Chapter 10, Solution 63.

Obtain the Norton equivalent of the circuit depicted in Fig. 10.106 at terminals *a-b*.

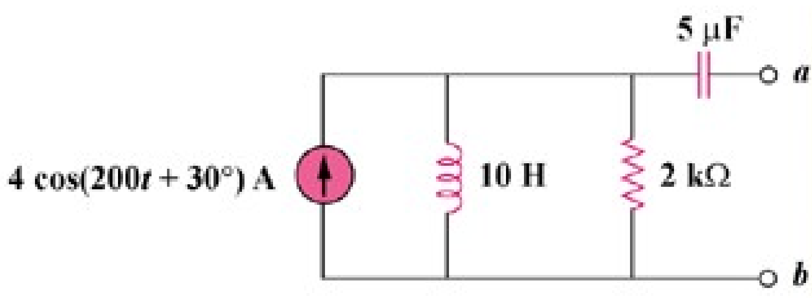


Figure 10.106
For Prob. 10.63.

Solution

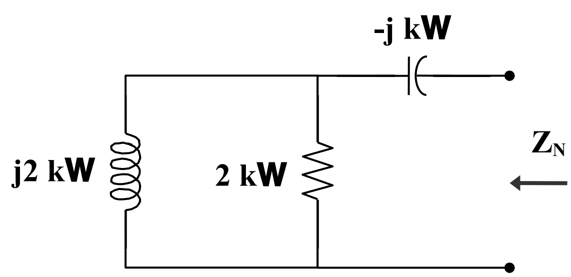
Transform the circuit to the frequency domain.

$$4\cos(200t + 30°) \longrightarrow 4\angle 30°, \quad \omega = 200$$

$$10\text{ H} \longrightarrow j\omega L = j(200)(10) = j2\text{ k}\Omega$$

$$5\ \mu\text{F} \longrightarrow \frac{1}{j\omega C} = \frac{1}{j(200)(5\times 10^{-6})} = -j\text{ k}\Omega$$

$\mathbf{Z}_N$ is found using the circuit in Fig. (a).

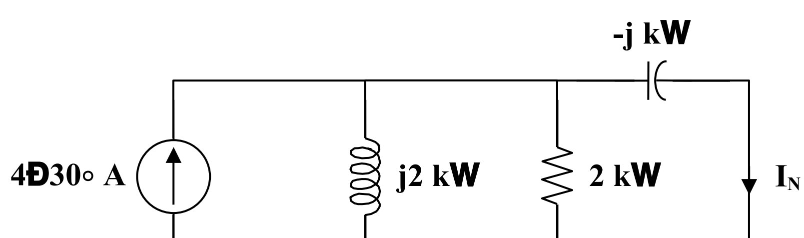


(a)

$$\mathbf{Z}_N = -j + 2 \,\|\, j2 = -j + 1 + j = 1\text{ k}\Omega$$

1 kΩ

We find $\mathbf{I}_N$ using the circuit in Fig. (b).



$$j2 \,||\, 2 = 1 + j$$

By the current division principle,

$$\mathbf{I}_N = \frac{1 + j}{1 + j - j}(4\angle 30°) = 5.657\angle 75°$$

Therefore,

$$\mathbf{I_N = 5.657\angle 75°\ A}$$

$$\mathbf{Z}_N = \mathbf{1\ kW}$$