

Electrical Circuit (2)

Impedance and Admittance (week2 class2)

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PART 2

AC Circuits 368

Chapter 9

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9.12 Let $\mathbf{X} = 4\angle 40^\circ$ and $\mathbf{Y} = 20\angle -30^\circ$. Evaluate the following quantities and express your results in polar form:

(a) $(\mathbf{X} + \mathbf{Y})\mathbf{X}^*$

(b) $(\mathbf{X} - \mathbf{Y})^*$

(c) $(\mathbf{X} + \mathbf{Y})/\mathbf{X}$

9.13 Evaluate the following complex numbers:

(a) $\frac{2 + j3}{1 - j6} + \frac{7 - j8}{-5 + j11}$

(b) $\frac{(5\angle 10^\circ)(10\angle -40^\circ)}{(4\angle -80^\circ)(-6\angle 50^\circ)}$

(c) $\begin{vmatrix} 2 + j3 & -j2 \\ -j2 & 8 - j5 \end{vmatrix}$

9.12 Let $\mathbf{X} = 4\angle 40^\circ$ and $\mathbf{Y} = 20\angle -30^\circ$. Evaluate the following quantities and express your results in polar form:

(a) $(\mathbf{X} + \mathbf{Y})\mathbf{X}^*$ *Ans* = $81.563 - j29.65$

(b) $(\mathbf{X} - \mathbf{Y})^*$ *Ans* = $-14.26 - j12.57$

(c) $(\mathbf{X} + \mathbf{Y})/\mathbf{X}$ *Ans* = $0.271 - j0.467$

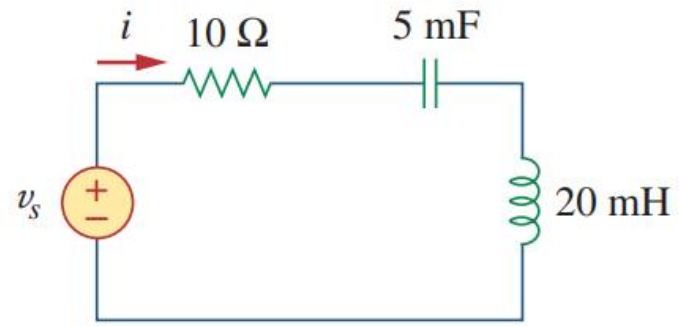
9.13 Evaluate the following complex numbers:

(a) $\frac{2 + j3}{1 - j6} + \frac{7 - j8}{-5 + j11}$ *Ans* = $-1.275 + j0.152$

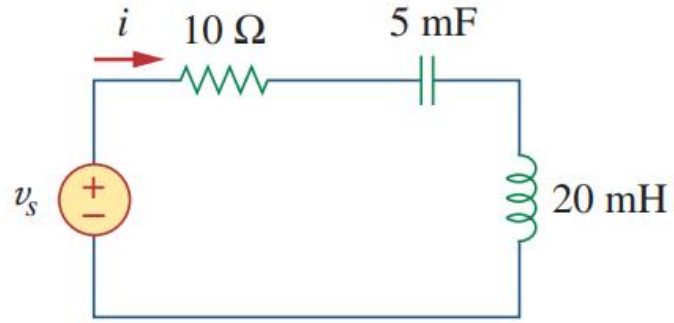
(b) $\frac{(5\angle 10^\circ)(10\angle -40^\circ)}{(4\angle -80^\circ)(-6\angle 50^\circ)}$ *Ans* = $0.362 - j2.05$

(c) $\begin{vmatrix} 2 + j3 & -j2 \\ -j2 & 8 - j5 \end{vmatrix}$ *Ans* = $35 + j14$

