Tutorial No. 2, ELG2336, winter 2008

Problem 4.54

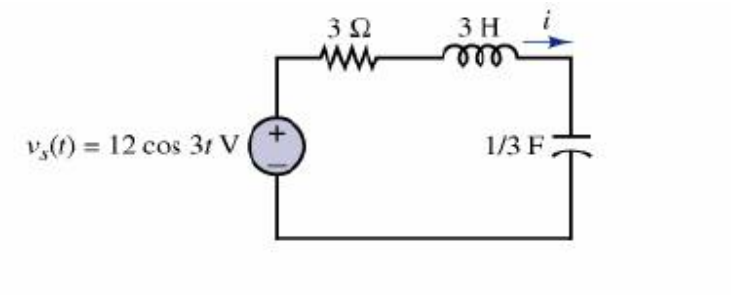

Figure 1: Problem 4.54

Known quantities:

The values of the impedance and the voltage applied to the circuit shown in Figure 1.

Find:

The current $i(t)$ in the circuit.

Analysis:

Assume clockwise current:

$$\omega = 3\frac{\text{rad}}{s}, V_S = 12\angle 0° \text{ V}$$

$$Z_C = \frac{1}{j\omega C} = -j\,\Omega, Z_L = j\omega L = j9\,\Omega \Rightarrow Z_{total} = 3 + j9 - j = 3 + j8\,\Omega$$

$$I = \frac{12}{3 + j8} = 0.4932 - j1.3151 \text{ A} = 1.4045\angle -69.44° \text{ A}, i(t) = 1.4\cos(\omega t - 69.4°) \text{ A}$$

Problem 4.55

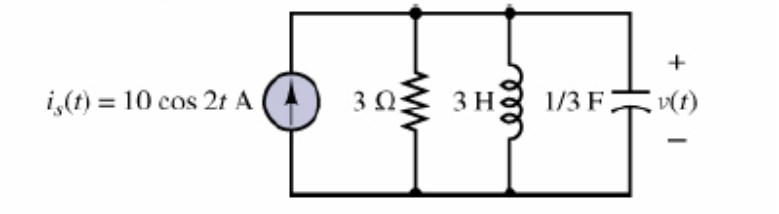

Figure 2: Problem 4.55

Known quantities:

The values of the impedance and the current source shown in Figure 2

Find:

The voltage $v(t)$

Analysis:

Assume clockwise currents:

$$\omega = 2\frac{\text{rad}}{s}, I_S = 10\angle 0° \text{ A}, Z_L = j\omega L = j9\,\Omega, \text{Z}_\text{C} = \frac{1}{j\omega C} = \text{-j}\omega 1.5\,\Omega$$

$$Z_{eq} = \frac{1}{\frac{1}{R}+\frac{1}{Z_L}+\frac{1}{Z_C}} = \frac{1}{\frac{1}{3}+j\frac{1}{6}+j\frac{2}{3}} = \frac{1}{0.33+j0.5} = 0.9231 - j1.3846\,\Omega$$

$$V = I_S Z_{eg} = 10\text{ A}\cdot(0.9231 - j1.3846)\,\Omega = 9.231 - j13.846\text{ V} = 16.641\angle -56.31°\text{ V}$$

Problem 4.56

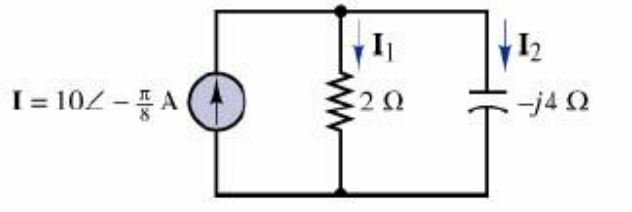

Figure 3: Problem 4.56

Known quantities:

The value of the impedance and the current source for the circuit shown in Figure 3.

Find:

The current I_1

Analysis:

Specifying the positive directions of the currents as in Figure 3:

$$Z_{eq} = \frac{1}{\frac{1}{2} + \left(\frac{1}{-j4}\right)} = 1.79\angle 26.56° \,\Omega$$

$$V_S = I_S Z_{eq} = (10\angle -22.5°)\,\text{A} \cdot (1.79\angle 26.56°)\,\Omega = 17.9\angle 4.06°\,\text{V}$$

$$I_1 = \frac{V_S}{R} = 8.95\angle 4.06°\,\text{A}$$

Problem 4.57

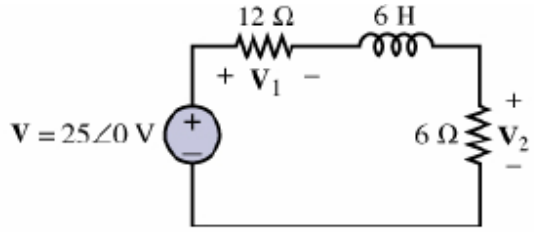

Figure 4: Problem 4.57

Known quantities:

The values of the impedance and the voltage source for circuit shown in Figure 4.

Find:

The voltage V_2

Analysis:

Specifying the positive directions as in Figure 4:

$$Z_L = j\omega L = j12\,\Omega$$

$$V_2 = \frac{R_{6\Omega}}{R_{12\Omega} + Z_L + R_{6\Omega}} V = \frac{6\Omega}{(12 + j12 + 6)\Omega} 25\angle 0°\,\text{V} = \frac{150\angle °}{18 + \text{j}12\Omega}\,\text{V} = 6.93\angle -33.7°\,\text{V}$$

Problem 4.60

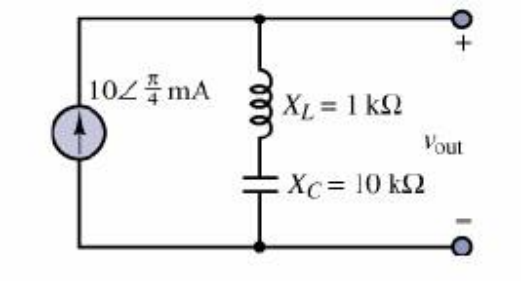

Figure 5: Problem 4.60

Known quantities:

The values of the reactance X_L= 1 **kΩ**, X_C= 10 **kΩ**, and the current source **I**=10∠45 º **mA** for circuit shown in Figure 5.

Find:

The voltage V_{out}

Analysis:

Specifying the positive directions of the currents as in Figure 5:

$$V_{out} = Z_{eq} I = (Z_L + Z_C) I = (0 + jX_L + 0 - jX_C) I = (j1\ \text{KΩ} - \text{j10 KΩ}) \cdot 10\angle 45° \text{ mA}$$

$$\Rightarrow V_{out} = (\text{-j9 KΩ}) \cdot 10\angle 45° \text{ mA} = (9\angle -90° \text{ KΩ}) \cdot 10\angle 45° \text{ mA} = 90\angle -45° \text{ V}$$

$$v_{out} = 90\cos(\omega t - 45°) \text{ V}$$