

Chapter 9, Solution 87.

The network in Fig. 9.87 is part of the schematic describing an industrial electronic sensing device. What is the total impedance of the circuit at 2 kHz?

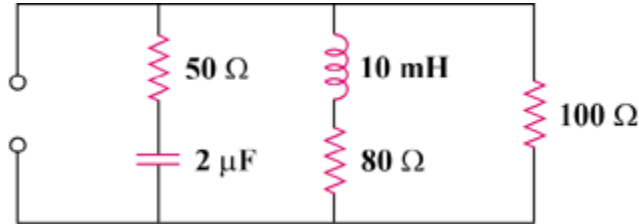


Figure 9.87
For Prob. 9.87.

Solution

$$\mathbf{Z}_1 = 50 + \frac{1}{j\omega C} = 50 + \frac{-j}{(2\pi)(2 \times 10^3)(2 \times 10^{-6})}$$

$$\mathbf{Z}_1 = 50 - j39.79$$

$$\mathbf{Z}_2 = 80 + j\omega L = 80 + j(2\pi)(2 \times 10^3)(10 \times 10^{-3})$$

$$\mathbf{Z}_2 = 80 + j125.66$$

$$\mathbf{Z}_3 = 100$$

$$\frac{1}{\mathbf{Z}} = \frac{1}{\mathbf{Z}_1} + \frac{1}{\mathbf{Z}_2} + \frac{1}{\mathbf{Z}_3}$$

$$\frac{1}{\mathbf{Z}} = \frac{1}{100} + \frac{1}{50 - j39.79} + \frac{1}{80 + j125.66}$$

$$\frac{1}{\mathbf{Z}} = 10^{-3} (10 + 12.24 + j9.745 + 3.605 - j5.663)$$

$$= (25.85 + j4.082) \times 10^{-3}$$

$$= 26.17 \times 10^{-3} \angle 8.97^\circ$$

$$\mathbf{Z} = 38.21 \angle -8.97^\circ \, \Omega$$