

Title: Power system modeling using a gas turbine governor system (GGOV).

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Abstract:

The power system model shown in Figure 1 uses a turbine and governor system (GGOV) connected to the generator model (GENROU). A three phase balanced fault is simulated in the FAULT bus during 2 to 2.15 seconds. The simulation results are plotted in Figure 2.

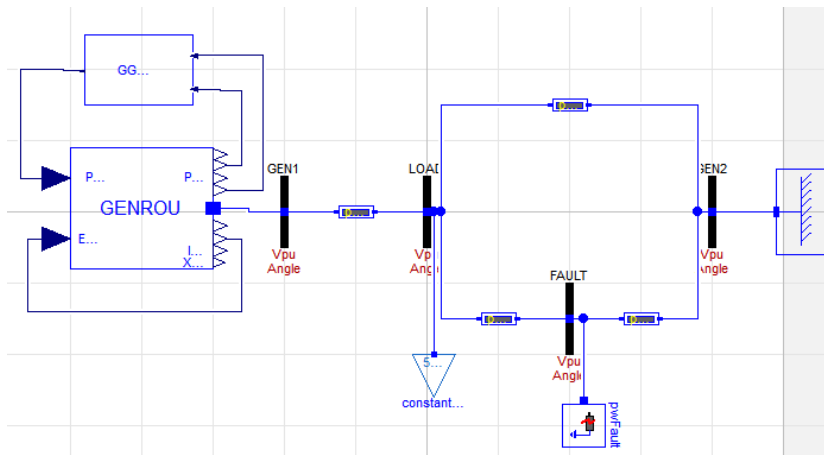


Figure 1: Modelica implementation of the infinite bus connected to generator machine.

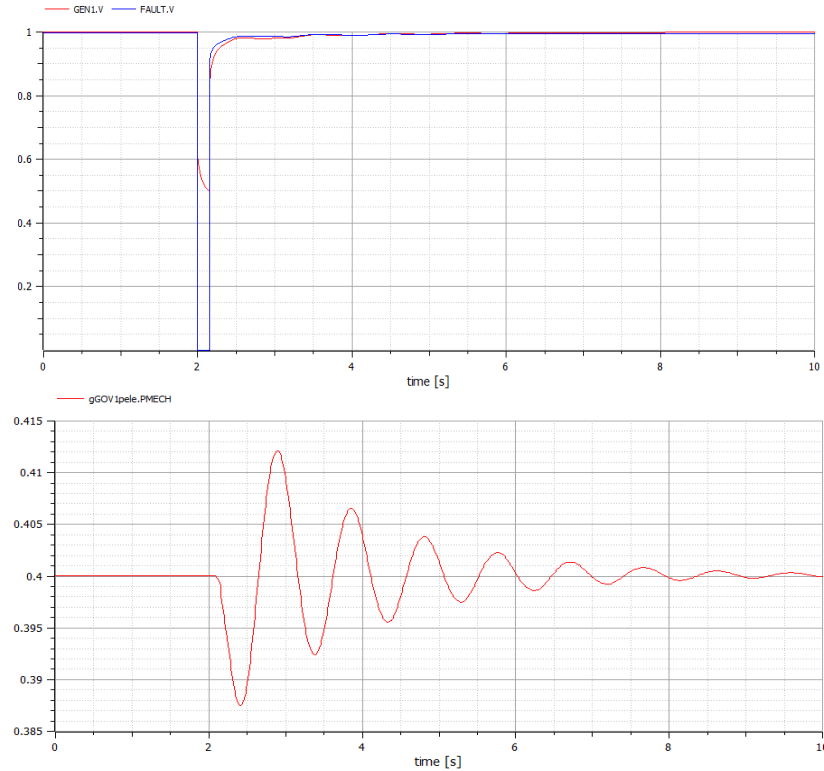


Figure 2: Bus voltages and the mechanical power of the turbine governor system.

**Explanation:**

The model contains following components:

Component Name	Path	Number
GE General Governor/Turbine Mode	OpenIPSL.Electrical.Controls.PSSE.TG.GGOV1.GGOV1	1
Three phase fault	OpenIPSL.Electrical.Events.PwFault	1
GENCLS	OpenIPSL.Electrical.Machines.PSSE.GENCLS	1
Round rotor generator model(GENROU)	OpenIPSL.Electrical.Machines.PSSE.GENROU	1
Constant load	OpenIPSL.Electrical.Loads.PSSE.Load_variation	1
Bus	OpenIPSL.Electrical.Buses.Bus	4
PwLine	OpenIPSL.Electrical.Branches.PwLine	4
Sysdata block	OpenIPSL.Electrical.SystemBase	1

In this model the stability of a single generator connected to an infinite bus is analyzed. Here we use a classical case of a single synchronous machine connected to an infinite bus. The machine is modelled in OpenModelica PSSE machine and has a governor connected(can be operated in Governor/Turbine Mode). The governor controls the mechanical power(Pm) of the generator by taking deviation in electrical power and speed of the generator as feedback. The governor parameters are set and the model is simulated. At t=2s, a three-phase fault is applied to the Bus 2 and at t=2.5s the fault is cleared. From the voltage profile of bus 2 (fault bus), during the fault we can see there is huge dip in the voltage profile and the voltage drops to zero as there is no fault reactance or resistance involved. The fault is cleared and the system becomes stable. The Governor connected to generator tries to dampen the oscillations in voltage and bring back the system to stability. This can be seen from the Fig 1 and Fig 2. The mechanical power oscillates about its steady state value and settles after some time.

**Conclusion:** Here we can see that the system is brought back to steady state after the fault occurred at 2 seconds and cleared at 2.15 seconds. The generator is connected with a turbine and governor system with PMECH (Mechanical power) as output and speed and electrical power as inputs which helps in damping the PMECH. It is observed from the plot of PMECH vs time. We can also observe from the voltage plot the voltage at the fault bus is completely dropped to zero during the fault and while at the generator bus it drops to 0.5 pu. The damping of the PMECH is achieved using turbine and governor system which in turn helps the voltage levels at the buses to get back to its nominal values.