ECE 476 – Power System Analysis Fall 2012
Homework 2

Reading: For lectures 4-6, read Chapter 4 from textbook. Sections 4.7, and 4.11-4.12 will not be covered in detail.
Due Date: Thursday September 13, 2012

Problem 1. In PowerWorld Simulator Problem 2.32 (see Figure 1 below) a 8 MW/4 Mvar load is supplied at 13.8 kV through a feeder with an impedance of (1+ j2) Ω. The load is compensated with a capacitor whose output, Q_{cap}, can be varied in 0.5 Mvar steps between 0 and 10.0 Mvars. What value of Q_{cap} minimizes the real power line losses? What value of Q_{cap} minimizes the MVA power flow into the feeder?

Problem 2. A three-phase line, which has an impedance of (2 + j4) Ω per phase, feeds two balanced three-phase loads that are connected in parallel. One of the loads is Y-connected with an impedance of (30 + j40) Ω per phase, and the other is Δ-connected with an impedance of (60 – j45) Ω per phase. The line is energized at the sending end from a 60-Hz, three-phase, balanced voltage source of $120\sqrt{3}$ V (rms, line-to-line). Determine:

1. The current, real power, and reactive power delivered by the sending-end source.
2. The line-to-line voltage at the load.
3. The current per phase in each load.
4. The total three-phase real and reactive powers absorbed by each load and by the line.

Check that the total three-phase complex power delivered by the source equals the total three-phase power absorbed by the line and loads.

Problem 3. Two three-phase generators supply a three-phase load through separate three-phase lines. The load absorbs 30 kW at 0.8 power factor lagging. The line impedance is (1.4 + j1.6) Ω per phase between generator G1 and the load, and (0.8 + j1) Ω per phase between generator G2 and the load. If generator G1 supplies 15 kW at 0.8 power factor lagging, with a terminal voltage of 460 V line-to-line, determine:

1. The voltage at the load terminals.
2. The voltage at the terminals of generator G2.
3. The real and reactive power supplied by generator G2.

Assume balanced operation.

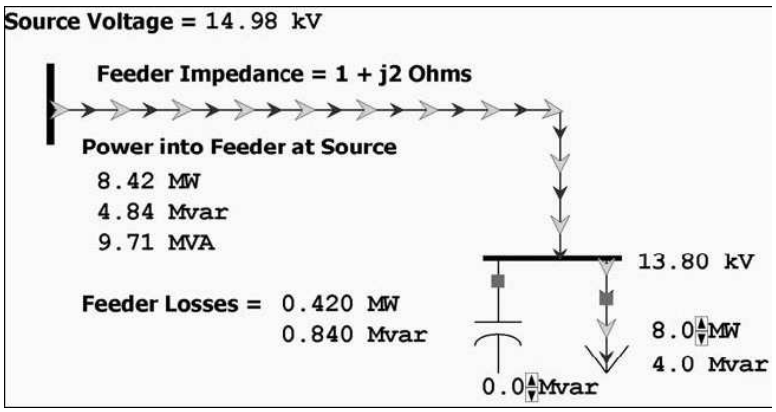

Figure 1: Screen for Problem 1.