**Ex 10.4**

\[ V_0 = \frac{10k}{10k+1k} \cdot 10V = 10V \]

Charging Capacitor Equation, derivation in the reading

\[ V_c(t) = V_0 (1 - e^{-\frac{t}{RC}}) \quad T = R \cdot C = \left(\frac{10k}{10k+1k}\right)^{-1} \cdot C = 9.09 \text{ ms} \]

\[ t > 1: \quad V_c(t) = V_0 e^{-\frac{t}{RC}} \quad T = 10 \text{ k} \cdot C = 1 \text{ s} \]

Discharging Capacitor Equation, derivation in the reading

**Ex 10.6**

\[ V = L \frac{dI}{dt} \]

Use eqn. for a charging inductor.

\[ I(t) = I_0 (1 - e^{-\frac{t}{R\cdot C}}) \]

\[ I_0 = \frac{V}{R} = 10 \text{ mA} \]

\[ T = \frac{R}{C} = 0.1 \text{ ms} \]

\[ V = \int dV = \int_0^t \frac{1}{C} \frac{dI}{dt} = \frac{t}{C} + \text{ const} \]

\[ C = \frac{Q}{V} \Rightarrow \frac{dV}{dt} = \frac{I}{C} \]

Solve Capacitor D.E.

\[ V_c(t) = 1000I - L \frac{dI}{dt} = 0 \]

\[ I(t) = A e^{-10^{-5}t} + \frac{10^{-4}}{999} e^{-10000t} \]

\[ V(t) = \frac{10k}{0.1 \mu F} \frac{dV}{dt} + \frac{V}{10000} \]

Initial condition gives \( A = \frac{10^{-4}}{999} \)

\[ V(0) = 0 \quad \text{so} \quad A = 0; \quad B = 10 \text{ found from} \]

\[ V(t) = 10 + e^{-10000t} \quad V \text{ plugging back in} \]

\[ I(t) = \frac{10}{999} \left( e^{-10^{-5}t} - e^{-10^{4}t} \right) \]

\[ 6.9 \mu s \]

\[ 0.001 \]
Ex 10.7

(a) charges by $I_o R (1 - e^{\frac{-t}{RC}})$ for $0 < t < t_o$

(b) discharges by $e^{\frac{t-t_o}{R}} A$ for $t > t_o$

\[ V = I_o R (1 - e^{\frac{-t}{RC}}) \]

\[ I = \frac{V}{R} + C \frac{dV}{dt} \]

\[ \frac{I_o}{C} = \frac{V}{RC} + \frac{dV}{dt} \]

\[ \Rightarrow \frac{dV}{dt} = \frac{I_o}{C} \Rightarrow V = \int_{t_0}^{t} \frac{I_o}{C} \, dt \Rightarrow V = \frac{I_o}{C} \]

Ex 10.14

\[ T = RC \]

But what do we use for $R$? It is the Theremin Resistance from the nodes on either side of the capacitor. To find $R_{th}$ we make the voltage source a short circuit.

\[ R_{th} = 1K \]

\[ T = 1K \Omega \cdot 1mF = 1ms = 0.001s \]