

Chapter 13 Answers to Assigned Homework

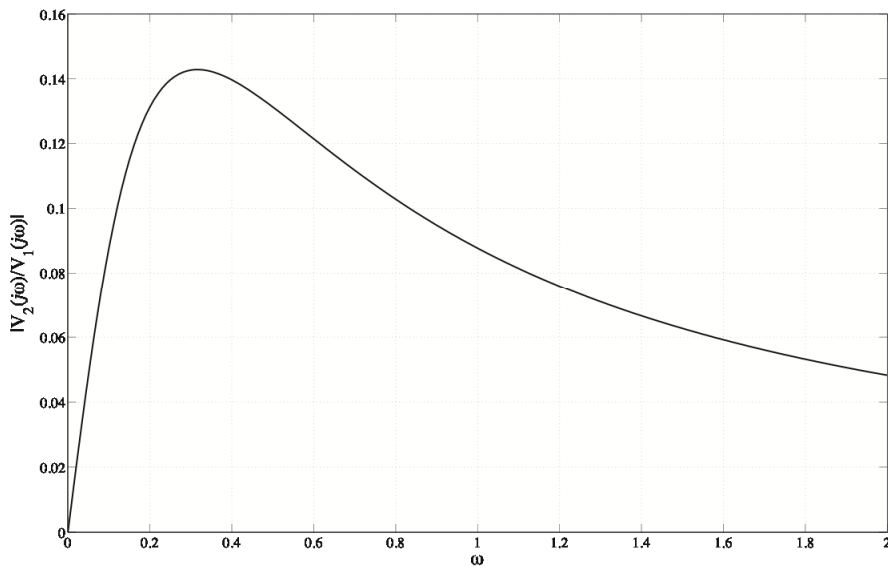
1. (a) $v_1(t) = -40 \sin(8t)$ mV
 (b) $v_2(t) = 300 \cos(100t)$ mV
 (c) $v_2(t) = 188.22 \cos(8t + 9.37^\circ)$ mV

3. (a) $v_1(t) = -10.5 \sin(70t)$ nV
 (b) $v_2(t) = 41.25 \sin(5t - 30^\circ)$ μ V
 (c) $v_2(t) = -15 \cos(5t)$ mV

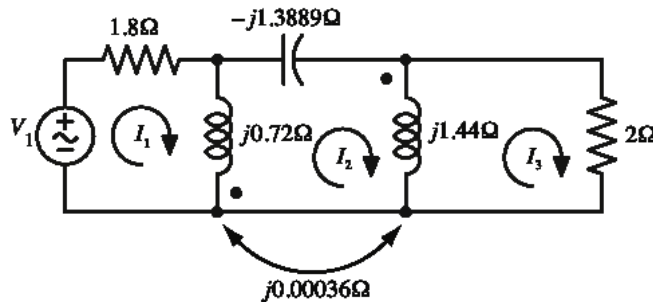
7. $i_1(t) = 533.33 \sin(5t)$ A + $i_1(0)$

10. $I_1 = 7.73 \angle -20.38^\circ$ mA, $I_2 = 2.563 \angle -163.1^\circ$ mA
 $V_2 / V_1 = 55.74 \angle -163.1^\circ$, $I_2 / I_1 = 0.3316 \angle -142.7^\circ$

11.



12.



$$\begin{bmatrix} 1.8 + j0.72 & -j0.72036 & j0.00036 \\ -j0.72036 & j0.77182 & -j1.44036 \\ j0.00036 & -j1.44036 & 2 + j1.44 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} V_1 \\ 0 \\ 0 \end{bmatrix}$$

$$i_2(t) = 3.1322 \cos(720t - 32.78^\circ)$$

14. (a) $P_s = -9.2 \text{ mW}$
 (b) $P_{10} = 8.7 \text{ mW}$ $P_5 = 0.47 \text{ mW}$
 (c) The inductances absorb zero average power
 (d) The mutual inductance absorbs zero average power.

