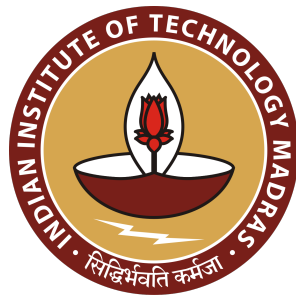

Computational Neuroscience Assignment 1

N Sowmya Manojna | BE17B007
Department of Biotechnology,
Indian Institute of Technology, Madras



Neural Firing Frequencies and Thresholding

1. Threshold values of External Current

The threshold currents are as follows:

- $I_1 = 0.03$
- $I_2 = 0.06$
- $I_3 = 0.45$

These values were obtained with a current sampling interval of 0.01 from $[0, 0.6]$

2. Assumptions

The assumptions made in the construction of the plot are as follows:

- The voltage threshold of a peak is set to 10mV. All voltage peaks greater than 10mV are considered in the spike count.
- Input current (I_1) at which spiking occurs is calculated by identifying the current where the number of spikes first becomes non zero.
- The current I_2 is calculated by identifying the current at which the number of spikes increases by more than 4 in the next current instant.
- The current I_3 is calculated by identifying the current at which the number of spikes decreases by more than 2 in the next current instant.

3. Plots

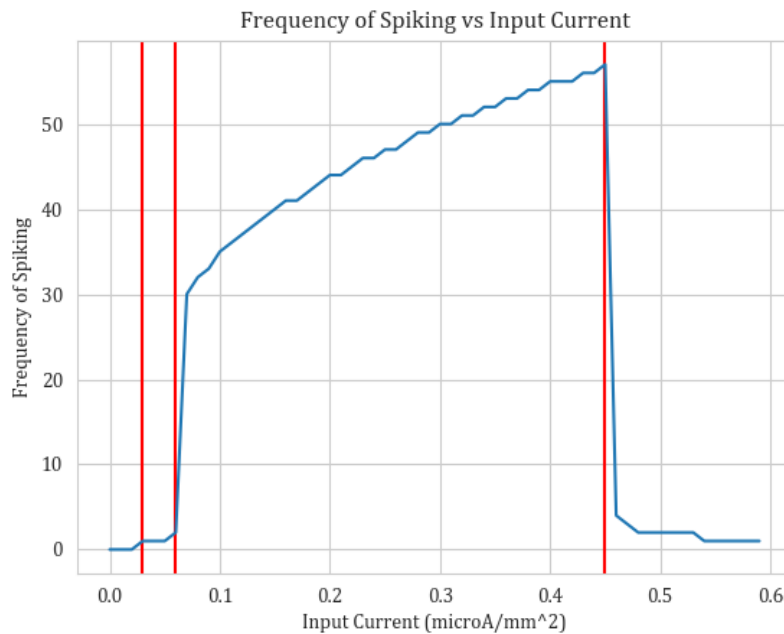


Figure 1: The change in frequency of firing as a function of Input current. The number of iterations performed for each current instance: $5(10^4)$. The red vertical bars indicate the current thresholds - I_1 , I_2 & I_3 respectively.

