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1. What do you expect to happen if an IF neuron is fed a very low input current? An LIF neuron?

If an IF neuron is fed a low input current, then it will always spike after some amount of time (because the total amount of voltage in the cell membrane never decreases). If a LIF is fed a low input current and the value of the current is less than the “leak” value, the neuron will never fire. If the current’s value is greater than the leak, then the neuron will eventually fire.

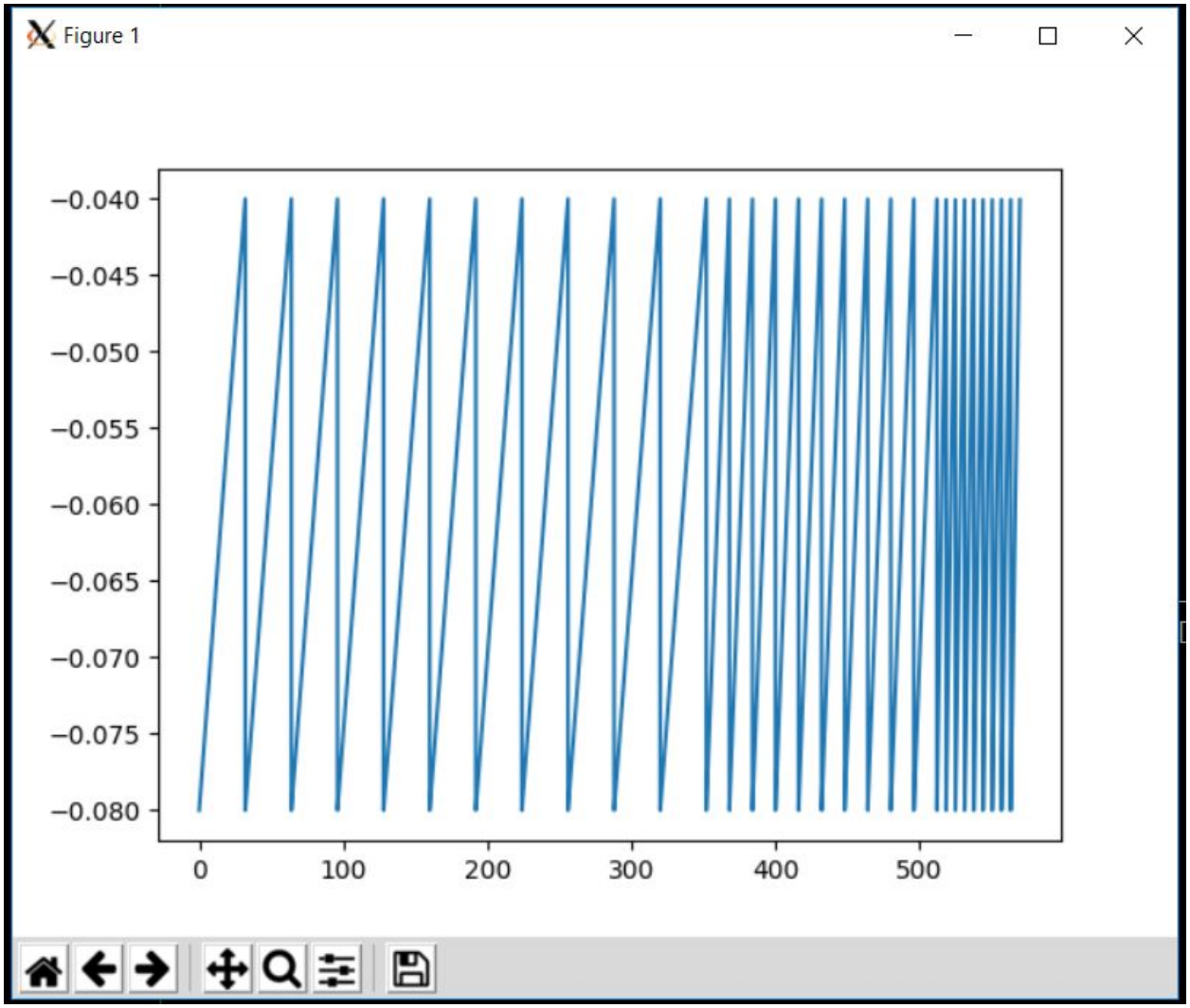
2. What do you expect to happen if an IF neuron is fed a larger input current? An LIF neuron?

