

### Problem 2-1

$t_{rr} = 5 \mu s$  and  $di/dt = 80 A/\mu s$

(a) From Eq. (2-10),

$$Q_{RR} = 0.5 (di/dt) t_{rr}^2 = 0.5 \times 80 \times 5^2 \times 10^{-6} = 1000 \mu C$$

(b) From Eq. (2-11),

$$I_{RR} = \sqrt{2Q_{RR} \frac{di}{dt}} = \sqrt{2 \times 1000 \times 80} = 400 A$$

### Problem 2-10

$R = 10 \Omega$ ,  $L = 5 mH$ ,  $V_s = 220 V$ ,  $I_1 = 10 A$

The switch current is described by

$$V_S = L \frac{di}{dt} + Ri$$

With initial condition:  $i(t=0) = I_1$ ,

$$i(t) = \frac{V_S}{R} (1 - e^{-tR/L}) + I_1 e^{-tR/L} = 22 - 12 e^{-2000t} \text{ A}$$

### Fig. p2-12b:

(a)  $\frac{1}{C} \int i dt + Ri = V_S - V_o$  or  $i(t) = \frac{V_S - V_o}{R} e^{-t/RC}$

(b)  $\frac{di}{dt} = \frac{V_S - V_o}{R^2 C} e^{-t/RC}$

(d) At  $t = 0$ ,  $di/dt = (V_S - V_o)/(R^2 C)$

Fig. p2-12c:

$$(a) \quad L \frac{di}{dt} + Ri = V_s \text{ or } i(t) = \frac{V_s}{R} e^{-tR/L}$$

$$(b) \quad \frac{di}{dt} = -\frac{V_s}{L} e^{-tR/L}$$

$$(d) \quad \text{At } t = 0, \quad di/dt = V_s/L$$

Fig. p2-12d:

$$(a) \quad V_S = L \frac{di}{dt} + \frac{1}{C} \int i dt + v_C(t=0)$$

With initial condition:  $i(t=0) = 0$  and  $v_C(t=0) = V_o$ ,

$$i(t) = (V_S - V_o) \sqrt{\frac{C}{L}} \sin(\omega_o t) = I_p \sin(\omega_o t)$$

$$\text{where } \omega_o = 1/\sqrt{LC}$$

$$(b) \quad \frac{di}{dt} = \frac{V_S - V_o}{L} \cos(\omega_o t)$$

$$(d) \quad \text{At } t = 0, \quad di/dt = (V_s - V_o)/L$$