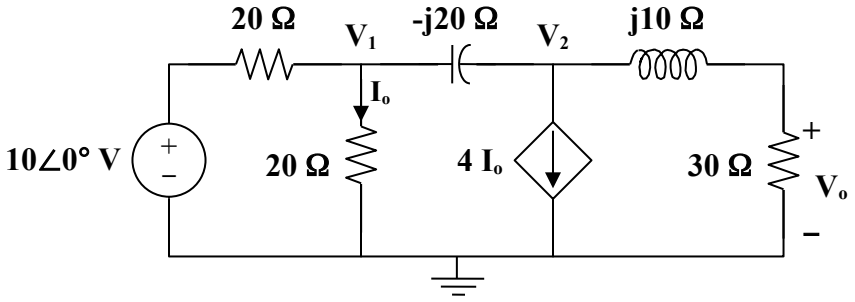
Chapter 10, Solution 9.

$$10\cos(10^3 t) \longrightarrow 10\angle 0°, \quad \omega = 10^3$$
$$10 \text{ mH} \longrightarrow j\omega L = j10$$
$$50\ \mu\text{F} \longrightarrow \frac{1}{j\omega C} = \frac{1}{j(10^3)(50\times 10^{-6})} = -j20$$

Consider the circuit shown below.



At node 1,

$$\frac{10 - \mathbf{V}_1}{20} = \frac{\mathbf{V}_1}{20} + \frac{\mathbf{V}_1 - \mathbf{V}_2}{-j20}$$
$$10 = (2 + j)\mathbf{V}_1 - j\mathbf{V}_2 \qquad (1)$$

At node 2,

$$\frac{\mathbf{V}_1 - \mathbf{V}_2}{-j20} = (4)\frac{\mathbf{V}_1}{20} + \frac{\mathbf{V}_2}{30 + j10}, \text{ where } \mathbf{I}_o = \frac{\mathbf{V}_1}{20} \text{ has been substituted.}$$
$$(-4 + j)\mathbf{V}_1 = (0.6 + j0.8)\mathbf{V}_2$$
$$\mathbf{V}_1 = \frac{0.6 + j0.8}{-4 + j}\mathbf{V}_2 \qquad (2)$$

Substituting (2) into (1)

$$10 = \frac{(2 + j)(0.6 + j0.8)}{-4 + j}\mathbf{V}_2 - j\mathbf{V}_2$$

or

$$\mathbf{V}_2 = \frac{170}{0.6 - j26.2}$$

$$\mathbf{V}_o = \frac{30}{30 + j10}\mathbf{V}_2 = \frac{3}{3 + j}\cdot\frac{170}{0.6 - j26.2} = 6.154\angle 70.26°$$

Therefore, $v_o(t) =$ **$6.154\cos(10^3 t + 70.26°)$ V**