Assuming that the input current exceeds the “leak” value in the LIF neuron, both types of neurons will eventually fire after the threshold is exceeded. The IF neuron would fire before the LIF neuron, if both are given the same amount of current at identical starting times.

3. What are the limitations of an LIF neuron?

A LIF neuron does not model a neuron’s refractory period.

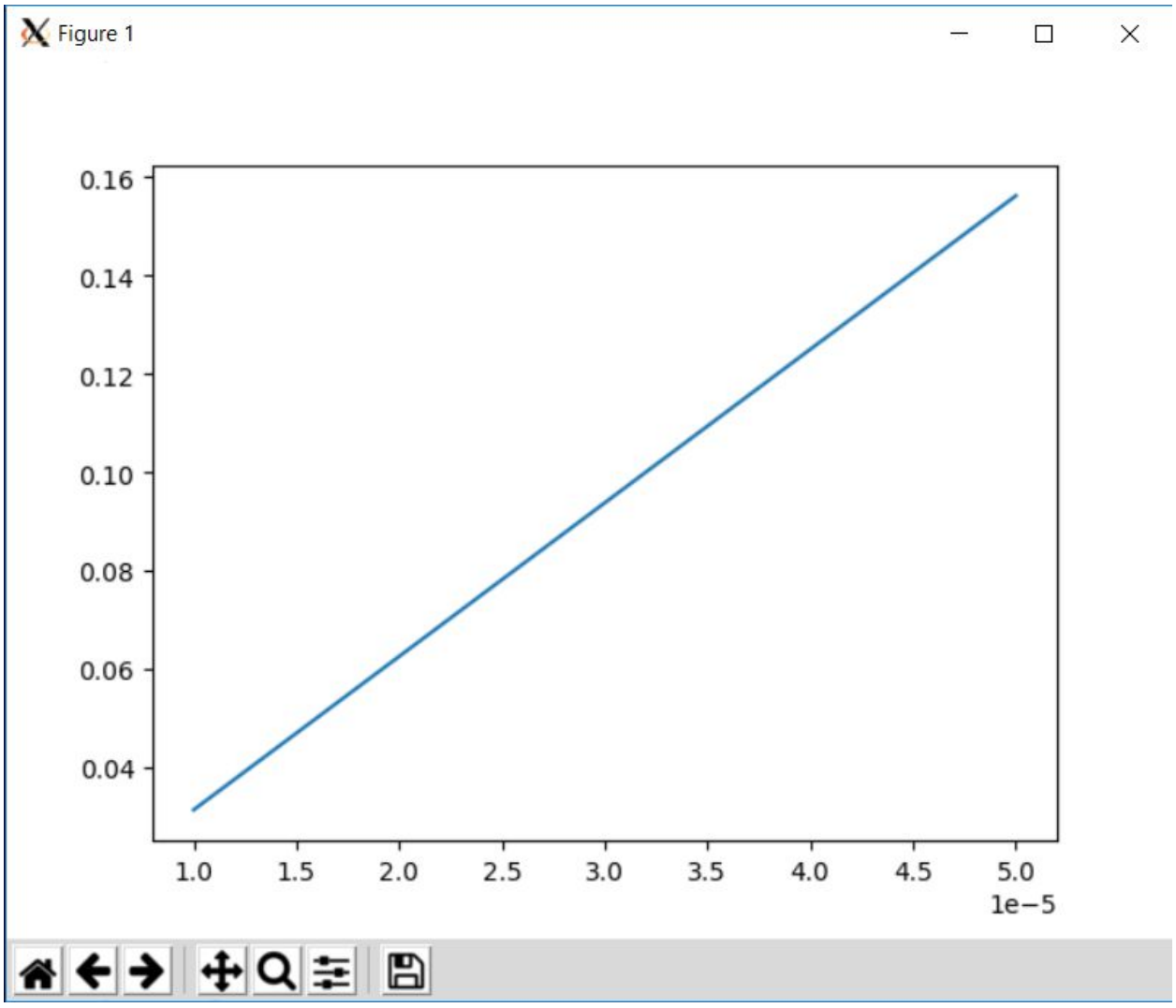
LIF neuron



