Phasors (EC_phasors_2.sqproj)

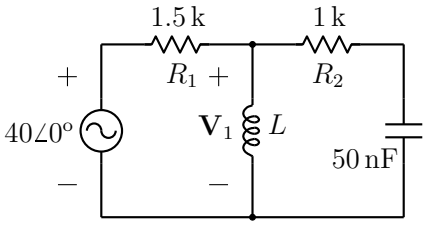

Figure 1: Phasor calculation example.

Question: In the circuit shown in the figure, the frequency is 1.6 kHz. With $L = 100\,\text{mH}$, find (a) $\mathbf{V}_1$, (b) P_{R2}, the average power dissipated in R_2.

Solution:

Using nodal analysis (see Fig. 1), we have

$$\frac{\mathbf{V}_s - \mathbf{V}_1}{R_1} = \frac{\mathbf{V}_1}{j\omega L} + \frac{\mathbf{V}_1}{R_2 - j/\omega C}. \tag{1}$$

With $f = 1.6\,\text{kHz}$, the impedances are evaluated as $j\omega L = j1\,\text{k}\Omega$ and $-j/\omega C = -j2\,\text{k}\Omega$. Substituting

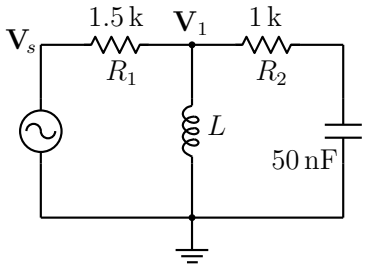

Figure 2: Nodal analysis of the circuit in Fig. 1.

in Eq. 1 and writing the currents in mA, we get

$$\frac{\mathbf{V}_s - \mathbf{V}_1}{1.5} = \frac{\mathbf{V}_1}{j1} + \frac{\mathbf{V}_1}{1 - j2}. \tag{2}$$

$$\rightarrow \frac{40}{1.5} = \mathbf{V}_1\left(0.67 - j1 + (0.2 + j0.4)\right). \tag{3}$$

Solving the above equation, we get $\mathbf{V}_1 = 25.4\angle 34.4°$, and $P_{R2} = \frac{1}{2}\left|\frac{\mathbf{V}_1}{1 - j2}\right|^2 R_2 = 64.8\,\text{mW}$.

SequelApp Exercises:

(a) Find L for which P_{R2} is half of the value obtained above.

(b) Find the corresponding $\mathbf{V}_1$.

Verify your answers using SequelApp.