9.35 Find current i in the circuit of Fig. 9.42, when $v_s(t) = 50 \cos 200t$ V.



9.35 Find current i in the circuit of Fig. 9.42, when $v_s(t) = 50 \cos 200t$ V.



$$X_C = \frac{1}{j2\pi fC} = \frac{1}{j 200 * 5 * 10^{-3}} = -j$$

$$X_L = j2\pi fL = j 200 * 20 * 10^{-3} = 4j$$

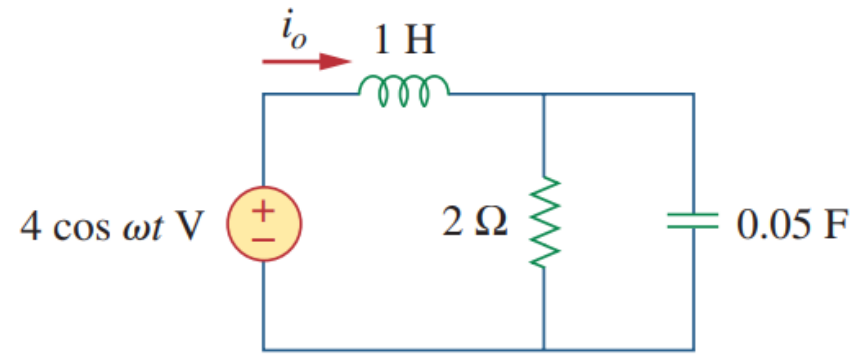
$$Z = R + X_L + X_C = 10 + 3j$$

$$I = \frac{V}{Z} = \frac{50\angle 0}{10 + 3j} = 4.59 - j1.376 = 4.79\angle -16.7$$

9.40 In the circuit of Fig. 9.47, find i_o when:

(a) $\omega = 1 \text{ rad/s}$ (b) $\omega = 5 \text{ rad/s}$

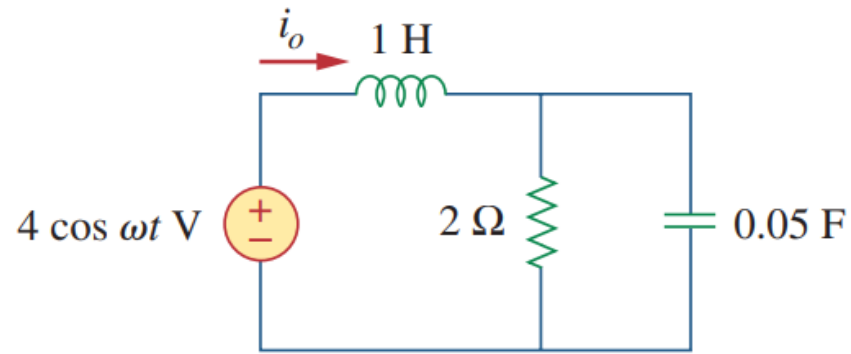
(c) $\omega = 10 \text{ rad/s}$



9.40 In the circuit of Fig. 9.47, find i_o when:

(a) $\omega = 1 \text{ rad/s}$ (b) $\omega = 5 \text{ rad/s}$

(c) $\omega = 10 \text{ rad/s}$



@1 rad/s

$$X_C = \frac{1}{j2\pi fC} = \frac{1}{j 1 * 50 * 10^{-3}} = -20j$$

$$X_L = j2\pi fL = j 1 * 1 = j$$

$$Z = X_L + \frac{R * X_C}{R + X_C} = j + \frac{2 * -20j}{2 - 20j} = 1.98 - j0.8$$

