Chapter 9, Solution 53.
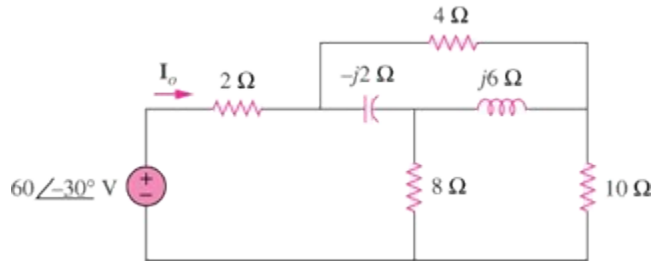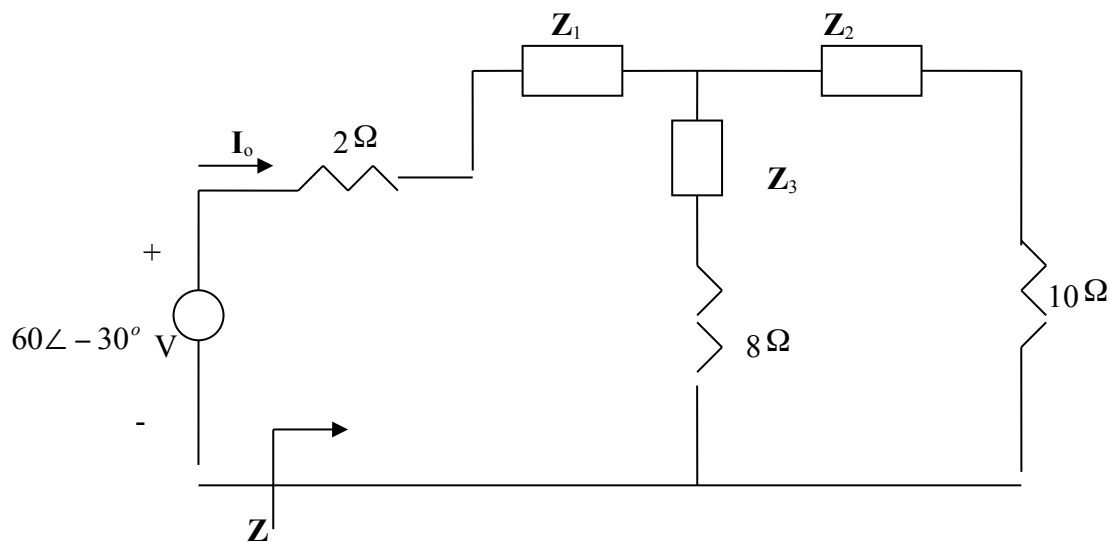
Find $\mathbf{I}_o$ in the circuit in Fig. 9.60.

Figure 9.60
For Prob. 9.53.

Solution

Convert the delta to wye subnetwork as shown below.

$$Z_1 = \frac{-j2 \times 4}{4 + j4} = \frac{8 \angle -90°}{5.6569 \angle 45°} = -1 - j1, \qquad Z_2 = \frac{j6 \times 4}{4 + j4} = 3 + j3,$$

$$Z_3 = \frac{12}{4 + j4} = 1.5 - j1.5$$

$$(Z_3 + 8) // (Z_2 + 10) = (9.5 - j1.5) // (13 + j3) = 5.691 \angle 0.21° = 5.691 + j0.02086$$

$$Z = 2 + Z_1 + 5.691 + j0.02086 = 6.691 - j0.9791$$

$$I_o = \frac{60 \angle -30°}{Z} = \frac{60 \angle -30°}{6.7623 \angle -8.33°} = \underline{8.873 \angle -21.67° \text{ A}}$$