# Exercise 02:
# Single-compartment model

**Theoretical Neuroscience I**

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**Question:**
Compute and plot the dependent variables of a neuron with the single-compartment model for a constant input current, an oscillating input current with low frequency (10Hz), an oscillating input current with medium frequency (100Hz) and a high frequency random input current. Use the following values for the independent variables: $r_m = 0.9\text{M}\Omega\,\text{mm}^2$, $c_m = 12\text{nF}\,\text{mm}^{-2}$, $V_0 = 0\text{mV}$ and $i_0 = 25\text{nA}\,\text{mm}^{-2}$.

**Answer:**

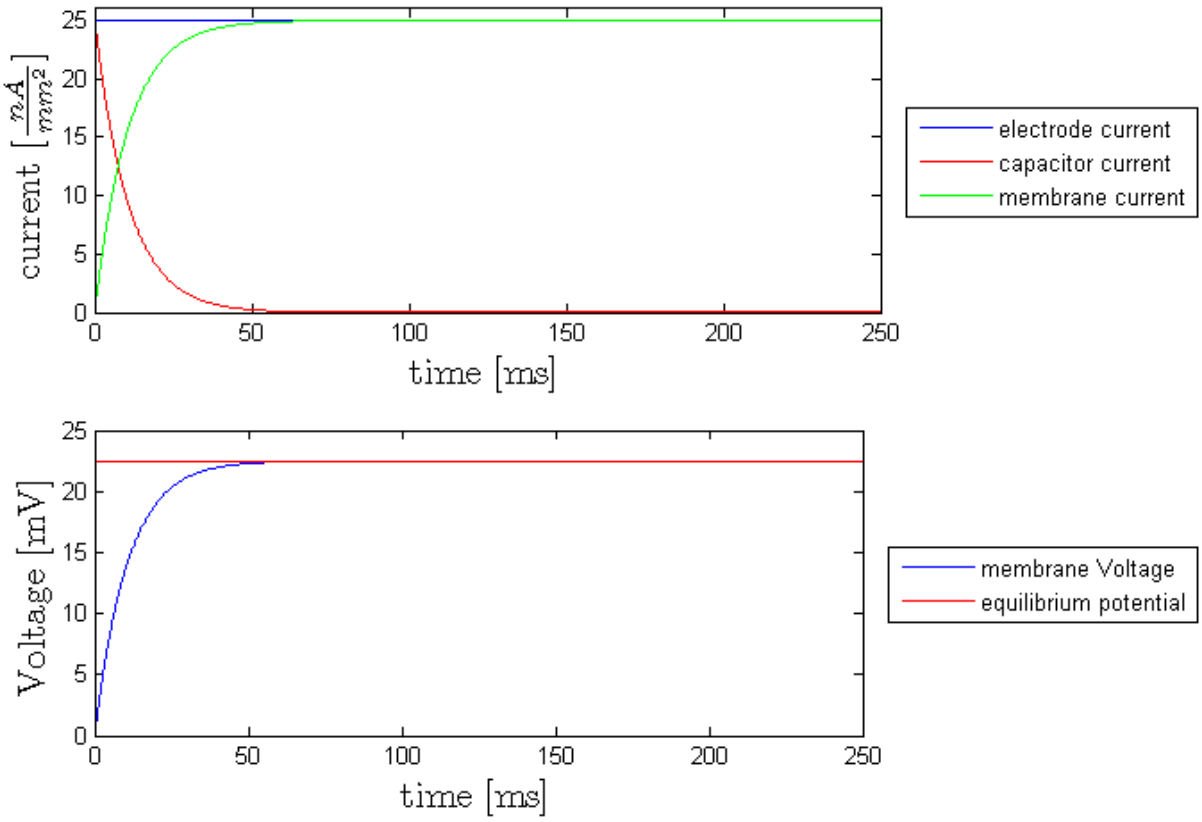


Figure 1: Constant input current: $i_e(t) = i_0$. Top: The electrode current($i_e$, blue), the capacitor current($i_c$, red) and the membrane current ($i_r$, green) over time. Bottom: The membrane voltage ($V_m$, blue) and the equilibrium potential ($V_\infty$, red) over time.

