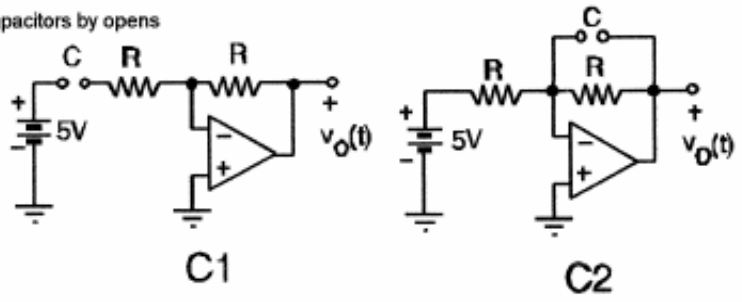
Homework Solutions 11

(6-45)

6-45 Replace capacitors by opens



For C1 when C is open the source and OP AMP are disconnected hence $v_O := 0$ V

For C2 when C is open the OP AMP circuit is an inverter hence $v_O := -5$ V

(7-15)

7-16

$$\frac{d}{dt}v(t) + 200\cdot v(t) = 25\cdot\sin(100\cdot t) \qquad v_N(t) = K\cdot\exp(-200\cdot t) \qquad v_P(t) = A\cdot\cos(100\cdot t) + B\cdot\sin(100\cdot t)$$

$$\frac{d}{dt}v_P(t) + 200\cdot V_P(t) = -100\cdot A\cdot\sin(100\cdot t) + 100\cdot B\cdot\cos(100\cdot t) + 200\cdot(A\cdot\cos(100\cdot t) + B\cdot\sin(100\cdot t)) = 25\cdot\sin(100\cdot t)$$

hence $\quad -100\cdot A + 200\cdot B = 25 \quad 100\cdot B + 200\cdot A = 0 \quad B = -2\cdot A \quad -500\cdot A = 25\ A := \frac{-1}{20} \quad B := \frac{1}{10}$

$$v(t) = \frac{-1}{20}\cdot\cos(100\cdot t) + \frac{1}{10}\cdot\sin(100\cdot t) + K\cdot\exp(-200\cdot t) \qquad v(0) = \frac{-1}{20} + K = 0 \qquad K := \frac{1}{20}$$

$$v(t) = \frac{-1}{20}\cdot\cos(100\cdot t) + \frac{1}{10}\cdot\sin(100\cdot t) + \frac{1}{20}\cdot\exp(-200\cdot t)$$ checking in Mathcad

$$\frac{d}{dt}\left(\frac{-1}{20}\cdot\cos(100\cdot t) + \frac{1}{10}\cdot\sin(100\cdot t) + \frac{1}{20}\cdot\exp(-200\cdot t)\right) + 200\cdot\left(\frac{-1}{20}\cdot\cos(100\cdot t) + \frac{1}{10}\cdot\sin(100\cdot t) + \frac{1}{20}\cdot\exp(-200\cdot t)\right)$$

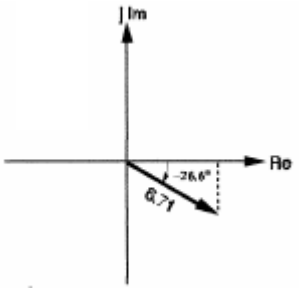
(8-2)

8-2, 15-2 $I_1 := 6\cdot\exp(j\cdot 0) \quad I_1 = 6$

$$I_2 := 3\cdot\exp\left(j\cdot\frac{-\pi}{2}\right) \quad I_2 = -3j$$

$$\left|I_1 + I_2\right| = 6.708 \qquad \frac{180}{\pi}\cdot\arg\left(I_1 + I_2\right) = -26.565$$

$$i_1(t) + i_2(t) = 6.708\cdot\cos(\omega\cdot t - 26.565)$$

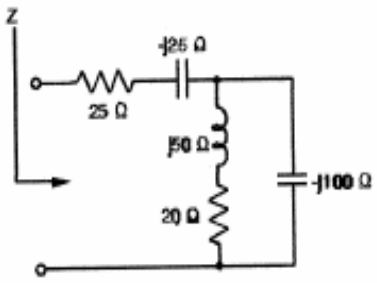


(8-12)

8-12, 15-12 $Z := 25 - j\cdot 25 + \dfrac{1}{\left(\dfrac{1}{-j\cdot 100} + \dfrac{1}{20 + j\cdot 50}\right)}$

$Z = 93.966 + 47.414j$

$|Z| = 105.25 \quad \dfrac{180}{\pi}\cdot\arg(Z) = 26.775$



(8-15)

8-15, 15-15 $V := 200\cdot\exp\left(-j\cdot\dfrac{\pi}{3}\right) \quad I := 20\cdot 10^{-3} + j\cdot 0$

(a) $Z := \dfrac{V}{I} \quad Z = 5000 - 8660j \quad \Omega$

(b) $V := 150\cdot\exp\left(-j\cdot 3\cdot\dfrac{\pi}{2}\right) \quad I := \dfrac{V}{Z} \quad I = -1.299\times 10^{-2} + 7.5j\times 10^{-3}$

$|I| = 1.5\times 10^{-2} \qquad \dfrac{180}{\pi}\cdot\arg(I) = 150$

$i(t) = 1.5\cdot 10^{-2}\cdot\cos\left(1000\cdot t + 150^{o}\right)\ A$

(8-26)

8-26, 15-26 $Z := \dfrac{1}{j\cdot 2000\cdot 2\cdot 10^{-6} + \dfrac{1}{250 + j\cdot 2000\cdot 0.25}}$

$Z_{IN} := 500 + Z \quad Z_{IN} = 625 - 375j$ <-Input Imp.

By double voltage division

$V_x := \left(\dfrac{Z}{Z_{IN}}\cdot 15\right)\cdot\dfrac{250}{250 + j\cdot 2000\cdot 0.25}$

$V_x = -0.882 - 3.529j \quad |V_x| = 3.638$

$\dfrac{180}{\pi}\cdot\arg(V_x) = -104 \quad v_x(t) = 3.638\cdot\cos\left(2000\cdot t - 104^{o}\right)$