Title: IEEE9 bus system implementation in Modelica using the OpenIPSL

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Short Abstract:

Modelica implementation of the IEEE9 bus system using the OpenIPSL library is shown in Figure 1. Figure 2 shows the simulation result of the voltage profile at Bus 9 when a three phase balanced fault is simulated during 3 to 3.1 seconds at the same bus.

Figure 1: Implementation of IEEE9 bus system using OpenIPSL
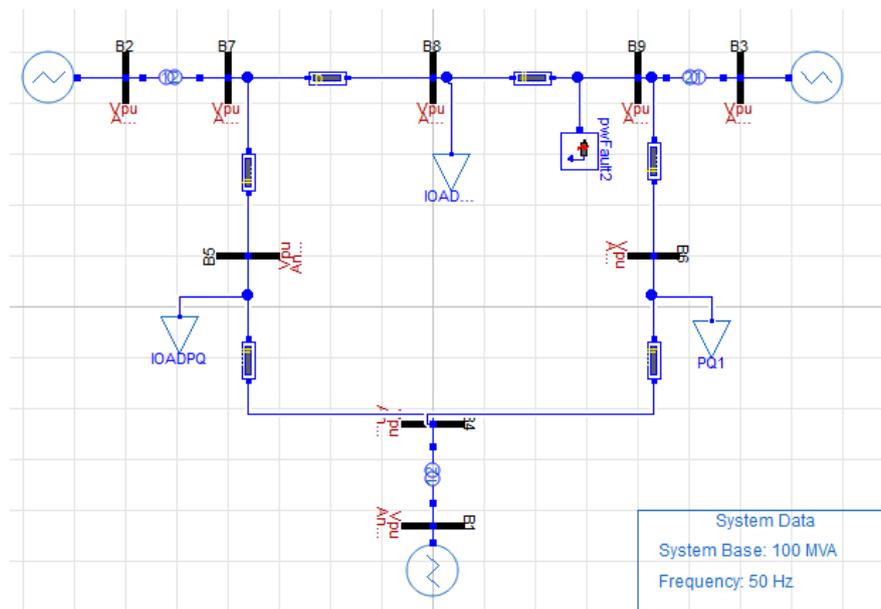
To run the simulation in your favorite Modelica tool, e.g. OpenModelica, follow the steps below:

1. Open the file "**IEEE_9_Buses.mo**".
2. Upload the **OpenIPSL** library package.
3. Go to the "**Simulation**" tab of your tool, and click the "**Simulate**" button.
4. The simulation results of the Bus 2 and Bus 9 voltage should be similar to the one shown below. As it can be seen the bus voltage stabilizes after the fault is cleared.

Description of the simulation:

From the Figure 1, it can be seen that a three-phase balanced fault is simulated at Bus 9 (B9) during 3 to 3.1 seconds. The simulation result of IEEE 9 bus model is plotted in Figure 2 for both fault bus and one of the generator buses. Observe from the voltage profile that, as soon as the fault occurs the voltage dips until the fault is cleared. After the fault is cleared at 1.2 seconds, the bus voltage recovers, however it becomes oscillating. The AVRs (Automatic Voltage Regulators) inside the generator models control the generator field voltage to stabilize this oscillation of the bus voltages after the fault is cleared.
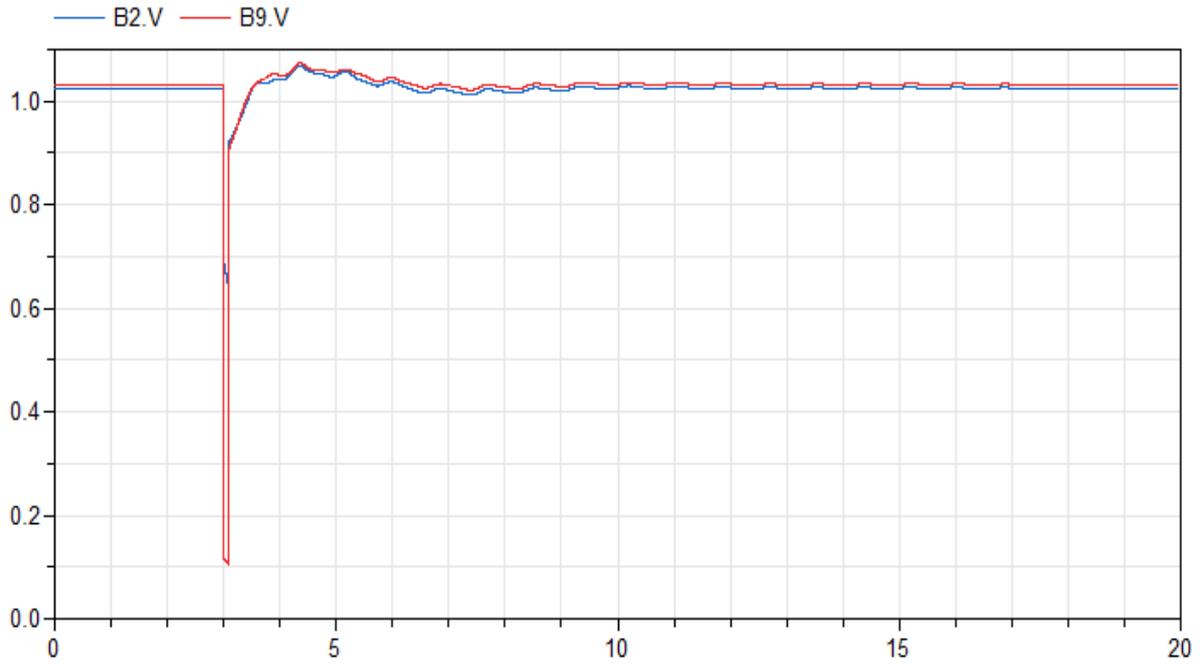
Figure 2: Voltage profile at bus B2 and B9

Conclusion:

The implemented IEEE 9 bus model in Modelica represents the system behavior before and after the fault occurs at Bus 9. The voltage profile at the fault bus indicates that the system can be brought back to stable operating condition even faster by adding additional controls such as Power System Stabilizers (PSS) and Turbine governor (TG) inside the generator models.