Tutorial - 1-02-h

Question 1 (14-46)

46. Perform the following operations (express your answers in rectangular form):

a. $\dfrac{(4 + j3) + (6 - j8)}{(3 + j3) - (2 + j3)}$

b. $\dfrac{8\ \angle 60°}{(2\ \angle 0°) + (100 + j100)}$

Question 2 (14-47)

47. a. Determine a solution for x and y if

$$(x + j4) + (3x + jy) - j7 = 16\ \angle 0°$$

b. Determine x if

$$(10\ \angle 20°)(x\ \angle -60°) = 30.64 - j25.72$$

Question 3 (14-49)

49. Express the following phasor currents and voltages as sine waves if the frequency is 60 Hz:

a. $\mathbf{I} = 40\ \text{A}\ \angle 20°$ **b.** $\mathbf{V} = 120\ \text{V}\ \angle 0°$

c. $\mathbf{I} = 8 \times 10^{-3}\ \text{A}\ \angle 120°$ **d.** $\mathbf{V} = 5\ \text{V}\ \angle 90°$

Question 4 (14-51)

51. For the system of Fig. 14.80, find the sinusoidal expression for the unknown current i_1 if

$$i_s = 20 \times 10^{-6} \sin(\omega t + 90°)$$
$$i_2 = 6 \times 10^{-6} \sin(\omega t - 60°)$$

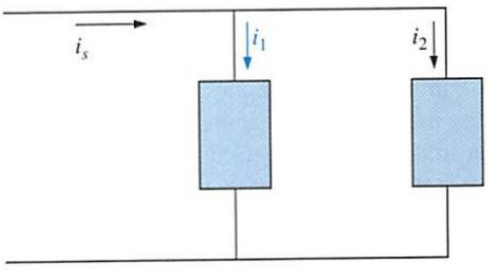

FIG. 14.80
Problem 51.

Question 5 (15-3)

3. Find the voltage v for the elements of Fig. 15.119 using complex algebra. Sketch the waveforms of v and i on the same set of axes.

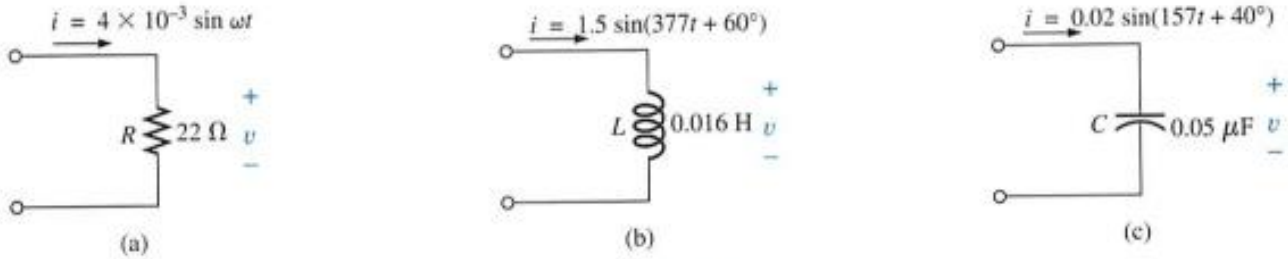

FIG. 15.119
Problem 3.

SOLUTION

Q1

46. a. $$\frac{10 - j5}{1 + j0} = 10.0 - j5.0$$

b. $$\frac{8\ \angle 60^\circ}{102 + j100} = \frac{8\ \angle 60^\circ}{142.843\ \angle 44.433^\circ} = 0.056\ \angle 15.567^\circ$$

Q2

47. a.
$$x + j4 + 3x + jy - j7 = 16$$
$$(x + 3x) + j(4 + y - 7) = 16 + j0$$
$$x + 3x = 16 \qquad 4 + y - 7 = 0$$
$$4x = 16 \qquad y = +7 - 4$$
$$x = 4 \qquad y = 3$$

b.
$$(10\ \angle 20^\circ)(x\ \angle -60^\circ) = 30.64 - j25.72$$
$$10x\ \angle -40^\circ = 40\ \angle -40^\circ$$
$$10x = 40$$
$$x = 4$$

Q3

49. a. $56.569 \sin(377t + 20^\circ)$

b. $169.68 \sin 377t$

c. $11.314 \times 10^{-3} \sin(377t + 120^\circ)$

d. $7.07 \sin(377t + 90^\circ)$

Q4

51. $i_s = i_1 + i_2 \Rightarrow i_1 = i_s - i_2$

(Using peak values) $= (20 \times 10^{-6}\ \text{A}\ \angle 90^\circ) - (6 \times 10^{-6}\ \text{A}\ \angle -60^\circ)$

and $i_1 = (0 + j2 \times 10^{-5}) - (3 \times 10^{-6} - j5.196 \times 10^{-6})$

$= -0.3 \times 10^{-5} + j2.5196 \times 10^{-5} = 2.537 \times 10^{-5}\ \angle 96.79^\circ$

$= 2.537 \times 10^{-5} \sin(\omega t + 96.79^\circ)$

Q5

3. a. $\mathbf{I} = (0.707)(4\text{ mA}\ \angle 0°) = 2.828\text{ mA}\ \angle 0°$

$\mathbf{V} = (I\ \angle 0°)(R\ \angle 0°) = (2.828\text{ mA}\ \angle 0°)(22\ \Omega\ \angle 0°) = 62.216\text{ mV}\ \angle 0°$

$v = 88 \times 10^{-3} \sin \omega t$

b. $\mathbf{I} = (0.707)(1.5\text{ A}\ \angle 60°) = 1.0605\text{ A}\ \angle 60°$

$X_L = \omega L = (377\text{ rad/s})(0.016\text{ H}) = 6.032\ \Omega$

$\mathbf{V} = (I\ \angle \theta)(X_L\ \angle 90°) = (1.0605\text{ A}\ \angle 60°)(6.032\ \Omega\ \angle 90°) = 6.397\text{ V}\ \angle 150°$

$v = 9.045 \sin(377t + 150°)$

c. $\mathbf{I} = (0.707)(20\text{ mA}\ \angle 40°) = 14.14\text{ mA}\ \angle 40°$

$$X_C = \frac{1}{\omega C} = \frac{1}{(157\text{ rad/s})(0.05 \times 10^{-6}\text{ F})} = 127.39\text{ k}\Omega$$

$\mathbf{V} = (I\ \angle \theta)(X_C\ \angle -90°) = (14.14\text{ mA}\ \angle 40°)(127.39\text{ k}\Omega\ \angle -90°)$

$= 1801.3\text{ V}\ \angle -50°$

$V_p = \sqrt{2}\,(1801.3\text{ V}) = 2547.4\text{ V}$

and $v = 2547.4 \sin(157t - 50°)$