Important Remarks

- Homework is due on April 1st at the beginning of class.

1. Problem 8.1
2. Problem 8.3
3. Problem 8.14
4. Problem 8.17

PROBLEMS FOR CHAPTER 8

8.1 For the circuit shown in Fig. P8.1, suppose that $v_s(t) = 12\cos 2t + 5\sin 2t$ V. Find $i(t)$ and $v_o(t)$ using time-domain analysis, and determine by how much $v_o(t)$ either leads or lags $v_s(t)$.

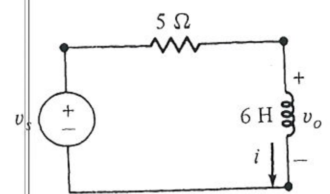

Fig. P8.1

8.2 For the circuit shown in Fig. P8.2, suppose that $i_s(t) = 8\sin\sqrt{3}t$ A. Find $v_o(t)$ using time-domain analysis, and determine by how much $v_o(t)$ either leads or lags $v_s(t)$.

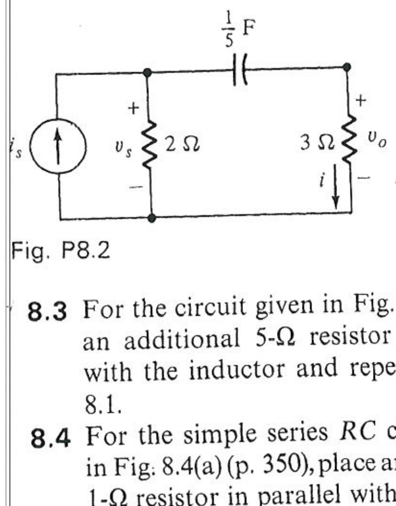

Fig. P8.2

8.3 For the circuit given in Fig. P8.1, place an additional 5-Ω resistor in parallel with the inductor and repeat Problem 8.1.

8.4 For the simple series RC circuit given in Fig. 8.4(a) (p. 350), place an additional 1-Ω resistor in parallel with the capacitor. Find $v_o(t)$ and $i(t)$ using time-domain analysis for the resulting circuit, and determine by how much $v_o(t)$ either leads or lags $v_s(t)$.

8.5 For the series RLC circuit given in Fig. 8.5 (p. 352) suppose that $R = \frac{5}{4}\ \Omega$, $L = \frac{1}{4}$ H, $C = 1$ F, and $v_s(t) = 4\cos 2t$ V. Find $v_C(t)$ using time-domain analysis, and determine by how much $v_C(t)$ either leads or lags $v_s(t)$.

8.6 For the RLC circuit shown in Fig. P8.6, suppose that $v_s(t) = 3\cos t$ V. Find $v_C(t)$ using time-domain analysis, and determine by how much $v_C(t)$ either leads or lags $v_s(t)$.

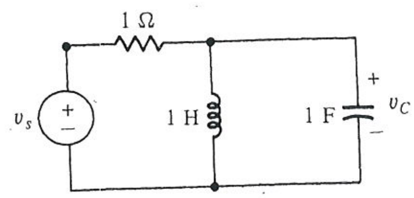

Fig. P8.6

8.7 For the RC circuit given in Fig. 8.4(a) (p. 350), find the zero-state response $v_o(t)$ for the case that the input voltage is $v_s(t) = 6\sin 2t\, u(t)$ V. (*Note*: The zero-state response includes both the forced and the natural responses.)

8.8 For the series RLC circuit given in Fig. 8.5 (p. 352), suppose that $R = \frac{5}{4}\ \Omega$, $L = \frac{1}{4}$ H, and $C = 1$ F. Find the zero-state response $v_C(t)$ for the case that the input voltage is $v_s(t) = 4\cos 2t\, u(t)$ V.

8.9 For the circuit given in Fig. P8.6, find the zero-state response $v_C(t)$ for the case that the input voltage is $v_s(t) = 3\cos t\, u(t)$ V.

