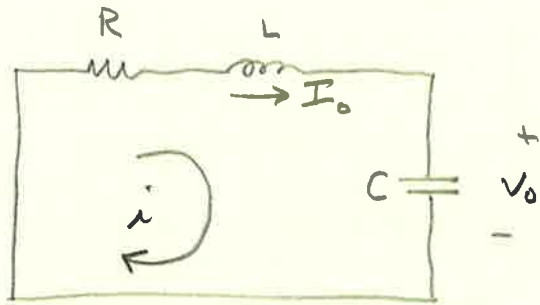


$$i = B_1 e^{-2000t} \cos 1500t + B_2 e^{-2000t} \sin 1500t$$

$$C = 80 \text{ mF}$$

$$I(0) = 7.5 \text{ mA}$$

$$V_C(0) = -30 \text{ V}$$



FIND $R, L, B_1, \text{ and } B_2$

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = 1500 \quad \alpha = 2000$$

$$\omega_0^2 = \omega_d^2 + \alpha^2 \Rightarrow \omega_0 = 2500 \text{ rad/sec}$$

$$\omega_0 = \frac{1}{\sqrt{LC}} \Rightarrow L = \frac{1}{\omega_0^2 C} = \boxed{2 \text{ H} = L}$$

$$\alpha = \frac{R}{2L} \Rightarrow R = 2L\alpha = 2(2)(2000) = \boxed{8000 \Omega = R}$$

$$i(0^-) = i(0^+) = 7.5 \text{ mA}$$

$$i(0^+) = \boxed{7.5 \text{ mA} = B_1}$$

$$i = 0.0075 e^{-2000t} \cos 1500t + B_2 e^{-2000t} \sin 1500t$$

$$\text{@ time } 0, \quad V_r + V_L + V_C = 0 \Rightarrow R I(0) + V_L - 30 = 0$$

$$-8000(0.0075) + 30 = V_L(0)$$

$$V_L(0) = -30 \text{ V}$$

$$V_L = L \frac{di}{dt}$$

$$-30 = V_L(0) = 2 \left[0.0075 e^{-2000t} (-\sin 1500t)(1500) + \cos 1500t (-2000)(0.0075) e^{-2000t} + B_2 e^{-2000t} \cos 1500t (1500) + \sin 1500t (-2000 B_2 e^{-2000t}) \right]_{t=0}$$

$$-30 = 2 [-2000(0.0075) + B_2 (1500)]$$

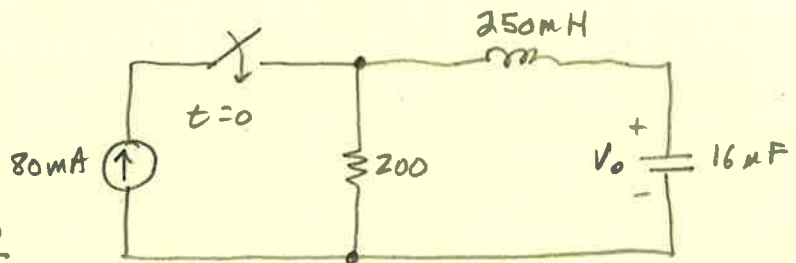
$$\boxed{B_2 = 0}$$

$$\boxed{i(t) = 0.0075 e^{-2000t} \cos 1500t \text{ A}}$$

initial energy = 0

find $V_o(t)$ for $t \geq 0$

$$\alpha = \frac{R}{2L} = \frac{200}{2(.25)} = 400 \frac{\text{rad}}{\text{s}}$$



$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{.25(16 \times 10^{-6})}} = 500 \frac{\text{rad}}{\text{s}}$$

$\omega_0 > \alpha$ so underdamped

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = 300 \text{ rad/s}$$

$$V_o = V_f + B_1 e^{-400t} \cos 300t + B_2 e^{-400t} \sin 300t$$

$$V_o(\infty) = 200(.08) = 16V$$

$$V_o(0) = 16 + B_1 = 0 \Rightarrow B_1 = -16$$

$$\therefore V_o(t) = 16 - 16e^{-400t} \cos 300t + B_2 e^{-400t} \sin 300t$$

we know the current through the capacitor = 0 @ $t=0$

$$i_c = C \frac{dv_c}{dt} \Big|_{t=0} = 0 = C \left(-16e^{-400t} (300(-\sin 300t)) + \cos 300t (-16)(-400)e^{-400t} \right. \\ \left. + C(B_2 e^{-400t} \cos 300t (300) + \sin 300t (-400B_2 e^{-400t})) \right)$$

$$\text{evaluate @ } t=0 : 0 = (-16)(-400) + 300B_2$$

$$B_2 = -21.33$$

$$V_o(t) = 16 - 16e^{-400t} \cos 300t - 21.33e^{-400t} \sin 300t \text{ V}$$