$$\int \frac{dF}{dt} = \int \frac{JR}{\tau} e^{t/\tau}$$

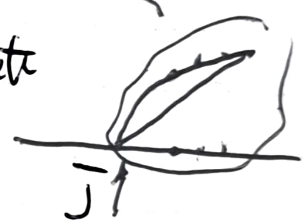
$$F(t) = \frac{R}{\tau}\int_0^t e^{t'/\tau} J(t')\,dt'$$ virtual time axis.

Assume $V(t) = F(t)e^{-t/\tau}$

$$V(t) = \frac{R}{\tau}\int_0^t \underbrace{e^{-t/\tau}\cdot e^{t'/\tau}}\cdot J(t')\,dt'$$

$$= \frac{R}{\tau}\int_0^t e^{-(t-t')/\tau}\cdot J(t')\,dt'$$

constant



$$V(t) = \frac{R}{\tau}\int_0^t e^{-(t-t')/\tau} J\,dt'$$

let $-(t-t')/\tau = u$ $\quad \frac{du}{dt'} = \frac{1}{\tau}$ $\quad dt' = \tau\,du$

$$V = \frac{R}{\cancel{\tau}}\int_0^t e^u J \cancel{\tau}\,du = RJ\,e^{-(t-t')/\tau}\Big|_{t'=0}^{t}$$

$$V = JR\left(1 - e^{-t/\tau}\right).$$

$$V_{th} = RJ\left(1 - e^{-t_{th}/\tau}\right)$$

$$\frac{V_{th}}{RJ} = 1 - e^{-t_{th}/\tau}$$

$$1 - \frac{V_{th}}{RJ} = e^{-t_{th}/\tau} \quad \text{when } JR \neq 0$$

$$t_{th} = -\tau \log\left(1 - \frac{V_{th}}{RJ}\right) \quad \text{when } 1 - \frac{V_{th}}{RJ} > 0$$

$$G(J) = \begin{cases} \dfrac{1}{t_{th} + \tau_{ref}} & \text{if } 1 - \dfrac{V_{th}}{RJ} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$G(J) = \begin{cases} \dfrac{1}{\tau_{ref} - \tau_{RC} \log\left(1 - \dfrac{V_{th}}{RJ}\right)} \\ 0 \end{cases} \quad \begin{matrix} R = 1 \\ V_{th} = 1 \end{matrix}$$

$$= \begin{cases} \dfrac{1}{\tau_{ref} - \tau_{RC} \log\left(1 - \dfrac{1}{J}\right)} & \text{if } J > 1 \\ 0 & \text{otherwise} \end{cases}$$