$$I = \frac{V}{Z} = \frac{4\angle 0}{1.98 - j0.8} = 1.736 + j0.7 \text{ A}$$

@5 rad/s $X_C = \frac{1}{j2\pi fC} = \frac{1}{j 5 * 50 * 10^{-3}} = -4j$

$$X_L = j2\pi fL = j 5 * 1 = 5j$$

$$Z = X_L + \frac{R * X_C}{R + X_C} = j5 + \frac{2 * -4j}{2 - 4j} = 1 + j9$$

$$I = \frac{V}{Z} = \frac{4\angle 0}{1 + 9j} = 0.3168 - j0.8317 \text{ A}$$

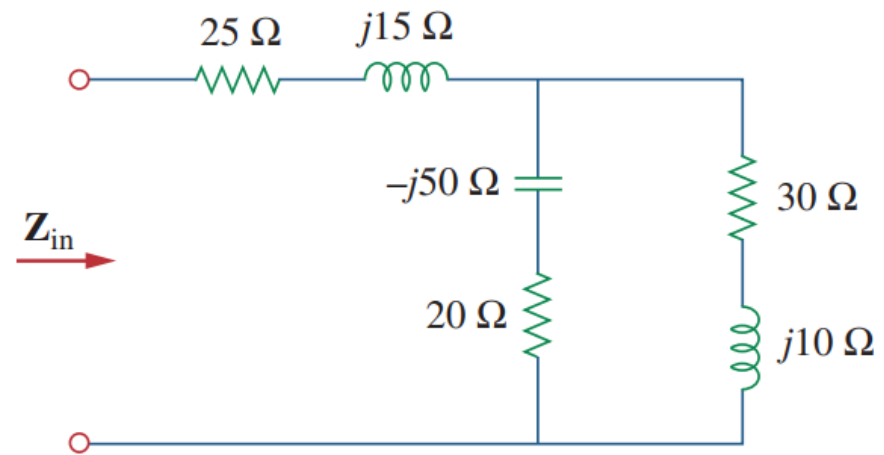
@10 rad/s $X_C = \frac{1}{j2\pi fC} = \frac{1}{j 10 * 50 * 10^{-3}} = -2j$

$$X_L = j2\pi fL = j 10 * 1 = j10$$

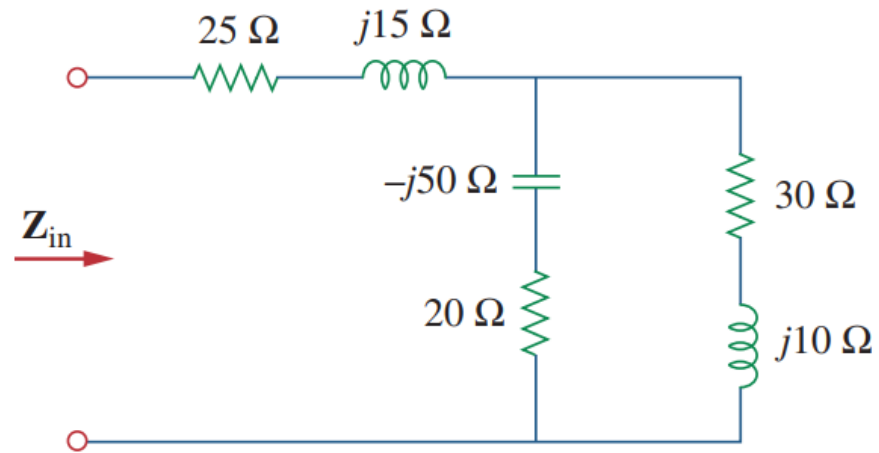
$$Z = X_L + \frac{R * X_C}{R + X_C} = j10 + \frac{2 * -2j}{2 - 2j} = 1 + j9$$

$$I = \frac{V}{Z} = \frac{4\angle 0}{1 + j9} = 0.04878 - j0.439 \text{ A}$$

9.60 Obtain $\mathbf{Z}_{\text{in}}$ for the circuit in Fig. 9.67.



9.60 Obtain $\mathbf{Z}_{in}$ for the circuit in Fig. 9.67.



$$Z1 = 25 + j15$$

$$Z2 = 20 - j50$$

$$Z3 = 30 + j10$$

$$Z_{in} = Z1 + \frac{Z2 \cdot Z3}{Z2 + Z3} = 25 + j15 + \frac{(20 - j50)(30 + j10)}{20 - j50 + 30 + j10}$$

$$Z_{in} = 51 + j10$$

