Problem 2-1

t_{rr} = 5 μs and di/dt = 80 A/μs

(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 Ω, L = 5 mH, Vs = 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,

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

Fig. p2-12b:

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

(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) $L\frac{di}{dt}+Ri=V_S \; or \; i(t)=\frac{V_S}{R}e^{-tR/L}$

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

(d) At t = 0, di/dt = V_s/L

Fig. p2-12d:

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

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

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

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

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

(d) At t = 0, di/dt = (V_s - V_o)/L