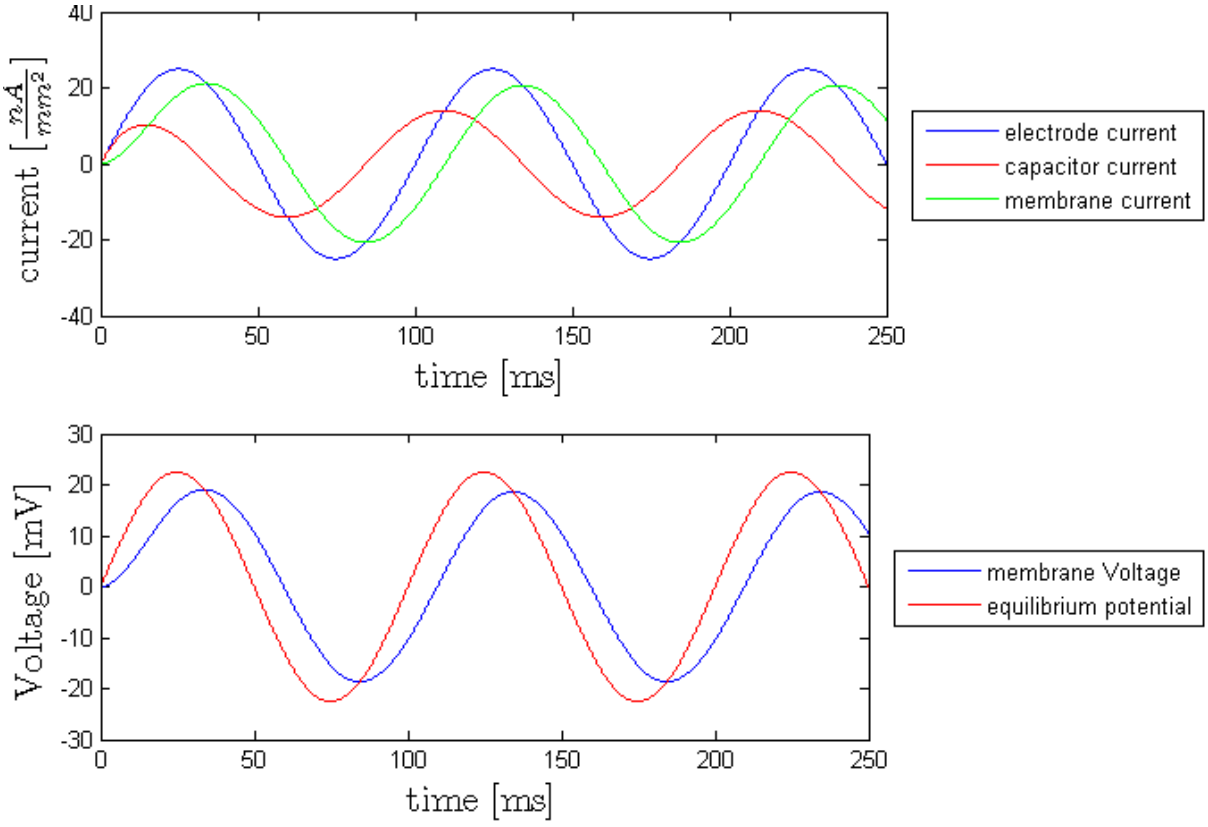


Figure 2: Low frequency input current: $i_e(t) = i_0 \cdot \sin 2\pi f t$ , $f = 10\text{Hz}$. Same variables shown as in Figure 1.

