

ECSE 6965 Ultra-wide-area Resilient Electrical Energy Transmission Networks, Fall 2014, JHC
 Homework # 1, Due September 10 (Wednesday) in class

This homework assignment will get you familiar with the use of the Power System Toolbox. If you don't have PST, please download it. Both problems are based on the two-area, four-machine system shown in Figure 1. The PST data for the system is given in the data file `data2a_CURRENT_HW1_14.m`. Generator 1 is the swing bus. The line parameters are given on 100 MVA base. Note that a high-impedance line (between Buses 3 and 13) has been added for disturbance simulation (not shown in the diagram).

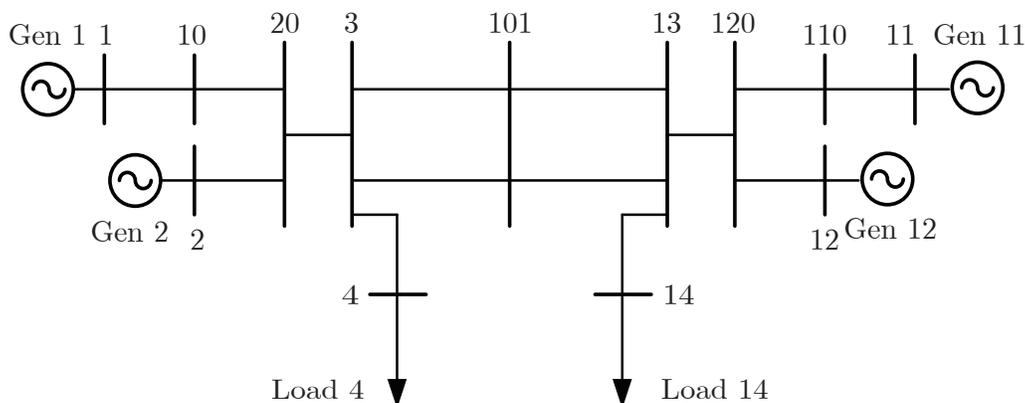


Figure 1: Test system

- Use the PST loadflow function `loadflow` to calculate the power flow of the network for the following active power load conditions at Buses 4 and 14:
 - $P_4 = 13.76$ pu, $P_{14} = 13.76$ pu
 - $P_4 = 12.76$ pu, $P_{14} = 14.76$ pu
 - $P_4 = 11.76$ pu, $P_{14} = 15.76$ pu

The reactive power load remains at 1 pu for all the cases at both buses. Print the power flow solutions for each of the three cases. Discuss your observations on the total amount of power flow between Buses 3 and 13, and the voltage at Bus 101, as the load is shifted to Bus 14.
- Simulate the impact of the following disturbances on the two-area system for the loads $P_4 = 12.76$ pu and $P_{14} = 14.76$ pu, with the reactive power at 1 pu.
 - Apply a short-circuit fault on Bus 3 at 0.1 sec. Clear the fault after 85 msec (about 5 cycles) by opening the line between Buses 3 and 13 at Bus 3. Open Line 3-13 at Bus 2 after another 5 msec. Simulate up to 10 sec and plot the time responses of the machine rotor angles and speeds.
 - Apply the same short-circuit fault on Bus 1 at 0.1 sec, but clear the fault after 130 msec. Open Line 3-13 at Bus 2 after another 5 msec. Simulate up to 10 sec and plot the time responses of the machine rotor angles and speeds.

Use the PST function `s_simu` for the simulation. The machine angles are contained in the variable `mac_ang` (in radians) and the machines speeds are contained in the variable `mac_spd` (in pu).