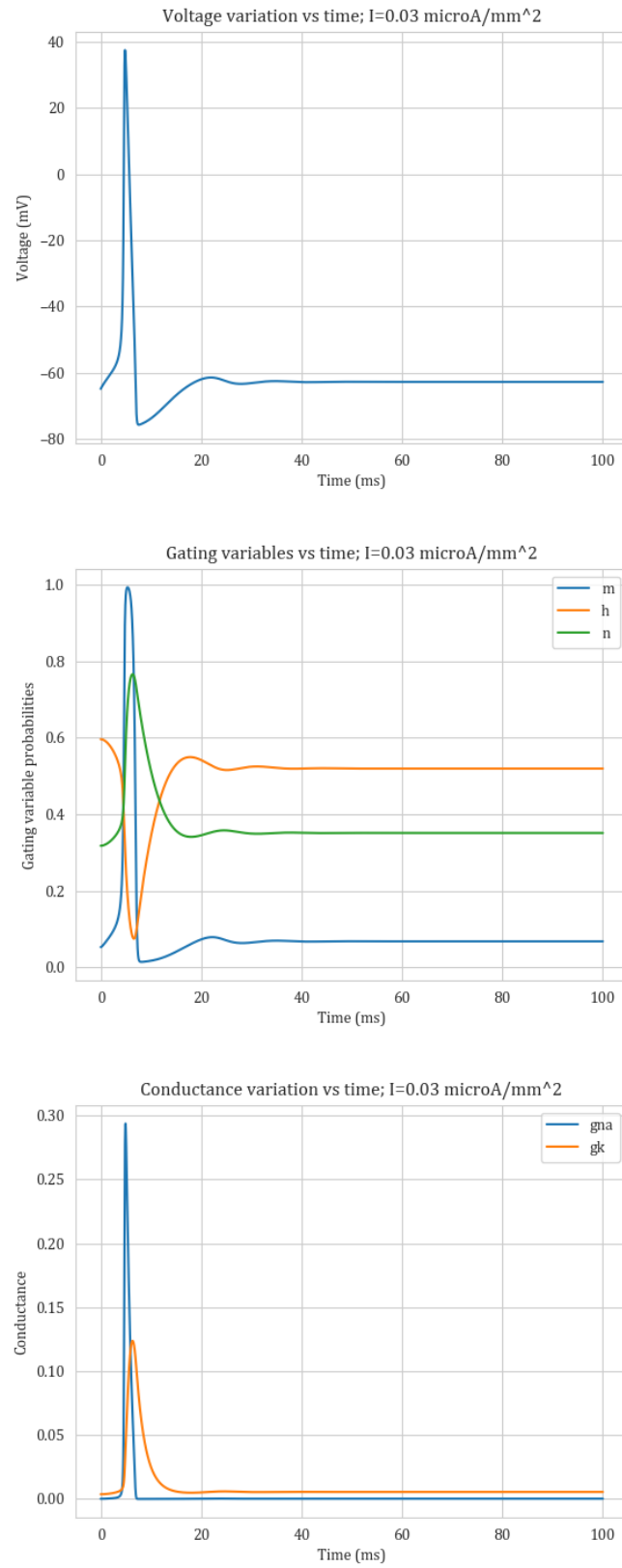


Figure 2: Variation of Voltage, Gating variables and Conductance at current instant I1. A single voltage spike is observed. Number of iterations performed: 10^4

