2018/6/21

COMPENDIUM OF THEORETICAL RESULTS:

$$V = \left[R_{on}\frac{w}{w_0} + R_{off}\left(1-\frac{w}{w_0}\right)\right] I, \quad \frac{dw}{dt} = \mu_v \frac{R_{on}}{w_0}|I| - \frac{w}{\tau}$$

R_{on}: 5e3 Ω $\quad$ μ_v: 0.5e-12 m^2/sV $\quad$ w_0: 5e-9 m

R_{off}: 5e6 Ω $\quad$ τ: 1 s $\quad$ V: 1 V

FOR SMALL I: $\quad \frac{dw}{dt} = -\frac{w}{\tau} \rightarrow w(t) = w_0 e^{-t/\tau}$

with proper initial magnitude

plus appropriate time shift

EXPONENTIAL DECAY

TIME CONSTANT τ, DECAYS TO 5% in ~ 3τ

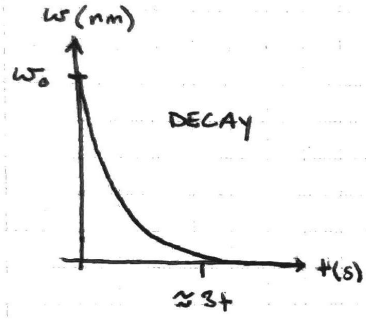
FOR LARGE I: $\quad \frac{dw}{dt} = \frac{\mu_v R_{on} V}{w_0 R_{off} + [R_{on}-R_{off}]w} \rightarrow$

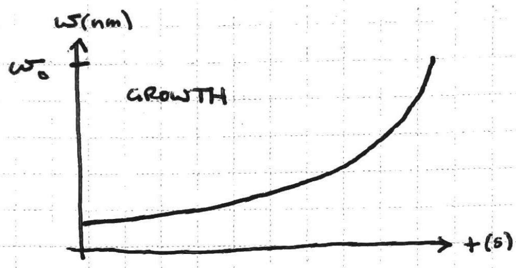
RADICAL RISE

$$\cancel{w(t) = 2\frac{R_{off}}{(R_{off}-R_{on})} w_0 - \sqrt{\frac{4R_{off}^2 w_0^2}{(R_{on}-R_{off})^2} + \frac{8\mu_v R_{on} V}{(R_{off}-R_{on})}\cdot t}}$$

$$w(t) = \frac{R_{off}}{(R_{off}-R_{on})} w_0 - \sqrt{-\frac{2\mu_v R_{on} V}{(R_{off}-R_{on})}\cdot t}$$

plus appropriate time shift





TIME DERIVATIVE:

DECAY: $\quad \frac{dw}{dt} = -\frac{w_0}{\tau} e^{-t/\tau}$

RISE: $\quad \frac{dw}{dt} = \frac{\mu_v R_{on} V}{R_{off} - R_{on}} \cdot \left[-\frac{2\mu_v R_{on} V}{R_{off}-R_{on}}\cdot t\right]^{-1/2}$ $\quad \leftarrow$ calculations make this look reasonable!

SO: $\quad \frac{dw}{dt} \propto \sqrt{V}, \quad \frac{dw}{dt} \approx \propto \sqrt{\frac{R_{on}}{R_{off}}}, \quad \frac{dw}{dt} \propto \sqrt{\mu_v}$.

CONSIDER ~~100%~~ ~~95%~~ n% growth of rise function.

$$n w_0 = \sqrt{\cdots} \rightarrow (n w_0)^2 = -\frac{2\mu_v R_{on} V}{R_{off} - \cancel{R_{on}}} + \underset{\approx 0}{\ldots}$$

ignore; not needed

$$t \approx \frac{R_{off}(n w_0)^2}{2\mu_v R_{on} V} \text{ to get to } (n)\%..$$

Rise Half-life (RHL): $\quad \frac{R_{off} w_0^2}{8\mu_v R_{on} V}$ $\qquad$ Decay HL (DHL): $\ln(2)\tau = .693\tau$

Ha! ~~Good fit~~ Currently, good ~~result~~ when chaotic width/current changes under constant voltage

$$RHL \approx \frac{DHL}{10 \text{ or } 100}.$$

const w/# NN

→ For 100-nw network, which has ~$\frac{1}{10}$ to $\frac{1}{100}$ V on each node!

edge of chaotic behavior?

?

記入者 $\quad$ 確認者

日付 $\quad$ 年 $\quad$ 月 $\quad$ 日