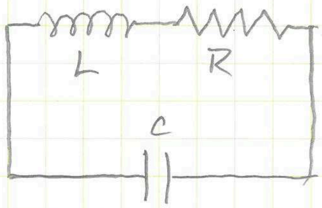
COMPUTE THE OSCILLATION FREQUENCIES, PERIODS, AND AMPLITUDE AFTER 2 PERIODS (AS A FRACTION OF A_0') FOR THE CIRCUIT SHOWN WITH $L = 0.01H$, $C = 10\,\mu F$ AND $R = 10\,\Omega$.



KIRCHOFF'S RULE GIVES

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

$$\Rightarrow \ddot{Q} + 2\beta\dot{Q} + \omega_N^2 Q = 0 \qquad \beta = \frac{R}{2L},\ \omega_N^2 = \frac{1}{LC}$$

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

START CLOCK AT $Q = Q_{MAX} = A_0$

FIND FREQUENCIES

$$\omega_N = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(0.01)(10\times10^{-6})}} = \underline{3162\ s^{-1} = \omega_N}$$

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

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

THE PERIODS ARE

$$\tau_N = \frac{2\pi}{\omega_N} = \frac{2\pi}{3162} = 1.987\times10^{-3}\ s = \underline{1.99\,ms = \tau_N}$$

$$\tau_s = \frac{2\pi}{\omega_s} = \frac{2\pi}{3122} = 2.012\times10^{-3}\ s = \underline{2.01\,ms = \tau_s}$$

AFTER TWO PERIODS

$$A(2\tau_s) = A_0 e^{-\beta t} = A_0 e^{-\beta(2\tau_s)} = A_0 e^{-2\beta\tau_s}$$

$$A_{2\tau_s} = A_0 e^{-2(500)(2.01)} = A_0 e^{-2.102}$$

$$\boxed{A_{2\tau_s} = 0.134\,A_0}$$

SO IT'S DOWN TO 13% AFTER TWO PERIODS!