Problems

3.1 For the circuit shown in Fig. P3.1*a*, suppose that $i(t)$ is described by the function given in Fig. P3.1*b*. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

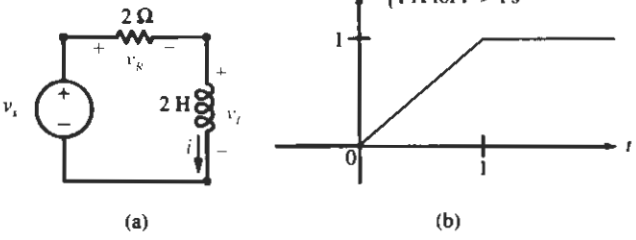


Fig. P3.1

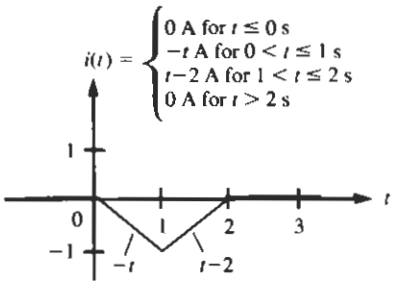


Fig. P3.2

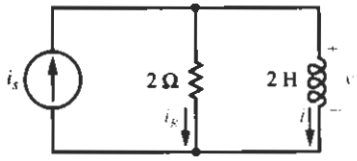


Fig. P3.3

3.2 For the circuit shown in Fig. P3.1*a*, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

3.3 For the circuit shown in Fig. P3.3, suppose that $i(t)$ is described by the function given in Fig. P3.1*b*. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $i_R(t)$, and (e) $i_s(t)$.

3.4 For the circuit shown in Fig. P3.3, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v(t)$, (b) $w_L(t)$, (c) $p_R(t)$, (d) $i_R(t)$, and (e) $i_s(t)$.

3.5 For the circuit shown in Fig. P3.5, suppose that $i(t)$ is described by the function given in Fig. P3.1*b*. Sketch (a) $v_R(t)$, (b) $v_L(t)$, and (c) $v(t)$.

3.6 For the circuit shown in Fig. P3.5, suppose that $i(t)$ is described by the function given in Fig. P3.2. Sketch (a) $v_R(t)$, (b) $v_L(t)$, and (c) $v(t)$.

3.7 For the circuit shown in Fig. P3.7*a*, suppose that $v(t)$ is described by the function given in Fig. P3.7*b*. Sketch (a) $i(t)$, (b) $w_C(t)$, (c) $p_R(t)$, (d) $v_R(t)$, and (e) $v_s(t)$.

3.8 For the circuit shown in Fig. P3.8, suppose that $v(t)$ is described by the function given in Fig. P3.7*b*.

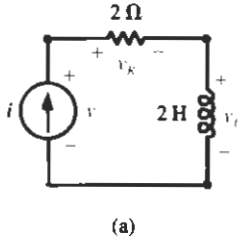


Fig. P3.5

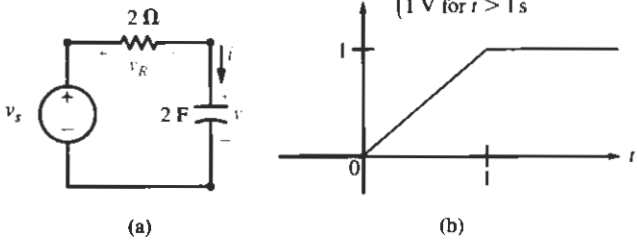


Fig. P3.7

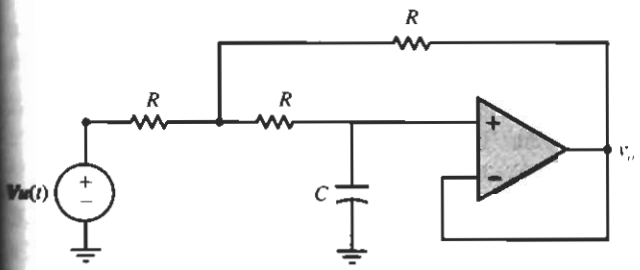


Fig. P3.50

3.50 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.50.

3.51 For the series *RC* circuit given in Fig. P3.7*a*, suppose that $v_s(t) = 12e^{-t/2}u(t)$ V. Find the responses $v(t)$ and $i(t)$.

3.52 For the series *RC* circuit given in Fig. P3.7*a*, suppose that $v_s(t) = 12e^{-t/4}u(t)$ V. Find the responses $v(t)$ and $i(t)$.

3.53 For the series *RL* circuit given in Fig. P3.1*a*, suppose that $v_s(t) = 12e^{-2t}u(t)$ V. Find the responses $i(t)$ and $v(t)$.