X-axis: seconds
Y-axis: membrane potential

Currents: 1 x 10^ -5
2 x 10^ -5
5 x 10^ -5

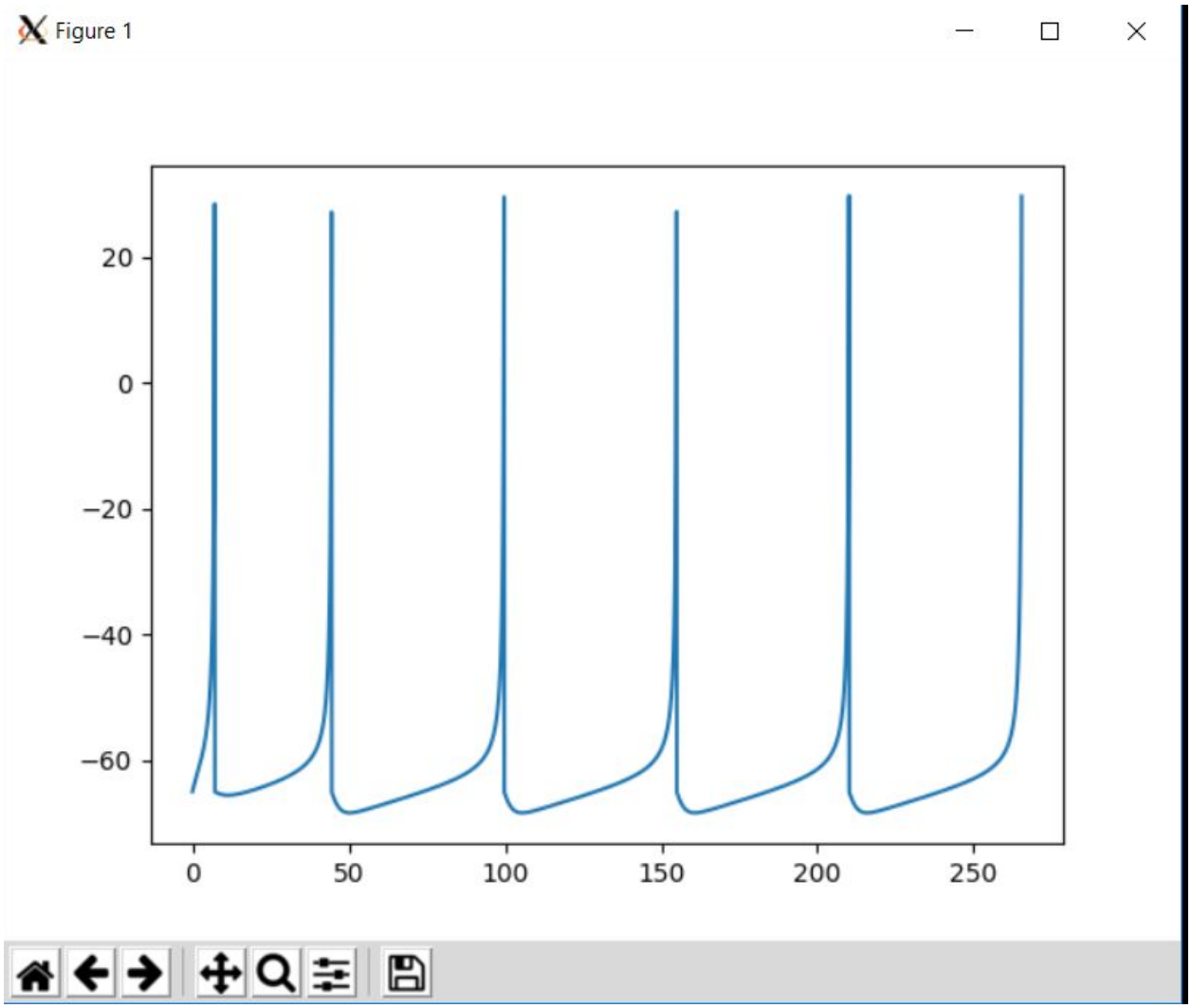
LIF firing rate



X-axis: time
Y-axis: firing rate

3. Using the LIF model, the spiking rate will continue increasing linearly as we increase the current. This behavior would not be possible in an actual neuron, because neurons typically have a refractory period. There would be a cap on the spiking rate.

