Title: IEEE14 bus system implementation in Modelica using the OpenIPSL

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Short Abstract:

Modelica implementation of the IEEE14 bus system using the OpenIPSL library is shown in Figure 1. Figure 2 shows the simulation result of the voltage profile at Bus 4 when a three phase balanced fault is simulated during 1 to 1.2 seconds at the same bus.

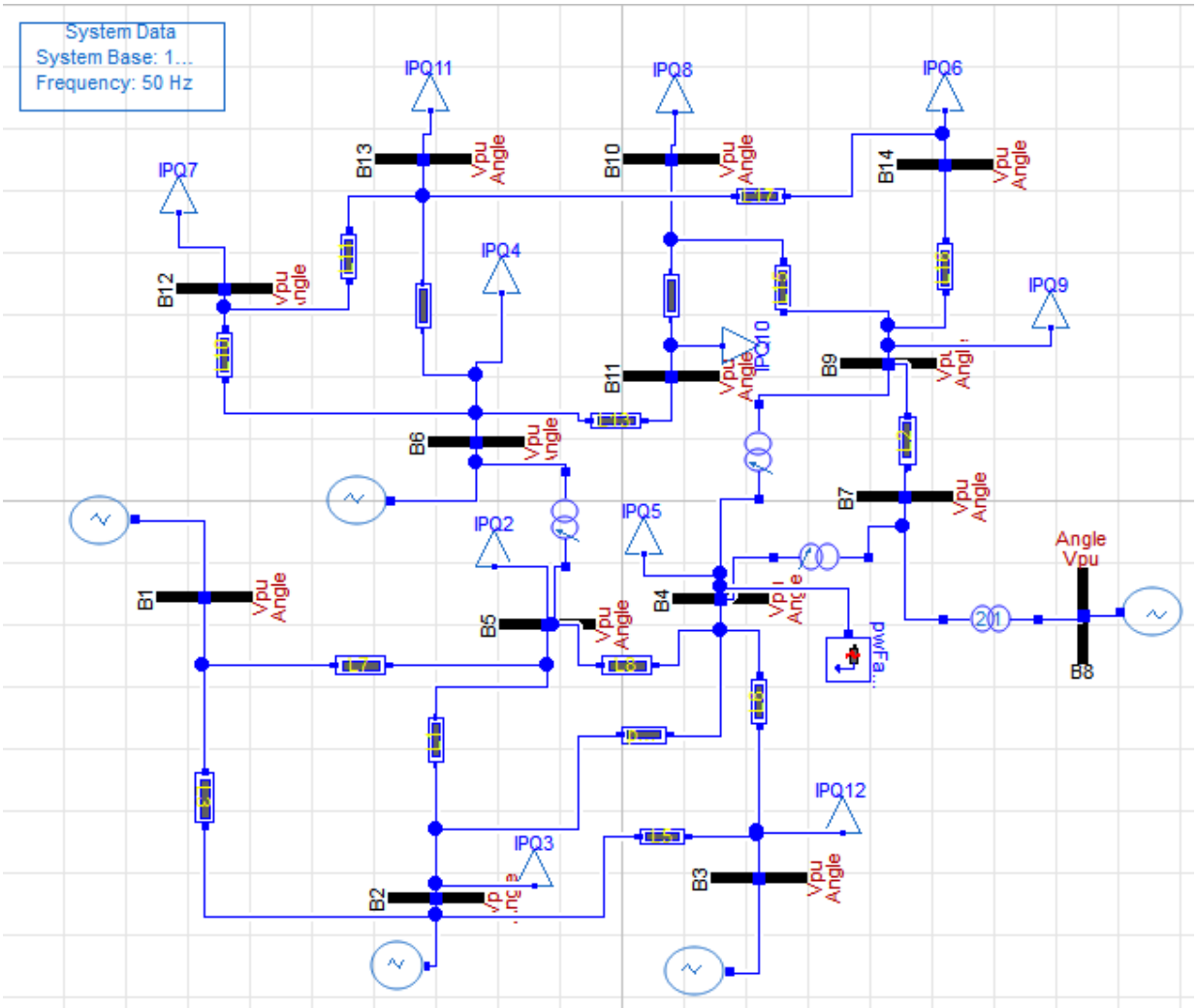

Figure 1: Implementation of IEEE14 bus system using OpenIPSL

To run the simulation in your favorite Modelica tool, e.g. Open Modelica, follow the steps below:

1. Open the file "**IEEE_14_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 result of the Bus 4 voltage should be similar to the one shown below. As it can be seen the bus voltage stabilizes after the fault is cleared.

