Problems

3.1 For the circuit shown in Fig. P3.1a, suppose that \( i(t) \) is described by the function given in Fig. P3.1b. Sketch (a) \( v(t) \), (b) \( w(t) \), (c) \( p(t) \), (d) \( n(t) \), and (e) \( u(t) \).

![](Fig.P3.1)

3.2 For the circuit shown in Fig. P3.1a, suppose that \( i(t) \) is described by the function given in Fig. P3.2. Sketch (a) \( v(t) \), (b) \( w(t) \), (c) \( p(t) \), (d) \( n(t) \), and (e) \( u(t) \).

![](Fig.P3.2)

3.3 For the circuit shown in Fig. P3.3, suppose that \( i(t) \) is described by the function given in Fig. P3.1b. Sketch (a) \( v(t) \), (b) \( w(t) \), (c) \( p(t) \), (d) \( n(t) \), and (e) \( u(t) \).

![](Fig.P3.3)

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) \( w(t) \), (c) \( p(t) \), (d) \( n(t) \), and (e) \( u(t) \).

![](Fig.P3.4)

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

![](Fig.P3.5)

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) \( v(t) \), (b) \( w(t) \), and (c) \( u(t) \).

3.7 For the circuit shown in Fig. P3.7a, suppose that \( v(t) \) is described by the function given in Fig. P3.1b. Sketch (a) \( i(t) \), (b) \( w(t) \), (c) \( p(t) \), (d) \( n(t) \), and (e) \( u(t) \).

![](Fig.P3.7a)

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

![](Fig.P3.7b)
3.50 Find the step response \( v_0(t) \) for the op-amp circuit shown in Fig. P3.50.

3.51 For the series RC circuit given in Fig. P3.7a, suppose that \( v(t) = 12e^{-2t}u(t) \) V. Find the responses \( v_0(t) \) and \( i(t) \).

3.52 For the series RC circuit given in Fig. P3.7a, suppose that \( v(t) = 12e^{-3t}u(t) \) V. Find the responses \( v_0(t) \) and \( i(t) \).

3.53 For the series RL circuit given in Fig. P3.1a, suppose that \( v(t) = 12e^{-2t}u(t) \) V. Find the responses \( v_0(t) \) and \( i(t) \).

3.54 For the series RL circuit given in Fig. P3.1a, suppose that \( v(t) = 12e^{-2t}u(t) \) V. Find the responses \( v_0(t) \) and \( i(t) \).

3.55 For the circuit shown in Fig. P3.30, when \( i(t) = 10e^{-t} \) A, then \( i(t) = 4(1 - e^{-4t}) \) A and \( v(t) = 20e^{-t}u(t) \) V. Find \( v(t) \) and \( v_0(t) \) when \( i(t) = 100 \) A and \( v_0(t) = 40 \) V.

3.56 For the circuit shown in Fig. P3.34, when \( i(t) = 12e^{-t} \) A, then \( v(t) = 18(1 - e^{-4t}) \) V and \( v(t) = 3e^{-4t}u(t) \) V. Find \( v(t) \) and \( v_0(t) \) when \( v(t) = 4(1 - 4e^{-t}) \) V.

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 \( 1 \) 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 \( 3 \) 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 \( 3 \) 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.)
3.63 For the series RLC circuit shown in Fig. P3.63, suppose that \( R = 7 \, \Omega \), \( L = 1 \, H \), \( C = 61 \, F \), \( v_i(t) = 12 \, V \) for \( t < 0 \) s and \( v_i(t) = 0 \, V \) 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 \( R = 2 \, \Omega \), \( L = 0.25 \, H \), \( C = 0.2 \, F \), \( v_i(t) = 10 \, V \) for \( t < 0 \) s and \( v_i(t) = 0 \, V \) for \( t \geq 0 \) s. Find \( v(t) \) and \( i(t) \) for all time.

Fig. P3.64

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

Fig. P3.65

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

Fig. P3.66

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

Fig. P3.67

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

Fig. P3.68

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 \( i_i(t) = 2 \, A \). 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 \( R = 3 \, \Omega \), \( L = 3 \, H \), \( C = 0.5 \, F \), and \( i_i(t) = 4 \, A \). 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 \( v_i(t) = 1 \, V \). Find the step responses \( v(t) \) and \( i(t) \).

3.72 For the series RLC circuit shown in Fig. P3.63, suppose that \( R = 2 \, \Omega \), \( L = 1 \, H \), \( C = 1 \, F \)
3.78 Find the step response \( v_d(t) \) for the op-amp circuit shown in Fig. P3.77 when \( C = \frac{1}{2} \) F and 
\( v_i(t) = 8u(t) \) V.

3.79 Find the step response \( v_d(t) \) for the op-amp circuit shown in Fig. P3.77 when \( C = \frac{1}{2} \) F and 
\( v_i(t) = 4u(t) \) V.

3.80 Find the step response \( v_d(t) \) for the op-amp circuit shown in Fig. P3.80 when \( C = \frac{1}{2} \) F and 
\( v_i(t) = 4u(t) \) V.

3.81 Find the step response \( v_d(t) \) for the op-amp circuit shown in Fig. P3.80 when \( C = 1 \) F and 
\( v_i(t) = 4u(t) \) V.

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