Chapter 9, Solution 52.

If $\mathbf{V}_o = 8\angle 30°$ V in the circuit of Fig. 9.59, find $\mathbf{I}_s$.

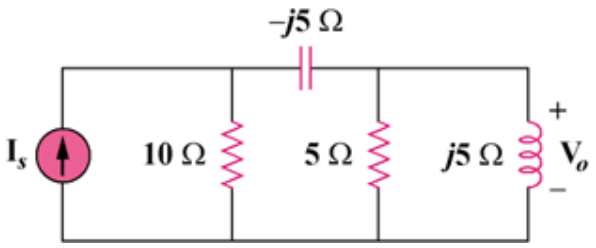


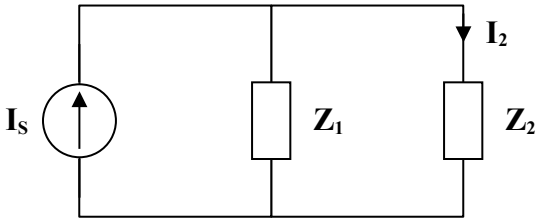
Figure 9.59
For Prob. 9.52.

Solution

We begin by simplifying the circuit. First, we replace the parallel inductor and resistor with their series equivalent.

$$5 \parallel j5 = \frac{j25}{5 + j5} = \frac{j5}{1 + j} = 2.5 + j2.5$$

Next let $\mathbf{Z}_1 = 10$, and $\mathbf{Z}_2 = -j5 + 2.5 + j2.5 = 2.5 - j2.5$.



By current division $\mathbf{I}_2 = \frac{\mathbf{Z}_1}{\mathbf{Z}_1 + \mathbf{Z}_2}\mathbf{I}_s = \frac{10}{12.5 - j2.5}\mathbf{I}_s = \frac{4}{5 - j}\mathbf{I}_s$.

Since $\mathbf{V}_o = \mathbf{I}_2 (2.5 + j2.5)$ we can now find $\mathbf{I}_s$.

$$8\angle 30° = \left(\frac{4}{5 - j}\right)\mathbf{I}_s (2.5)(1 + j) = \frac{10(1 + j)}{5 - j}\mathbf{I}_s$$

$$\mathbf{I}_s = \frac{(8\angle 30°)(5 - j)}{10(1 + j)} =$$ **2.884∠–26.31° A**.