demand and pressure set point
10. **Coefficient K_{14}**: inverse of load reference servomotor time constant
11. **Positive rate change limit R_{MAX}**: load reference positive rate of change limit
12. **Negative rate change limit R_{MIN}**: load reference negative rate of change limit
13. **Maximum load reference L_{MAX}**: maximum load reference
14. **Minimum load reference L_{MIN}**: minimum load reference
15. **Coefficient C_1**: pressure drop coefficient
16. **Coefficient C_2**: gain for the pressure error bias
17. **Coefficient C_3**: adjustment to the pressure set point
18. **Frequency bias B**: frequency bias for load reference control
19. **Gain K_I**: controller integral gain
20. **Lead time constant T_I**: controller proportional lead time constant
21. **Lead time constant T_R**: controller rate lead time constant
22. **Lag time constant T_{R1}**: lag time constant associated with lead time constant T_R
23. **Time constant C_B**: boiler storage time constant
24. **Maximum controller output C_{MAX}**: maximum controller output
25. **Minimum controller output C_{MIN}**: minimum controller output
26. **Fuel time delay T_D**: time delay in the fuel supply system
27. **Fuel and air time constant T_F**: fuel and air system time constant
28. **Water wall time constant T_W**: water wall time constant
29. **Gain K_{MW}**: gain of the MW transducer
30. **Time constant T_{MW}**: MW transducer time constant
31. **Gain K_L**: feedback gain from the load reference
32. **Pressure error D_{PE}**: deadband in pressure error
33. **Initial pressure set point $P_{SPInitial}$**: Initial throttle pressure set point

1.2.2 Turbine tab

The turbine tab allows to input:

1. **Time constant T_4**: steam flow time constant
2. **Time constant T_5**: first reheater time constant
3. **Time constant T_6**: second reheater time constant
4. **Time constant T_7**: crossover time constant
5. **HP turbine power fraction K_1**: high pressure turbine power fraction
6. **HP turbine power fraction K_3**: high pressure turbine power fraction
7. **HP turbine power fraction K_5**: high pressure turbine power fraction
8. **HP turbine power fraction K_7**: high pressure turbine power fraction
9. **LP turbine power fraction K_2**: low pressure turbine power fraction
10. **LP turbine power fraction K_4**: low pressure turbine power fraction
11. **LP turbine power fraction K_6**: low pressure turbine power fraction
12. **LP turbine power fraction K_8**: low pressure turbine power fraction

2 Initial conditions

The initial output is equal to the generator mechanical power (base for power) at t = 0 s.

3 References

[1] “Dynamic Models for Turbine-Governors in Power System Studies,” Technical report PES-TR1. IEEE Power & Energy Society Jan 2013.

[2] P. Kundur, “Power System Stability and Control”, McGraw-Hill 1994