

# 1 Neuron Models

In this exercise, the objective is the implementation of neuron models from scratch in Python.

## 1.1 Implementation

Implement the LIF, ELIF, and adaptive ELIF neuron models in Python. Notice that you need to be able to modify the parameters of your implemented models. So, proper implementation is that independent of model parameters and be just an abstract model with arbitrary parameters. Our advice is that just create a base model class that can have any ground dynamical system, and some methods to simulate this dynamical system.

## 1.2 Experiments

- For each model, draw the plots of Voltage vs. Time (u-t) and Frequency vs. Current (F-I) responses of the model, for different arbitrary input currents (and also for constant currents). At least five different sets of parameters and input currents (eg. constant current, step-function current, and sine wave current, and ...) must be analyzed and described in your report file. Notice that for the adaptive ELIF model, draw the Adaptation Current vs. time (w-t) plot instead of the F-I plot.
- Repeat the previous part with random input current to your models. In this part, there is no need to draw an F-I plot.

## 1.3 Examples

Here is some example of different plots.

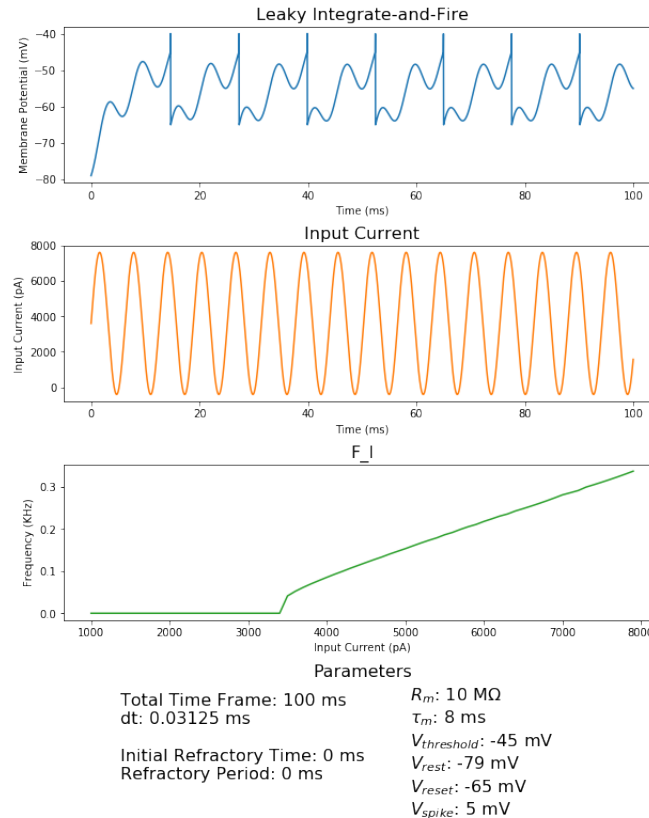


Figure 1: LIF ( $I = 4000 \cdot (\sin(t) + 0.9)$ )

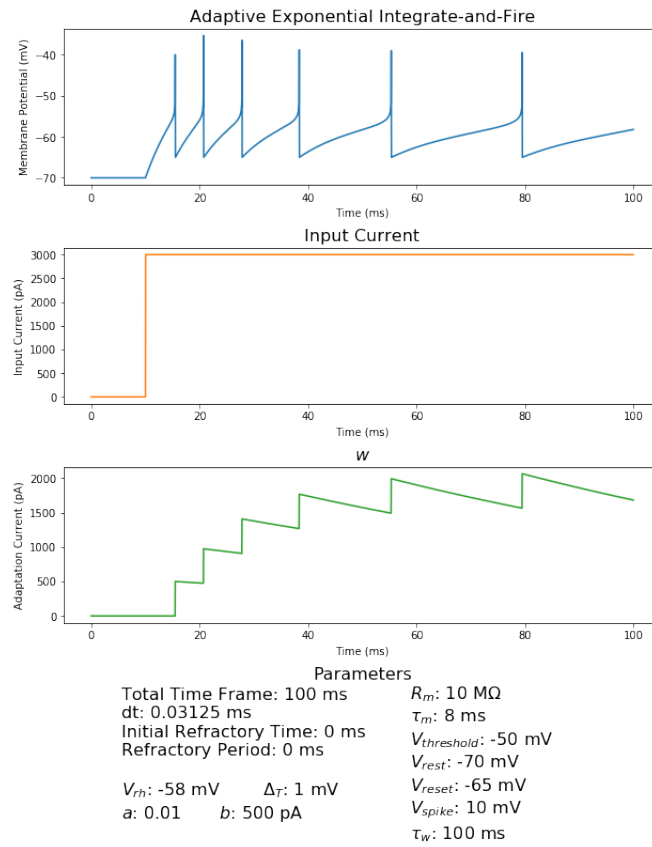


Figure 2: AELIF1

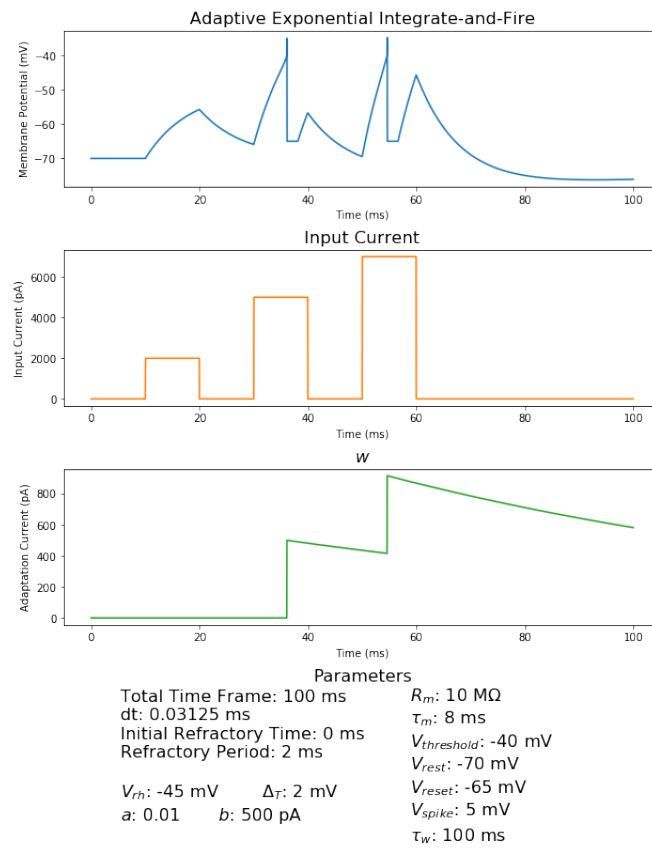


Figure 3: AELIF2