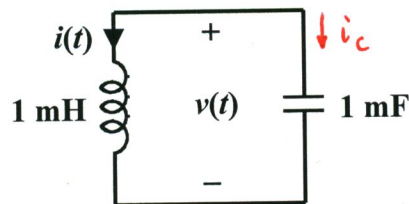


EE 2240
Problem #07

Find $v(t)$ for $t \geq 0$ if $v(0) = -1\text{V}$ and $i(0) = 1\text{A}$.



$$v = 10^{-3} \frac{di}{dt} \Rightarrow \left. \frac{di}{dt} \right|_{t=0} = (1000 v(0)) = -1000 \frac{\text{A}}{\text{s}}$$

$$i_c = 10^{-3} \frac{dv}{dt} = 10^{-6} \frac{d^2 i}{dt^2}$$

$$i_c + i = 0 \Rightarrow 10^{-6} \frac{d^2 i}{dt^2} + i = 0 \quad \text{or} \quad \frac{d^2 i}{dt^2} + 10^6 i = 0$$

$$r^2 + 10^6 = 0 \Rightarrow r = \pm j1000$$

$$i(t) = K_1 \cos 1000t + K_2 \sin 1000t$$

$$\frac{di}{dt} = -1000K_1 \sin 1000t + 1000K_2 \cos 1000t$$

$$\left. \begin{aligned} i(0) &= K_1 = 1 \\ \left. \frac{di}{dt} \right|_{t=0} &= 1000K_2 = -1000 \end{aligned} \right\} \begin{aligned} K_1 &= 1 \\ K_2 &= -1 \end{aligned}$$

$$i(t) = \cos 1000t - \sin 1000t \quad \text{A, } t \geq 0$$

$$\begin{aligned} v(t) &= 10^{-3} \frac{di}{dt} = 10^{-3} (-1000 \sin 1000t - 1000 \cos 1000t) \\ &= -\sin 1000t - \cos 1000t \quad \text{V, } t \geq 0 \end{aligned}$$