Computational Neuroscience Coursework3

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Question 1

1) Implemented Euler's method to compute differentiation part of ODE.

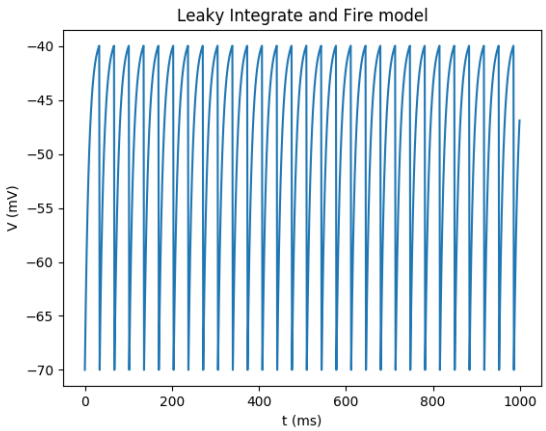

Figure 1: *Leaky Integrate and Fire model (Ie = 31 mV)*

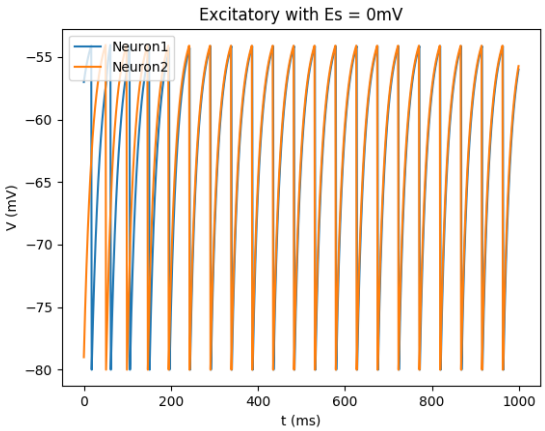

Figure 3: *Case of Excitatory (Es = 0mV)*

Excitatory case: two neurons are converged in different phase whatever initial value is.

Question 2

1) Two result are considered two neurons with excitatory or inhibitory connection of each synapses.

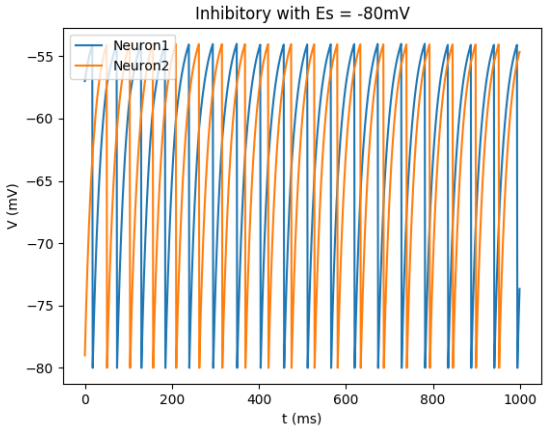

Figure 2: *Case of Inhibitory (Es = -80mV)*

Inhibitory case: two neurons are converged in one phase whatever initial value is.

Question 3

1) From the formula,

$$V(t) = E_L + R_m I_e + [V(0) - E_L - R_m I_e]e^{-t/\tau_m} \quad (1)$$

We know when t increases, then exponential part is converge to 0. Therefore, we can assume like,

$$I_e > \frac{V_t - E_L}{R_m} \quad (2)$$

Then I_e should be bigger than 3.0 (nA)

2) If I_e is 2.9 (nA), It shows that the voltage never

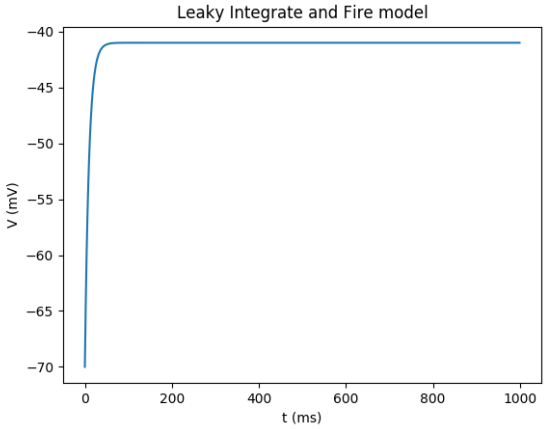

Figure 4: *Case of Ie = 2.9 (nA)*

exceeds threshold.

3) Firing rate of each I_e

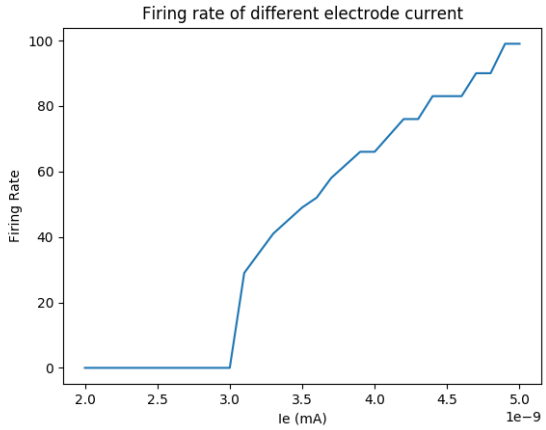

Figure 5: *Firing rate*