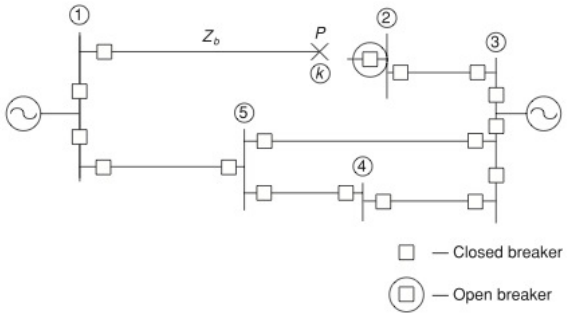

FIGURE 9.26
Problem 9.54

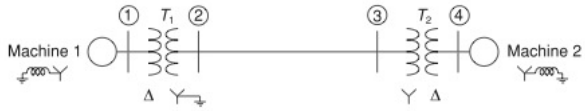

FIGURE 9.27
Problem 9.55

On a base of 100 MVA and 345 kV in the zone of the transmission line, the series reactances of the transmission line are $X_1 = X_2 = 0.15$ and $X_0 = 0.5$ per unit. (a) Draw each of the sequence networks and determine the bus impedance matrix for each of them. (b) Assume the system to be operating at nominal system voltage without prefault currents when a bolted line-to-line fault occurs at bus 3. Compute the fault current, the line-to-line voltages at the faulted bus, and the line-to-line voltages at the terminals of machine 2. (c) Assume the system to be operating at nominal system voltage without prefault currents, when a bolted double line-to-ground fault occurs at the terminals of machine 2. Compute the fault current and the line-to-line voltages at the faulted bus.

9.56 The system shown in Figure 9.28 is the same as in Problem 9.48 except that the transformers are now Y–Y connected and solidly grounded on both sides. (a) Determine the bus impedance matrix for each of the three sequence networks. (b) Assume the system to be operating at nominal system voltage without prefault currents when a bolted single-line-to-ground fault occurs on phase A at bus 3. Compute the fault current, the current out of phase C of machine 2 during the fault, and the line-to-ground voltages at the terminals of machine 2 during the fault.

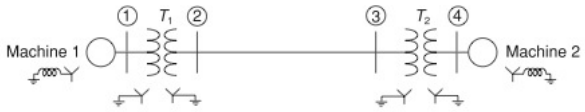

FIGURE 9.28
Problem 9.56

9.57 The results in Table 9.5 show that during a phase *a* single line-to-ground fault the phase angle on phase *a* voltages is always zero. Explain why we would expect this result.

PW **9.58** The results in Table 9.5 show that during the single line-to-ground fault at bus 2 the *b* and *c* phase voltage magnitudes at bus 2 actually rise above the prefault voltage of 1.05 per unit. Use PowerWorld Simulator with case Example 9_8 to determine the type of in-line fault midway between bus 2 and 4 fault that gives the highest per-unit voltage magnitude.

PW **9.59** Using PowerWorld Simulator case Example 9_8, plot the variation in the bus 2 phase *a*, *b*, *c* voltage magnitudes during a single line-to-ground fault at bus 2 as the fault reactance is varied from 0 to 0.30 per unit in 0.05 per-unit steps (the fault impedance is specified on the Fault Options page of the Fault Analysis dialog).

PW **9.60** Using the Example 9_8 case determine the fault current in amps, except with a line-to-line fault at each of the buses. Compare the fault currents with the values given in Table 9.4.

PW **9.61** Using the Example 9_8 case determine the fault current in amps, except with a bolted double line-to-ground fault at each of the buses. Compare the fault currents with the values given in Table 9.4.

PW **9.62** Re-determine the Example 9_8 fault currents, except with a new line installed between buses 2 and 5. The parameters for this new line should be identical to those of the existing line between buses 2 and 5. The new line is not mutually coupled to any other line. Are the fault currents larger or smaller than the Example 9_8 values?

PW **9.63** Re-determine the Example 9_8 fault currents, except with a second generator added at bus 3. The parameters for the new generator should be identical to those of the existing generator at bus 3. Are the fault currents larger or smaller than the Example 9_8 values?

PW **9.64** Using PowerWorld Simulator case Chapter 9_Design, calculate the per-unit fault current and the current supplied by each of the generators for a single line-to-ground fault at the ORANGE69 bus. During the fault, what percentage of buses have voltage magnitude below 0.75 per unit?

PW **9.65** Repeat Problem 9.64, except place the fault at the POPLAR69 bus.

DESIGN PROJECT 3 (*CONTINUED*): POWER FLOW/ SHORT CIRCUITS

Additional time given: 3 weeks
Additional time required: 10 hours

This is a continuation of Design Project 3. Assignments 1 and 2 are given in Chapter 6. Assignment 3 is given in Chapter 7.