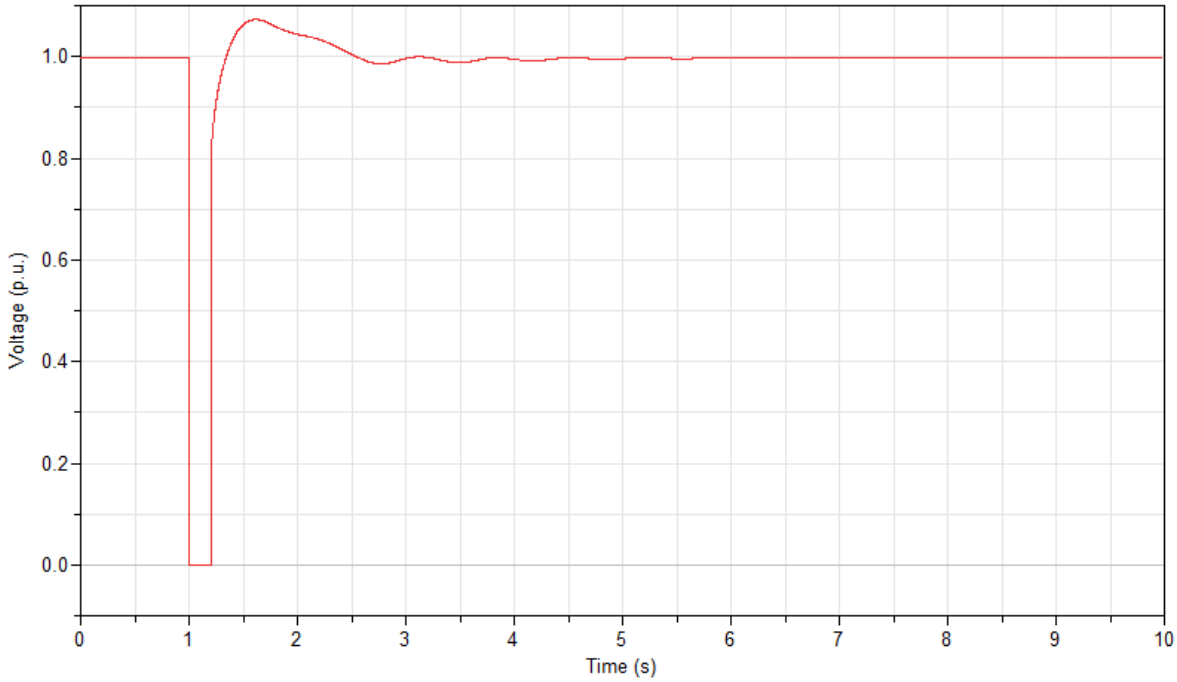

Figure 2: Voltage profile at Bus B4

Description of the simulation:

The IEEE 14 bus model is used to study the voltage stability at different buses which is implemented in Modelica using the OpenIPSL library. From the figure 1, it can be seen a three- phase balanced fault is simulated at Bus 4 (B4) during 1 to 1.2 seconds. The voltage profile of Bus 4 is plotted at Figure 2. Observe from the voltage profile that, as soon as the fault occurs the voltage reduces to zero until the fault is cleared. After the fault is cleared at 1.2 seconds, the bus voltage recovers, however it becomes oscillating. The generator models in the implemented network use AVRs (Automatic Voltage Regulators) along with synchronous generators of order VI. The purpose of using the AVR is to control the generator field voltage to stabilize this oscillation of the bus voltage after the fault clearing time.

Conclusion:

The implemented IEEE 14 bus model in Modelica represents the system behavior before and after the fault occurs at the load bus B4. 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) in the generator model.