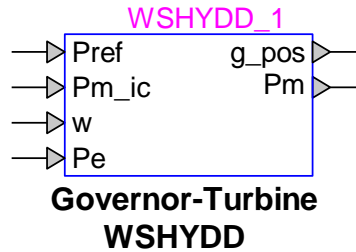


# Exciters and Governors: Governor-Turbine WSHYDD



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## 1 Description

This device is an implementation of a general model for turbine and governor WSHYDD. 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 6 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

### 1.2 Parameters

The default set of parameters are obtained from [1].

#### 1.2.1 Governor tab

The parameters on the Governor tab are:

1. **Deadband  $db_1$** : intentional deadband of speed governor
2. **Deadband hysteresis  $E_{RR}$** : deadband hysteresis of speed governor
3. **Time constant  $T_D$** : input filter time constant

4. **Gain  $K_1$** : derivative gain
5. **Time constant  $T_F$** : derivative time constant
6. **Gain  $K_D$** : double derivative gain
7. **Gain  $K_P$** : integral gain
8. **Permanent droop  $R$** : permanent droop
9. **Time constant  $T_T$** : power feedback time constant
10. **Gain  $K_G$** : gate servo gain
11. **Time constant  $T_P$** : gate servo time constant
12. **Gate opening velocity  $VEL_{OP}$** : maximum gate opening rate
13. **Gate closing velocity  $VEL_{CL}$** : maximum gate closing rate
14. **Maximum gate opening  $P_{MAX}$** : maximum gate opening
15. **Minimum gate opening  $P_{MIN}$** : minimum gate opening
16. **Deadband width  $db_2$** : Unintentional deadband of power gate
17. **Feedback switch control**: see explanation below.

There are two possible selections for the feedback mode option:

1. Electrical power feedback
2. Gate position feedback

### 1.2.2 Turbine tab

The turbine tab allows to input:

1. **Time constant  $T_{TURB}$** : turbine time constant
2. **Lead time constant multiplier  $A_{TURB}$** : turbine lead time constant multiplier
3. **Lag time constant multiplier  $B_{TURB}$** : turbine lag time constant multiplier
4. **Ratio turbine-generator rating  $T_{RATE}$** : ratio turbine-generator rating

## 2 Initial conditions

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

## 3 References

- [1] "Review of Existing Hydroelectric Turbine-Governor Simulation Models", Argonne national Laboratory, August 2013