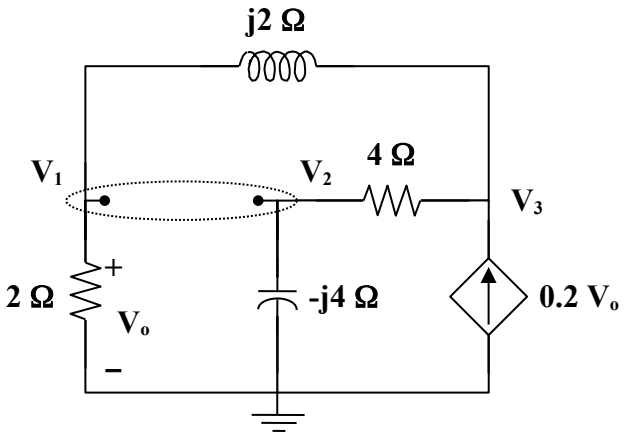
Chapter 10, Solution 19.

We have a supernode as shown in the circuit below.



Notice that $\mathbf{V}_o = \mathbf{V}_1$.

At the supernode,

$$\frac{\mathbf{V}_3 - \mathbf{V}_2}{4} = \frac{\mathbf{V}_2}{-\,j4} + \frac{\mathbf{V}_1}{2} + \frac{\mathbf{V}_1 - \mathbf{V}_3}{j2}$$

$$0 = (2 - j2)\,\mathbf{V}_1 + (1 + j)\,\mathbf{V}_2 + (-1 + j2)\,\mathbf{V}_3 \qquad (1)$$

At node 3,

$$0.2\mathbf{V}_1 + \frac{\mathbf{V}_1 - \mathbf{V}_3}{j2} = \frac{\mathbf{V}_3 - \mathbf{V}_2}{4}$$

$$(0.8 - j2)\,\mathbf{V}_1 + \mathbf{V}_2 + (-1 + j2)\,\mathbf{V}_3 = 0 \qquad (2)$$

Subtracting (2) from (1),

$$0 = 1.2\mathbf{V}_1 + j\,\mathbf{V}_2 \qquad (3)$$

But at the supernode,

$$\mathbf{V}_1 = 12\angle 0° + \mathbf{V}_2$$

or

$$\mathbf{V}_2 = \mathbf{V}_1 - 12 \qquad (4)$$

Substituting (4) into (3),

$$0 = 1.2\mathbf{V}_1 + j(\mathbf{V}_1 - 12)$$

$$\mathbf{V}_1 = \frac{j12}{1.2 + j} = \mathbf{V}_o$$

$$\mathbf{V}_o = \frac{12\angle 90°}{1.562\angle 39.81°}$$

$$\mathbf{V}_o = \mathbf{7.682\angle 50.19°\ V}$$