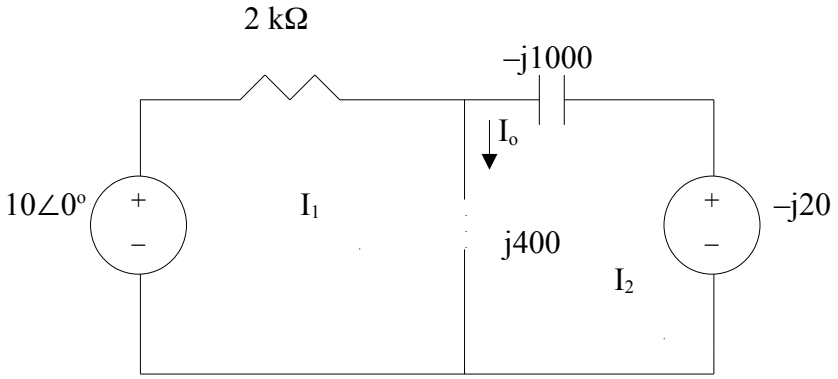
Chapter 10, Solution 26.

$$0.4H \longrightarrow j\omega L = j10^3 x0.4 = j400$$

$$1\mu F \longrightarrow \frac{1}{j\omega C} = \frac{1}{j10^3 x10^{-6}} = -j1000$$

$$20\sin(10^3 t) = 20\cos(10^3 t - 90°) \; which\; leads\; ¿\; 20\angle -90° = -j20$$

The circuit becomes that shown below.



For loop 1,

$$-10 + (12000 + j400)I_1 - j400I_2 = 0 \longrightarrow 1 = (200 + j40)I_1 - j40I_2 \quad (1)$$

For loop 2,

$$-j20 + (j400 - j1000)I_2 - j400I_1 = 0 \longrightarrow -12 = 40I_1 + 60I_2$$

(2)

In matrix form, (1) and (2) become

$$\begin{bmatrix} 1 \\ -12 \end{bmatrix} = \begin{bmatrix} 200 + j40 & -j40 \\ 40 & 60 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

Solving this leads to

I_1 =0.0025-j0.0075, I_2 = -0.035+j0.005

$I_o = I_1 - I_2 = 0.0375 - j0.0125 = 39.5\angle -18.43°$ mA

$$i_o(t) = \mathbf{39.5\cos(10^3 t - 18.43°)\ mA}$$