HW4 - 1

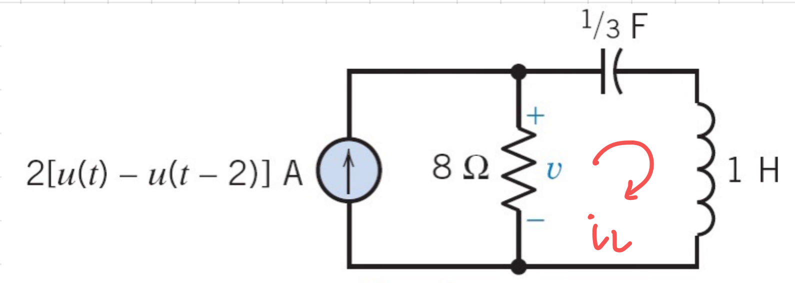


Figure 1

superposition : $I_{in} = 2u(t)$

$$\begin{cases} (I_{in} - i_L)\cdot R = V_C + L\cdot\dfrac{di_L}{dt} \\ i_C = i_L = C\cdot\dfrac{dV_C}{dt} \end{cases}$$

$$\Rightarrow \quad \frac{d^2V_C}{dt} + \frac{R}{L}\frac{dV_C}{dt} + \frac{V_C}{LC} = \frac{I_{in}\cdot R}{LC}$$

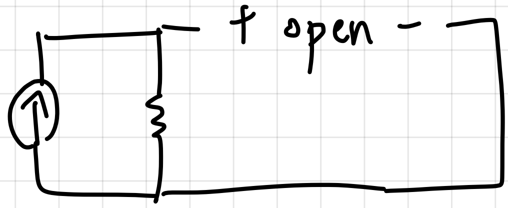
$$V_{C1.p} = I_{in}\cdot R = 16u(t)$$

$$V_{C1.h} = A_1 e^{s_1 t} + A_2 e^{s_2 t}$$

charavsitic eqn : $s^2 + 8s + 3 = 0$

$$\rightarrow s = -4 \pm \sqrt{13}$$

initial condition :



short

$i_L(0) = 0$

$V_C(0) = 0$

$$\begin{cases} V_c = 16 + A_1 + A_2 = 0 \\ I_L = C(A_1 S_1 + A_2 S_2) = 0 \end{cases}$$

$$\Rightarrow A_1 = \frac{16 S_2}{S_1 - S_2} = \frac{-32}{13}\sqrt{13} - 8 \approx -16.875$$

$$A_2 = \frac{16 S_1}{S_2 - S_1} = \frac{32}{13}\sqrt{13} - 8 \approx 0.875$$

$$V_{c1} = 16 + A_1 e^{(-4+\sqrt{13})t} + A_2 e^{(-4-\sqrt{13})t}$$

$$V_1 = \left(2 - C\frac{dV_c}{dt}\right) R$$

$$= 16 - \frac{64\sqrt{13}}{13} e^{(-4+\sqrt{13})t} + \frac{64\sqrt{13}}{13} e^{(-4-\sqrt{13})t}$$

② $I_{in} = -2u(t-2)$

→ replace $t \to t-2$ and multiply negative sign. from above.

$$\Rightarrow V_2 = -16 + \frac{64\sqrt{13}}{13} e^{(-4+\sqrt{13})(t-2)} - \frac{64\sqrt{13}}{13} e^{(-4-\sqrt{13})(t-2)}$$

$$V = V_1 + V_2$$

$$= \left[16 - \frac{64\sqrt{13}}{13} e^{(-4+\sqrt{13})t} + \frac{64\sqrt{13}}{13} e^{(-4-\sqrt{13})t}\right] u(t)$$

$$+ \left[-16 + \frac{64\sqrt{13}}{13} e^{(-4+\sqrt{13})(t-2)} - \frac{64\sqrt{13}}{13} e^{(-4-\sqrt{13})(t-2)}\right] u(t-2)$$

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