3.54 For the series *RL* circuit given in Fig. P3.1*a*, suppose that $v_s(t) = 12e^{-t}u(t)$ V. Find the responses $i(t)$ and $v(t)$.

3.55 For the circuit shown in Fig. P3.30, when $i_s(t) = 10u(t)$ A, then $i(t) = 4(1 - e^{-t})u(t)$ A and $v(t) = 20e^{-t}u(t)$ V. Find $i(t)$ and $v(t)$ when $i_s(t) = 10u(t) - 5u(t - 1)$ A.

3.56 For the circuit shown in Fig. P3.34, when $v_s(t) = 12u(t)$ V, then $v(t) = 18(1 - e^{-4t})u(t)$ V and $i(t) = 3e^{-4t}u(t)$ A. Find $v(t)$ and $i(t)$ when $v_s(t) = 12u(t) - 4u(t - 2)$ V.

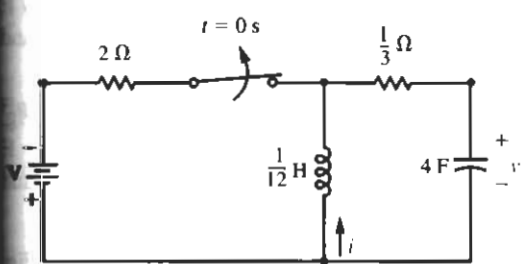


Fig. P3.57

3.57 For the circuit shown in Fig. P3.57, the switch opens at time $t = 0$ s. Find $v(t)$ and $i(t)$ for all time.

3.58 For the circuit shown in Fig. P3.57, change the value of the capacitor to $\frac{1}{3}$ F. For the resulting circuit, the switch opens at time $t = 0$ s. Find $v(t)$ and $i(t)$ for all time.

3.59 For the circuit shown in Fig. P3.57, change the value of the capacitor to 3 F. For the resulting circuit, the switch opens at time $t = 0$ s. Find $v(t)$ and $i(t)$ for all time.

3.60 For the circuit shown in Fig. P3.60, the switch opens at time $t = 0$ s. Find $i(t)$ and $v(t)$ for all time. (See p. 184.)

3.61 For the circuit shown in Fig. P3.60, change the value of the resistor to $\frac{1}{2}$ Ω. For the resulting circuit, the switch opens at time $t = 0$ s. Find $i(t)$ and $v(t)$ for all time. (See p. 184.)

3.62 For the circuit shown in Fig. P3.60, change the value of the inductor to $\frac{2}{9}$ H. For the resulting circuit, the switch opens at time $t = 0$ s. Find $v(t)$ and $i(t)$ for all time. (See p. 184.)

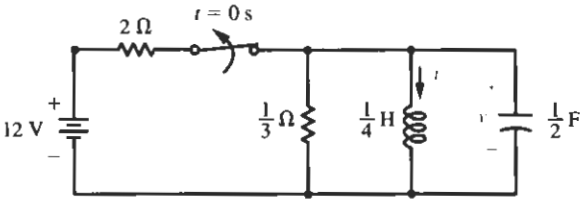


Fig. P3.60

3.63 For the series *RLC* circuit shown in Fig. P3.63, suppose that $R = 7\ \Omega$, $L = 1$ H, $C = 0.1$ F, $v_s(t) = 12$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time.

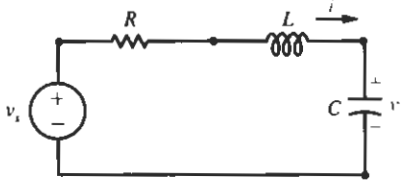


Fig. P3.63

3.64 For the series *RLC* circuit shown in Fig. P3.63, suppose that $R = 2\ \Omega$, $L = 0.25$ H, $C = 0.2$ F, $v_s(t) = 10$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time.

3.65 For the series *RLC* circuit shown in Fig. P3.63, suppose that $R = 2\ \Omega$, L = 1 H, $C = 1$ F, $v_s(t) = 6$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find $v(t)$ and $i(t)$ for all time.

3.66 For the circuit shown in Fig. P3.66, suppose that $v_s(t) = 6$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find $v_2(t)$ and $v_1(t)$ for all time.

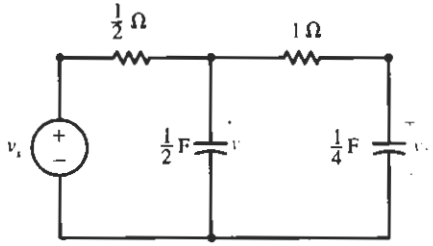


Fig. P3.66

3.67 For the circuit shown in Fig. P3.67, suppose that $v_s(t) = 6$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find $i(t)$ and $v(t)$ for all time.