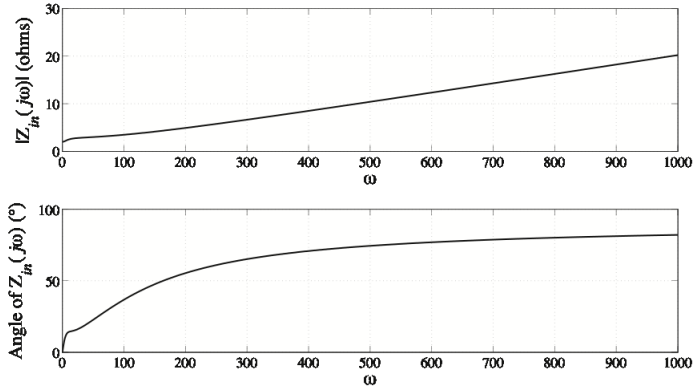
17. $V_{AG} = 320.69 \angle 86.25^\circ$ (positive reference on top)
 $V_{CG} = 34.93 \angle -113.63^\circ$ (positive reference on top)
 $V_{AB} = 328.07 \angle 91.22^\circ$ (positive reference on top)

19.
$$i_C(t) = \frac{30t}{(t^2 + 0.01)^2} \mu\text{A}$$

21. (a)
$$\begin{bmatrix} 6 + j5\omega & -j2\omega & -6 \\ -j2\omega & 4 + j5\omega & -j4\omega \\ -6 & -j4\omega & 11 + j6\omega \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 100 \\ 0 \\ 0 \end{bmatrix}$$

(b)
$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 11.309 \angle -57.56^\circ \\ 7.406 \angle -34.35^\circ \\ 4.32 \angle -54.3^\circ \end{bmatrix}$$

23. (a)
$$Z_{in}(j\omega) = \frac{-0.01\omega^2 + j1.5\omega + 10}{j0.5\omega + 5}$$

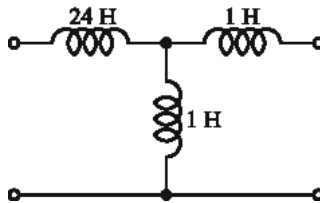


(b)
 (c) $Z_{in}(j50) = 3 \angle 22.62^\circ$

25. (a) $M = 5.3 \text{ mH}$
 (b) $E_1(2\text{ms}) = 319.32 \text{ nJ}$ $E_2(t) = 0$ $E_M(t) = 0$
 (c) $E_1(t) = 319.32 \text{ nJ}$ $E_2(t) = 13.973 \mu\text{J}$ $E_M(t) = 3.166 \mu\text{J}$

29. $v_1(t) = 468 \cos(5t + 118.15^\circ) \text{ mV}$
 $v_1(t) = 1.136 \cos(5t + 128.64^\circ) \text{ mV}$
 $P_{1,abs} = 109.5 \text{ mW}$
 $P_{2,abs} = 322.6 \text{ mW}$
 $P_{s,sup} = 432.2 \text{ mW}$

32.



The voltage between C and D (positive on top) is $V_{CD} = 200 \angle -90^\circ \text{ mV}$.

37. $\frac{I_L}{V_s} = j0.0714 \frac{\omega}{\omega^2 - j0.7143\omega - 0.1071} \Rightarrow \frac{V_1}{V_s} = j0.1429 \frac{\omega}{\omega^2 - j0.7143\omega - 0.1071}$

39. $Z_{in} = \frac{-0.9213\omega^2 + j0.3071\omega}{j3.3071\omega + 1}$

40. (a) $V_2 = 24 \angle 32^\circ \text{ V}$ $I_2 = 16.97 \angle 77^\circ \text{ A}$
 (b) I_2 is infinite $V_2 = 24 \angle 32^\circ \text{ V}$
 (c) $V_3 = 12 \angle 118^\circ \text{ V}$ $I_2 = 8 \angle 98^\circ \text{ A}$

42. $P_{400} = 8.877 \mu\text{W}$ $P_{21} = 466.02 \mu\text{W}$

46.

$$\begin{bmatrix} I_s \\ V_1 \\ V_2 \\ I_3 \\ I_x \end{bmatrix} = \begin{bmatrix} 43.223 \angle -30^\circ \\ 15.107 \angle -30^\circ \\ 75.536 \angle 150^\circ \\ 7.268 \angle 150^\circ \\ 6.884 \angle -30^\circ \end{bmatrix}$$

48. (a) $v_2(t) = 3.8989 \cos(500t - 90^\circ)$

(b) $v_2(t) = 117 \sin(500t) \text{ V}$

(c) $v_2(t) = 3.9617 \cos(500t - 90^\circ)$

50. There is no real value of b that can satisfy the requirements.