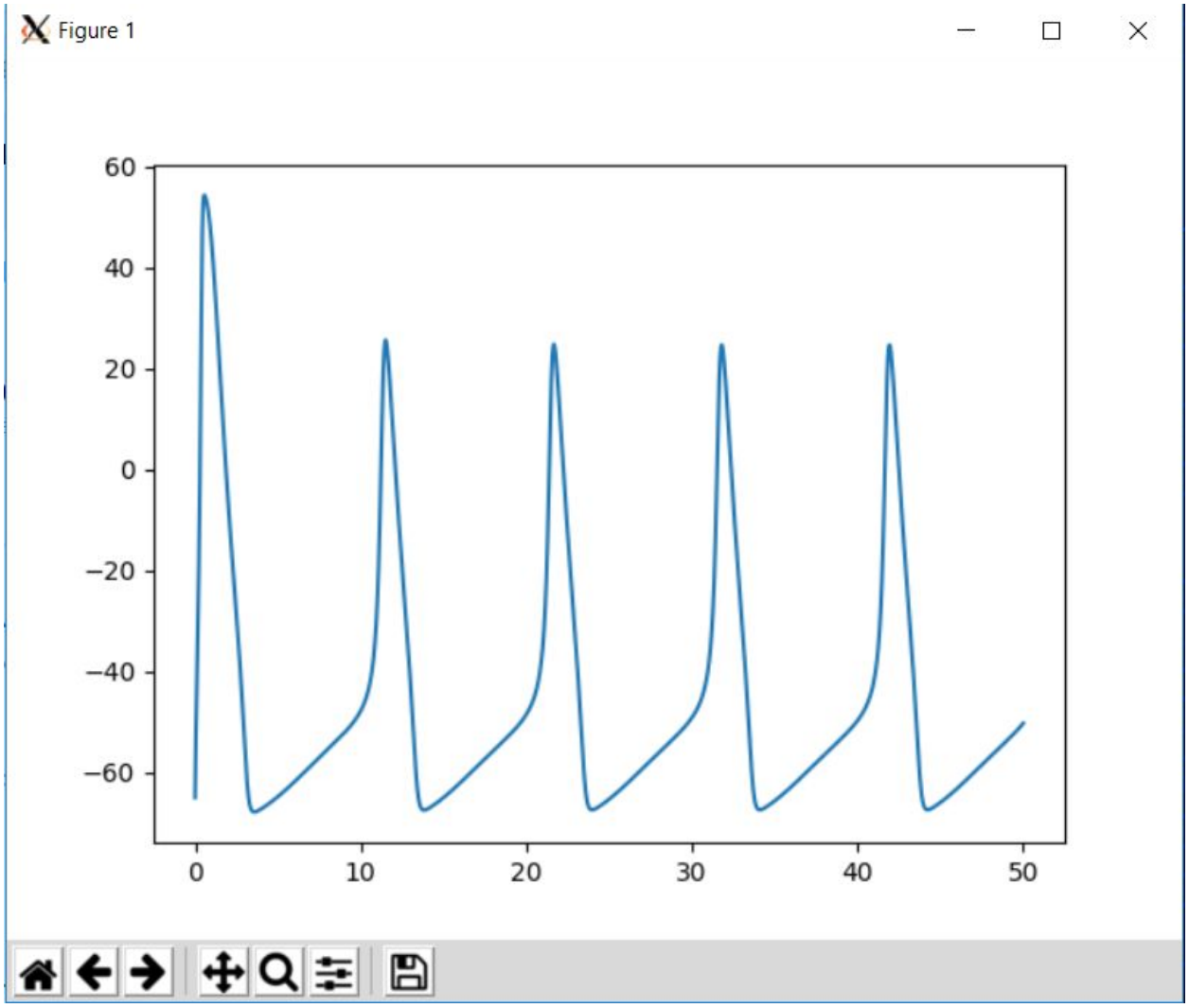
4. **Izhikevich neuron**



X- axis: time

Y- axis: membrane potential

Hodgkin-Huxley model



x-Axis: time
y-axis : membrane potential