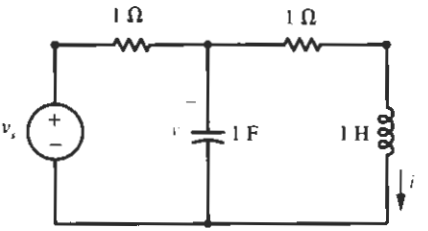


Fig. P3.67

3.68 For the circuit shown in Fig. P3.67, interchange the inductor and the capacitor. Suppose that $v_s(t) = 6$ V for $t < 0$ s and $v_s(t) = 0$ V for $t \geq 0$ s. Find the capacitor voltage $v(t)$ and the inductor current $i(t)$ for all time.

3.69 For the parallel RLC circuit shown in Fig. P3.69, suppose that $R = 0.5\ \Omega$, $L = 0.2$ H, $C = 0.25$ F, and $i_s(t) = 2u(t)$ A. Find the step responses $i(t)$ and $v(t)$.

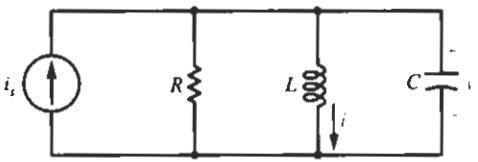


Fig. P3.69

3.70 For the parallel *RLC* circuit shown in Fig. P3.69, suppose that $R = 3\ \Omega$, L = 3 H, $C = \frac{1}{12}$ F, and $i_s(t) = 4u(t)$ A. Find the step responses $i(t)$ and $v(t)$.

3.71 For the series *RLC* circuit shown in Fig. P3.63, suppose that $R = 7\ \Omega$, $L = 1$ H, $C = 0.1$ F, and $v_s(t) = 12u(t)$ V. Find the step responses $v(t)$ and $i(t)$.

3.72 For the series *RLC* circuit shown in Fig. P3.63, suppose that $R = 2\ \Omega$, $L = 1$ H, $C = 1$ F,

d $v_s(t) = 12u(t)$ V. Find the step responses $v(t)$ and
).

.73 For the *RLC* circuit shown in Fig. 3.43 on p.
2, suppose that $R = \frac{1}{2}\ \Omega$, $L = \frac{1}{3}$ H, $C = \frac{1}{4}$ F, and
= 1 V. Find the unit step responses $i(t)$ and $v(t)$.

.74 For the *RLC* circuit shown in Fig. 3.43 on p.
2, suppose that $R = \frac{1}{2}\ \Omega$, $L = \frac{1}{4}$ H, $C = \frac{1}{2}$ F, and
= 1 V. Find the unit step responses $i(t)$ and $v(t)$.

.75 For the circuit shown in Fig. P3.66, suppose
t $v_s(t) = 9u(t)$ V. Find the step response $v_2(t)$.

.76 For the circuit shown in Fig. P3.67, suppose
t $v_s(t) = 6u(t)$ V. Find the step responses $i(t)$ and
).

.77 Find the step response $v_o(t)$ for the op-amp
cuit shown in Fig. P3.77 when $C = \frac{1}{3}$ F and
$t) = 4u(t)$ V.

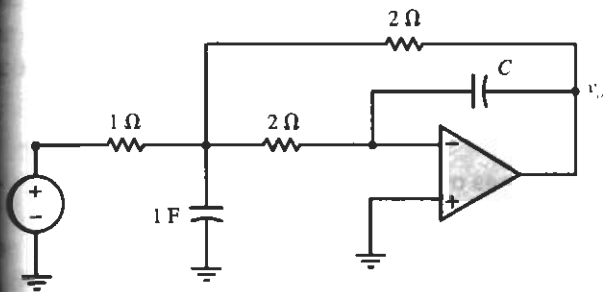
3.78 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.77 when $C = \frac{1}{8}$ F and $v_s(t) = 8u(t)$ V.

3.79 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.77 when $C = \frac{1}{4}$ F and $v_s(t) = 6u(t)$ V.

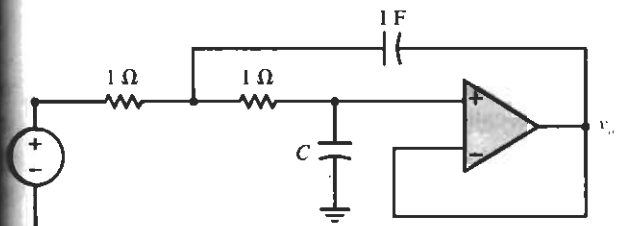
3.80 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = \frac{4}{3}$ F and $v_s(t) = 4u(t)$ V.

3.81 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = 1$ F and $v_s(t) = 3u(t)$ V.

3.82 Find the step response $v_o(t)$ for the op-amp circuit shown in Fig. P3.80 when $C = \frac{1}{5}$ F and $v_s(t) = 2u(t)$ V.



. P3.77



. P3.80