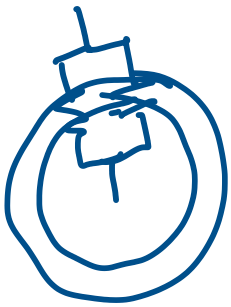
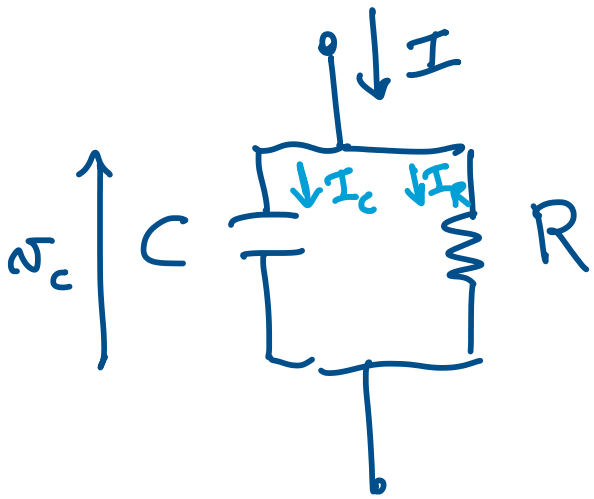
Lezione 13/04/2021

martedì 13 aprile 2021 15:52

Integrate & fire





$$I_C = C\dot{v}_C$$

$$I_R = \frac{v_C}{R}$$

$$C\dot{v}_C = (I - I_R) = I - \frac{v_C}{R}$$

$$C\dot{v}_C = -\frac{v_C}{R} + I$$

$$\boxed{\dot{v}_C = -\frac{v_C}{\tau} + \frac{I}{C}}$$

$$\tau = RC$$

Se $I = I_0$ costante

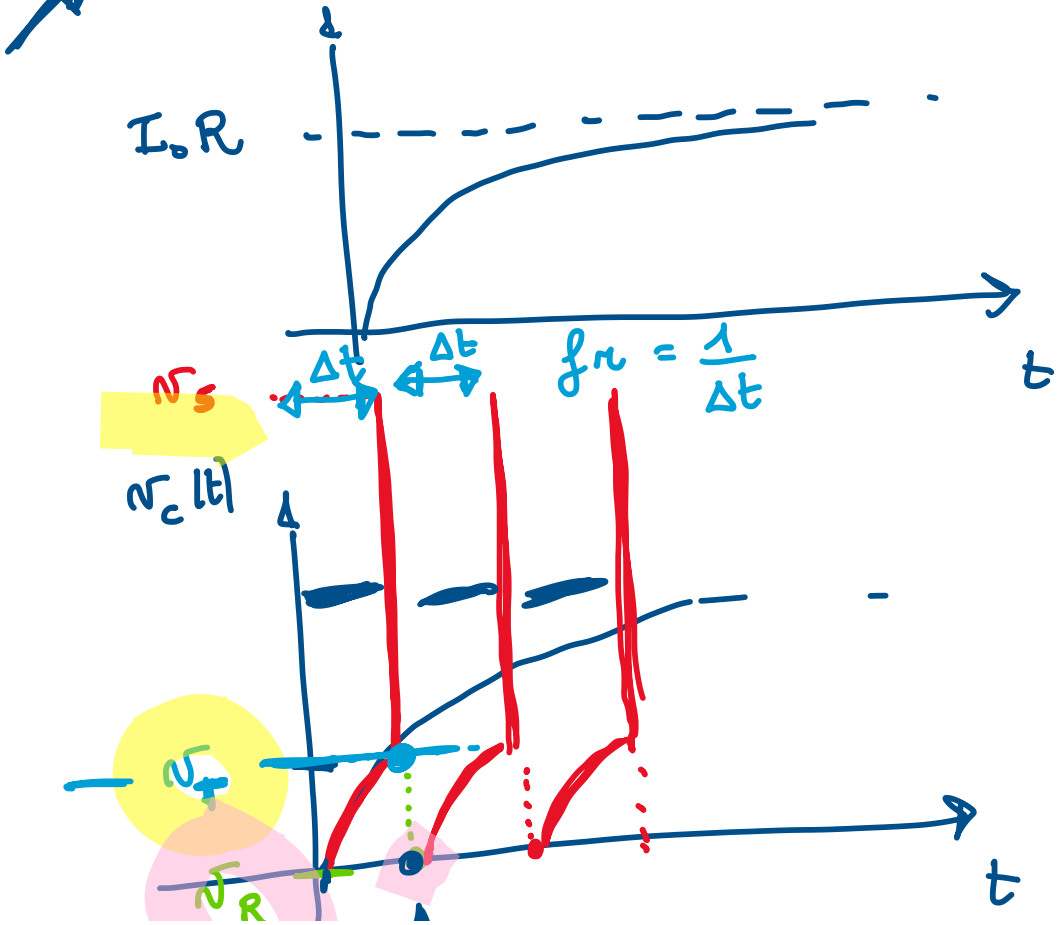
$$\dot{v}_c(t) = -\frac{v_c(t)}{\tau} + \frac{I_0}{C}$$

$$v_c(t) = A\, e^{-\frac{t}{\tau}} + I_0 R$$

$$v_c(0) = 0$$

$$A + I_0 R = 0 \qquad A = -I_0 R$$

$$v_c(t) = I_0 R \left(1 - e^{-\frac{t}{\tau}}\right)$$



$$t^*: \quad v_c(t^*) = v_T$$

$$v_c(t^*) = I_0 R\left(1 - e^{-\frac{t^*}{\tau}}\right) = v_T$$

$$1 - e^{-\frac{t^*}{\tau}} = \frac{v_T}{I_0 R}$$

$$+ e^{-\frac{t^*}{\tau}} = -\frac{v_T}{I_0 R} + 1 = \frac{I_0 R - v_T}{I_0 R}$$

$$-\frac{t^*}{\tau} = \ln\left(\frac{I_0 R - v_T}{I_0 R}\right)$$

$$t^* = +\tau \ln\left(\frac{I_0 R}{I_0 R - v_T}\right)$$

$$f_R = \frac{1}{\tau \ln\left(\frac{I_0 R}{I_0 R - v_T}\right)}$$