Chapter 10, Solution 32.

Determine $\mathbf{V}_o$ and $\mathbf{I}_o$ in the circuit of Fig. 10.80 using mesh analysis.

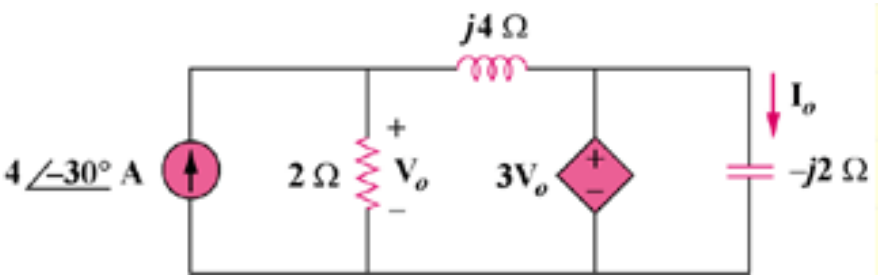
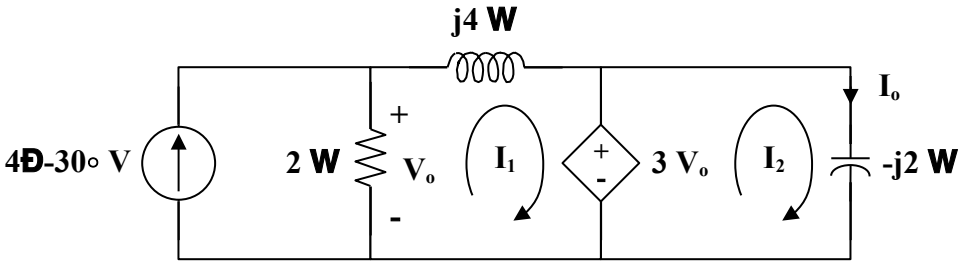


Figure 10.80
For Prob. 10.32.

Solution

Consider the circuit below.



For mesh 1,

$$(2 + j4)\mathbf{I}_1 - 2(4\angle -30^\circ) + 3\mathbf{V}_o = 0$$

where

$$\mathbf{V}_o = 2(4\angle -30^\circ - \mathbf{I}_1)$$

Hence,

$$(2 + j4)\mathbf{I}_1 - 8\angle -30^\circ + 6(4\angle -30^\circ - \mathbf{I}_1) = 0$$

$$4\angle -30^\circ = (1 - j)\mathbf{I}_1$$

or

$$\mathbf{I}_1 = 2\sqrt{2}\angle 15^\circ$$

$$\mathbf{I}_o = \frac{3\mathbf{V}_o}{-j2} = \frac{3}{-j2}(2)(4\angle -30^\circ - \mathbf{I}_1)$$

$$\mathbf{I}_o = j3(4\angle -30^\circ - 2\sqrt{2}\angle 15^\circ)$$

$$\mathbf{I}_o = 8.485Ð15◦ \text{ A}$$

$$\mathbf{V}_o = \frac{-j2\mathbf{I}_o}{3} = \mathbf{5.657Ð\text{-}75^\circ\ V}$$