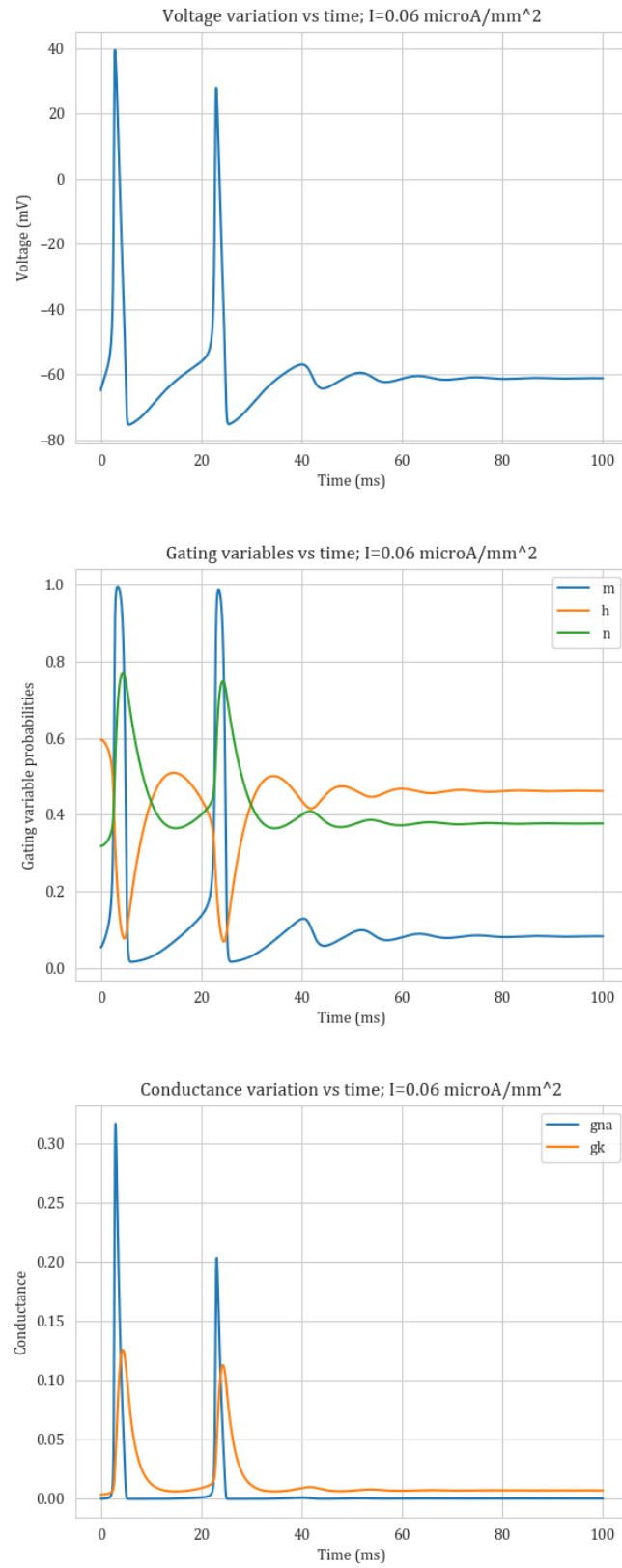


Figure 3: Variation of Voltage, Gating variables and Conductance at current instant I2. Finite number of voltage spikes are observed. Number of iterations performed: 10^4

