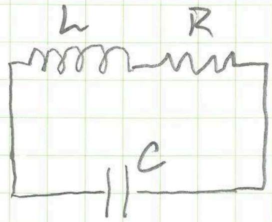
COMPUTE THE OSCILLATION FREQUENCIES, PERIODS AND AMPLITUDE AFTER 2 PERIODS (AS A FRACTION OF A_0) FOR THE CIRCUIT FOR $L = 0.1H$, $C = 10\mu F$ AND $R = 10\,\Omega$.



KIRCHOFF'S RULE GIVES

$$L\ddot{Q} + R\dot{Q} + \frac{1}{C}Q = 0$$

$$\Rightarrow \quad \ddot{Q} + \frac{R}{L}\dot{Q} + \frac{1}{LC}Q = 0$$

FOR $\omega_N^2 = \frac{1}{LC}$ AND $2\beta = \frac{R}{L}$ THIS BECOMES

$$\ddot{Q} + 2\beta\dot{Q} + \omega_N^2 Q = 0$$

ASSUME $\delta = 0$

SO $Q(t) = A_0 e^{-\beta t}\cos(\omega_s t + \cancel{\delta})$

$$I(t) = -A_0 e^{-\beta t}\left[\beta\cos(\omega_s t) + \omega_s \sin(\omega_s t)\right]$$

WITH $\omega_N = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(0.01)(10\times10^{-6})}} = \boxed{3162.3\,s^{-1} = \omega_N}$

$$\beta = \frac{R}{2L} = \frac{10}{2(0.01)} = \frac{100}{2} = \boxed{500\,s^{-1} = \beta}$$

$$\omega_s = \sqrt{\omega_N^2 - \beta^2} = \sqrt{(3162)^2 - (500)^2} = \boxed{3122\,s^{-1} = \omega_s}$$

$$\tau_s = \frac{2\pi}{\omega_s} = \frac{2\pi}{3122} = \boxed{2.01\times10^{-3}\,\text{SEC} = \tau}$$

AT $2\tau_s = 4.02\times10^{-3}\,s$, FIND THE AMPLITUDE

$$A(t = 2\tau) = A_0 e^{-\beta(2\tau)} = A_0 e^{-(500)(4.02\times10^{-3})}$$

$$\boxed{A(t = 2\tau) = 0.13369\,A_0}$$

$$\nu_s = \frac{\omega_s}{2\pi} = 4.967\,kHz$$

$$\nu_N = \frac{\omega_N}{2\pi} = 4.904\,kHz$$

NOT STRONG DAMPING