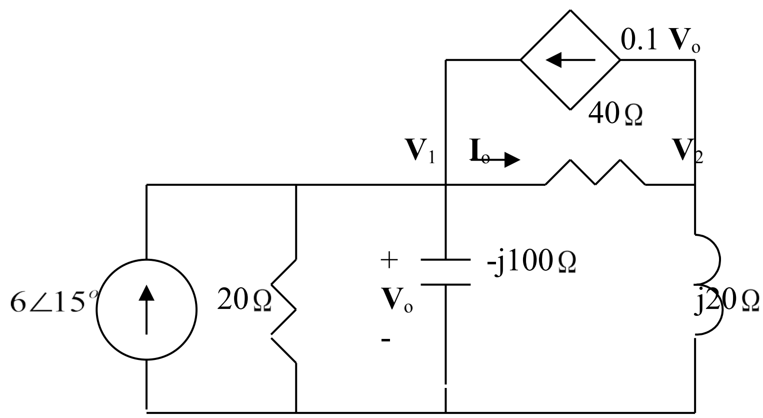
Chapter 10, Solution 8.

$\omega = 200,$

$100\text{mH} \longrightarrow j\omega L = j200\text{x}0.1 = j20$

$$50\mu F \longrightarrow \frac{1}{j\omega C} = \frac{1}{j200\text{x}50\text{x}10^{-6}} = -j100$$

The frequency-domain version of the circuit is shown below.



At node 1,

$$6\angle 15^o + 0.1V_1 = \frac{V_1}{20} + \frac{V_1}{-j100} + \frac{V_1 - V_2}{40}$$

or $\quad 5.7955 + j1.5529 = (-0.025 + j0.01)V_1 - 0.025V_2$ (1)

At node 2,

$$\frac{V_1 - V_2}{40} = 0.1V_1 + \frac{V_2}{j20} \longrightarrow 0 = 3V_1 + (1 - j2)V_2 \qquad (2)$$

From (1) and (2),

$$\begin{bmatrix} (-0.025 + j0.01) & -0.025 \\ 3 & (1 - j2) \end{bmatrix} \begin{pmatrix} V_1 \\ V_2 \end{pmatrix} = \begin{pmatrix} (5.7955 + j1.5529) \\ 0 \end{pmatrix} \quad \text{or} \quad AV = B$$

Using MATLAB,

V = inv(A)*B

leads to $V_1 = -70.63 - j127.23, \qquad V_2 = -110.3 + j161.09$

$$I_o = \frac{V_1 - V_2}{40} = 7.276\angle -82.17^o$$

Thus,

$$\underline{\boldsymbol{i_o(t) = 7.276\cos(200t - 82.17^o)\ \text{A}}}$$