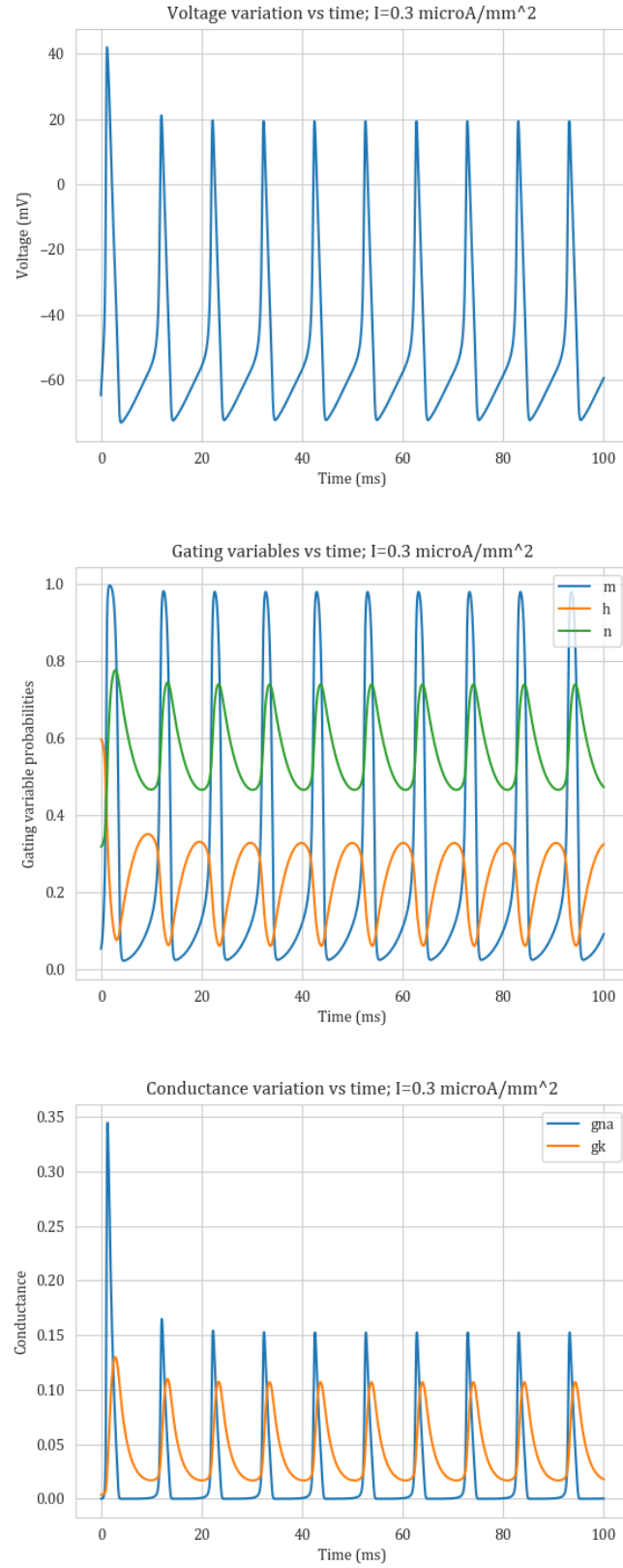


Figure 4: Variation of Voltage, Gating variables and Conductance at current instant I3. Limit cycle behavior in voltage spikes is observed. Number of iterations performed: 10^4

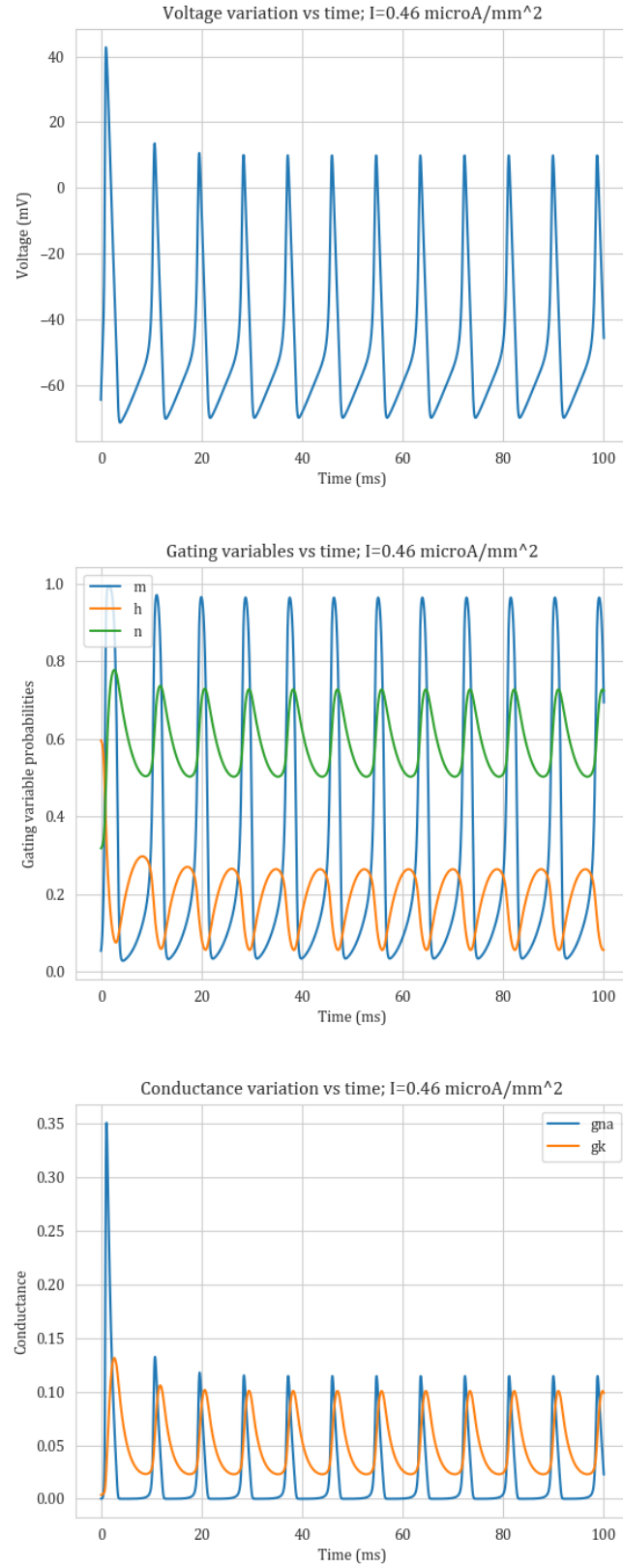


Figure 5: Variation of Voltage, Gating variables and Conductance at current instant after I3. Significant reduction in the number of spikes with amplitude greater than 10mV is observed. Number of iterations performed: 10^4