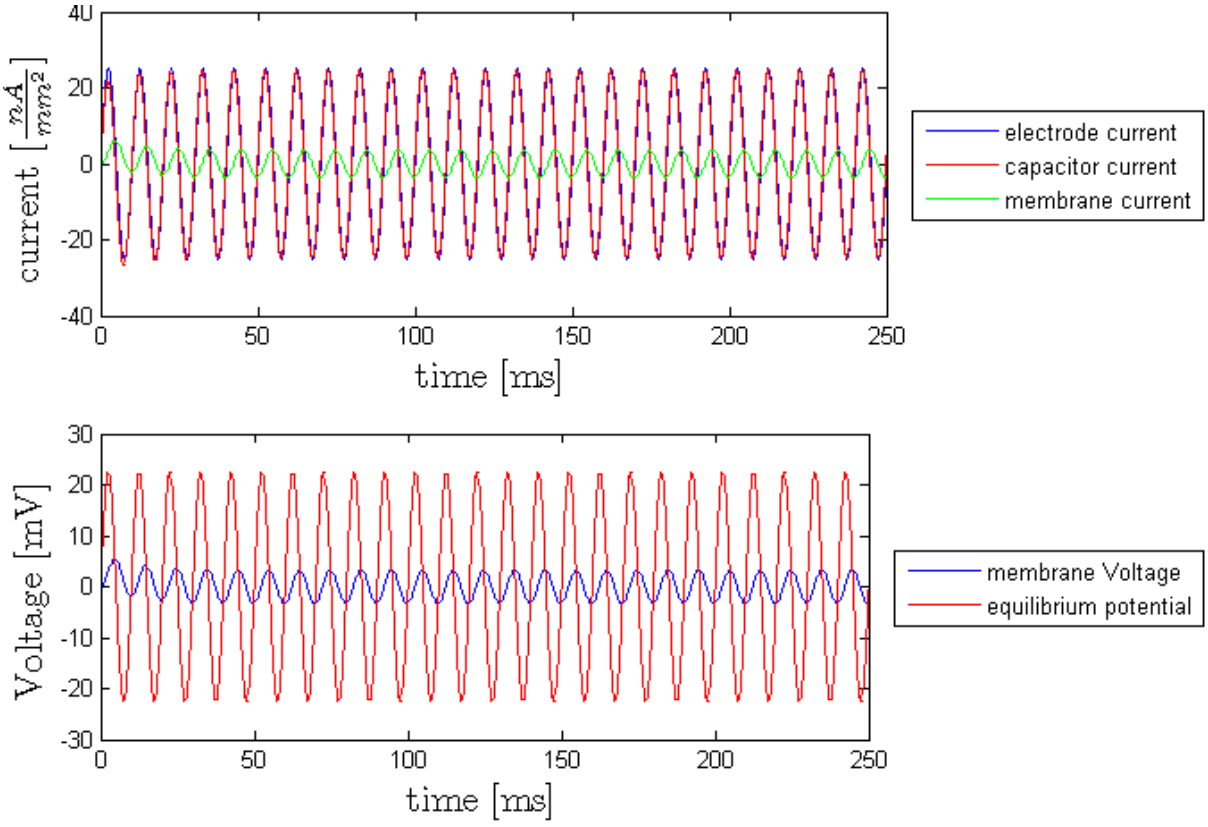


Figure 3: Medium frequency input current: $i_e(t) = i_0 \cdot \sin 2\pi f t$ , $f = 100$Hz. Same variables shown as in Figure 1.

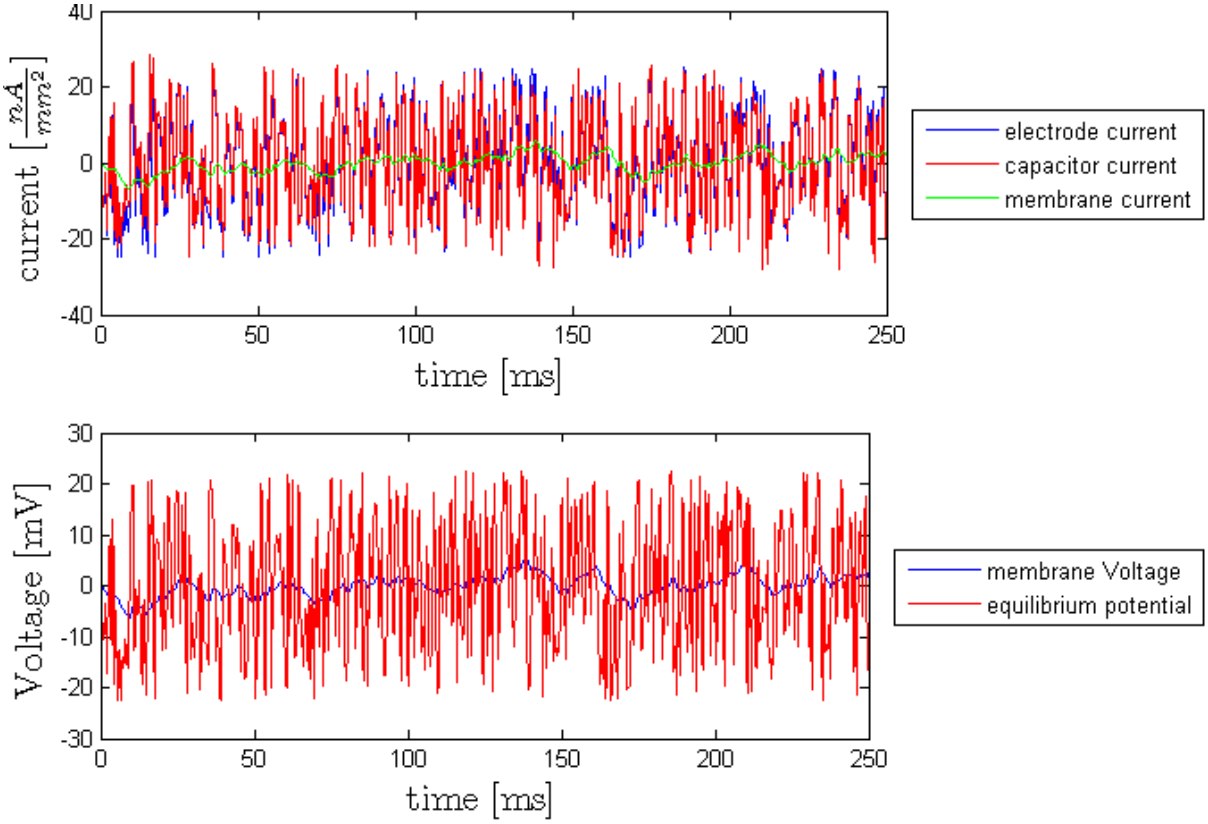


Figure 4: High frequency random input current. Same variables shown as in Figure 1.