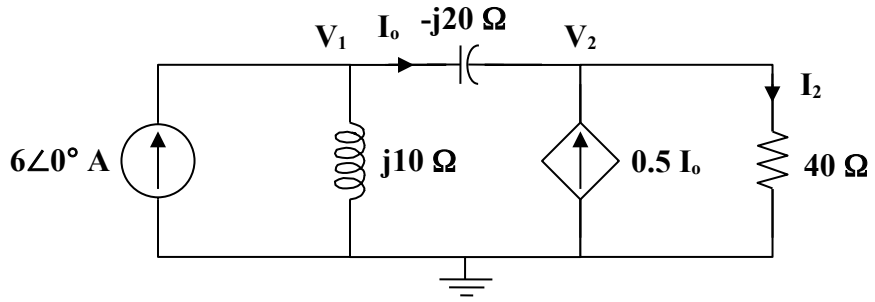
Chapter 11, Solution 8.

We apply nodal analysis to the following circuit.



At node 1,

$$6 = \frac{\mathbf{V}_1}{\text{j}10} + \frac{\mathbf{V}_1 - \mathbf{V}_2}{-\text{j}20}\ \mathbf{V}_1 = \text{j}120 - \mathbf{V}_2 \qquad (1)$$

At node 2,

$$0.5\mathbf{I}_o + \mathbf{I}_o = \frac{\mathbf{V}_2}{40}$$

But,
$$\mathbf{I}_o = \frac{\mathbf{V}_1 - \mathbf{V}_2}{-\text{j}20}$$

Hence,
$$\frac{1.5(\mathbf{V}_1 - \mathbf{V}_2)}{-\text{j}20} = \frac{\mathbf{V}_2}{40}$$

$$3\mathbf{V}_1 = (3 - \text{j})\mathbf{V}_2 \qquad (2)$$

Substituting (1) into (2),

$$\text{j}360 - 3\mathbf{V}_2 - 3\mathbf{V}_2 + \text{j}\mathbf{V}_2 = 0$$

$$\mathbf{V}_2 = \frac{\text{j}360}{6 - \text{j}} = \frac{360}{37}(-1 + \text{j}6)$$

$$\mathbf{I}_2 = \frac{\mathbf{V}_2}{40} = \frac{9}{37}(-1 + \text{j}6)$$

$$\text{P} = \frac{1}{2}|\mathbf{I}_2|^2\text{R} = \frac{1}{2}\left(\frac{9}{\sqrt{37}}\right)^2(40) = \mathbf{43.78\ W}$$