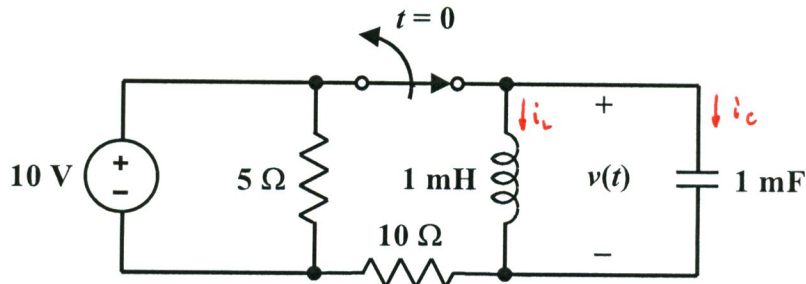


EE 2240
Problem #06

The switch has been closed for a *very* long time. It is opened at $t = 0$. Find $v(t)$ for $t \geq 0$.



$$i_L(0) = \frac{10\text{V}}{10\Omega} = 1\text{A}, \quad v(0) = 0$$

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

$$i_C = 10^{-3} \frac{dv}{dt} = 10^{-6} \frac{d^2 i_L}{dt^2}$$

$$10^{-6} \frac{d^2 i_L}{dt^2} + i_L = 0 \Rightarrow \frac{d^2 i_L}{dt^2} + 10^6 i_L = 0$$

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

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

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

$$i_L(0) = K_1 = 1 \Rightarrow K_1 = 1$$

$$\left. \frac{di_L}{dt} \right|_{t=0} = 1000 K_2 = 0 \Rightarrow K_2 = 0$$

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

$$v(t) = 10^{-3} \frac{di_L}{dt} = -\sin 1000t \text{ V}, \quad t \geq 0$$