

The Leaky Integrate and Fire (LIF) Model

$$\tau_m \frac{dV(t)}{dt} = -(V(t) - E_L) + R_i I(t)$$

Membrane voltage: $V(t)$

Membrane time constant: τ_m

Resting potential: E_L

Input resistance: R_i

External current: $I(t)$

Integrating the LIF Model

$$\frac{dV(t)}{dt} = \frac{1}{\tau_m} (-(V(t) - E_L) + R_i I(t))$$

For $\Delta \rightarrow 0$ this can be solved by:

$$V(t) = V(t - \Delta) + \frac{\Delta}{\tau_m} (-V(t) + E_L - R_i I(t))$$

This is a good approximation if $\Delta \ll \tau_m$

Example for a step current