8.10 Repeat Problem 8.9 for the case that the value of the resistor is changed to 0.5 Ω.

8.11 Find the exponential form of the following complex numbers given in rectangular form:

(a) $4 + j7$	(e) 4
(b) $3 - j5$	(f) -5
(c) $-2 + j3$	(g) $j7$
(d) $-1 - j6$	(h) $-j2$

8.12 Find the rectangular form of the following complex numbers given in exponential form:

(a) $3e^{j70°}$ (e) $6e^{j90°}$
(b) $2e^{j120°}$ (f) $e^{-j90°}$
(c) $5e^{-j60°}$ (g) $2e^{j180°}$
(d) $4e^{-j150°}$ (h) $2e^{-j180°}$

8.13 Find the rectangular form of the sum $\mathbf{A}_1 + \mathbf{A}_2$ given that
(a) $\mathbf{A}_1 = 3e^{j30°}$; $\mathbf{A}_2 = 4e^{j60°}$
(b) $\mathbf{A}_1 = 3e^{j30°}$; $\mathbf{A}_2 = 4e^{-j30°}$
(c) $\mathbf{A}_1 = 5e^{-j60°}$; $\mathbf{A}_2 = 2e^{j120°}$
(d) $\mathbf{A}_1 = 4e^{j45°}$; $\mathbf{A}_2 = 2e^{-j90°}$

8.14 Express the following sums as a single sinusoid of the form $A\cos(\omega t + \theta)$:
(a) $3\cos(\omega t + 30°) + 4\cos(\omega t + 60°)$
(b) $3\cos(\omega t + 30°) + 4\cos(\omega t - 60°)$
(c) $5\cos(\omega t - 60°) + 2\cos(\omega t + 120°)$
(d) $4\cos(\omega t + 45°) + 2\sin\omega t$

8.15 For the complex numbers given in Problem 8.13, find the rectangular form of the product $\mathbf{A}_1\mathbf{A}_2$.

8.16 Verify the following identities:
(a) $Me^{j90°} = jM$
(b) $Me^{-j90°} = -jM$
(c) $Me^{j180°} = -M$
(d) $Me^{-j180°} = -M$
(e) $Me^{j0°} = M$
(f) $-Me^{j\theta} = Me^{j(\theta \pm 180°)}$

8.17 Express the following as a single complex number in exponential form:
(a) $\dfrac{-j6}{1+j}$ (d) $\dfrac{85}{-1-j4}$
(b) $\dfrac{-8}{2+j3}$ (e) $\dfrac{200(1-j)}{4+j3}$
(c) $\dfrac{j3}{-2+j}$ (f) $\dfrac{20(1+j)}{4+j3}e^{-j30°}$
(g) $37.1e^{j14°} + 20.6e^{-j166°}$
(h) $16.5e^{j14°} + 4.12e^{-j76°}$

8.18 Express each part of Problem 8.17 as a single complex number in rectangular form.

8.19 Express each of the following as a single complex number:
(a) $2 + 2e^{j120°} + 2e^{-j120°}$
(b) $2e^{j60°} + 2e^{j180°} + 2e^{-j60°}$
(c) $2e^{j45°} + 2e^{j165°} + 2e^{-j75°}$

8.20 Repeat Problem 8.1 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.21 Repeat Problem 8.2 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.22 Repeat Problem 8.3 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.23 Repeat Problem 8.4 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.24 Repeat Problem 8.5 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.25 Repeat Problem 8.6 using frequency-domain analysis. Draw the corresponding phasor diagram.

8.26 For the series *RLC* circuit given in Fig. 8.5 (p. 352), suppose that $R = 4\ \Omega$, $L = 2$ H, and $v_s(t) = A\cos(3t + \theta)$ V. Determine by how much $v_C(t)$ either leads or lags $v_s(t)$ when C is (a) $\frac{1}{8}$ F, (b) $\frac{1}{18}$ F, and (c) $\frac{1}{32}$ F.

8.27 For the circuit shown in Fig. P8.27, (a) use mesh analysis to find $v_o(t)$, and

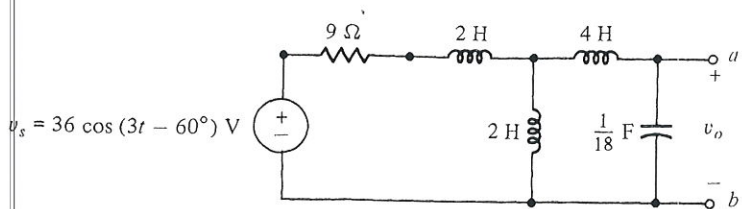

Fig. P8.27