

Advanced Neural Networks - Homework 1

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1 Baseline

Figure 1 illustrates the Risi with the Basic Integrate and Fire Neuron model. The following parameters were used: $V_{reset} = -0.065$, $V_{th} = -0.05$, $E_l = -0.065$, $\tau = 0.03$, $R_m = 9.0e7$.

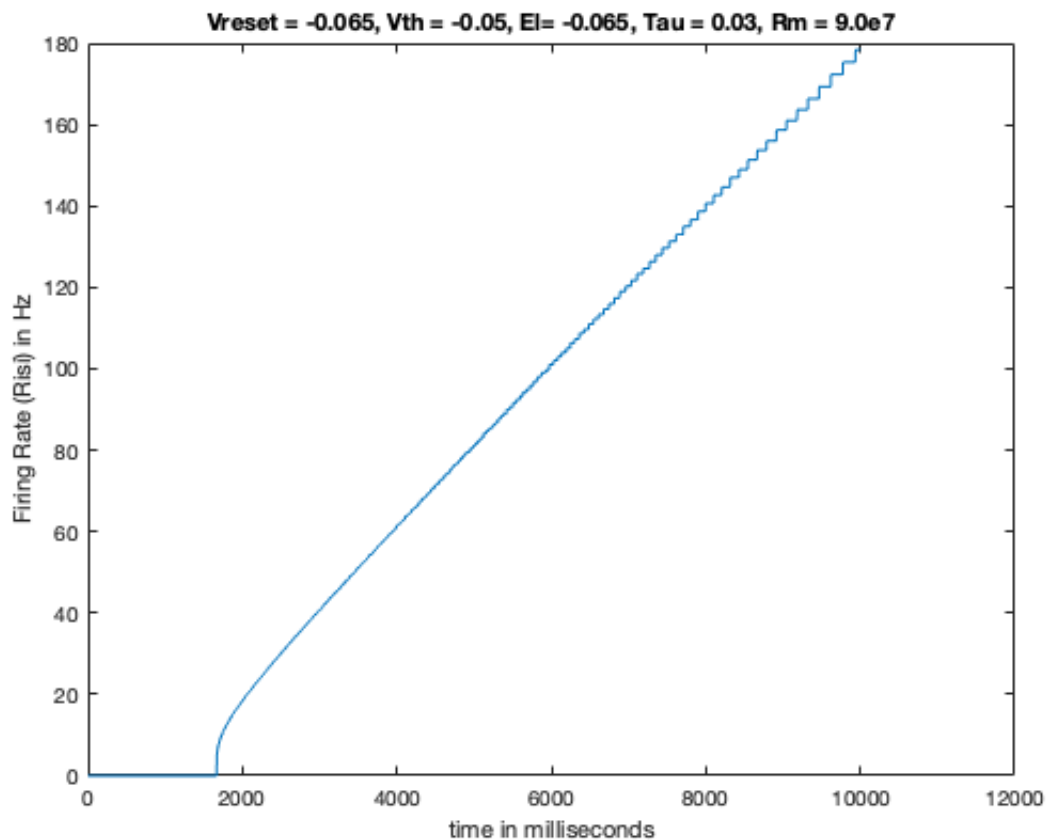


Figure 1: Average Risi over time in milliseconds.

2 Varying Threshold

Figure 2 illustrates how our original baseline curve changes with varying threshold values. With a threshold value set at -0.06mV , the neuron begins firing much earlier than the models with a threshold of -0.05 and -0.04 . Overall slope of the line is steeper for the lower values than for the higher values.

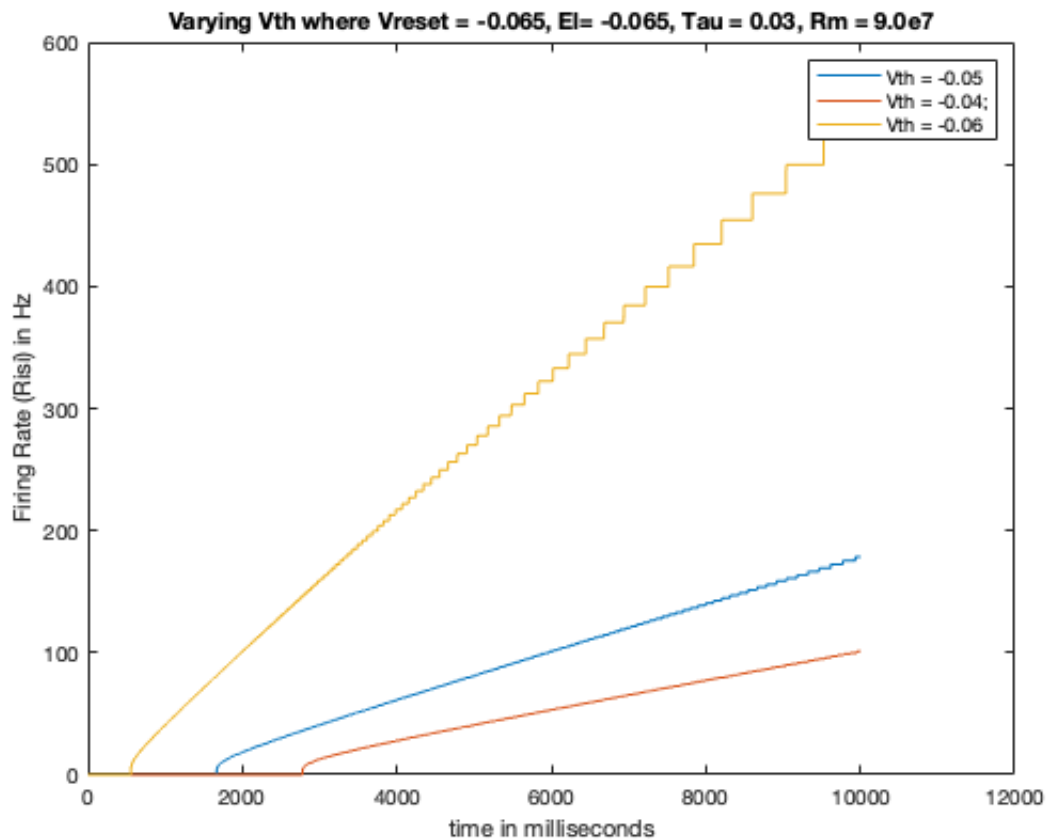


Figure 2: Average Risi with different V_{th} values.

3 Varying Vreset

By varying Vreset, we are changing the refractory period in the neuron model, which can be seen in Figure 3. Higher Vreset values significantly increased the average firing rate over time.

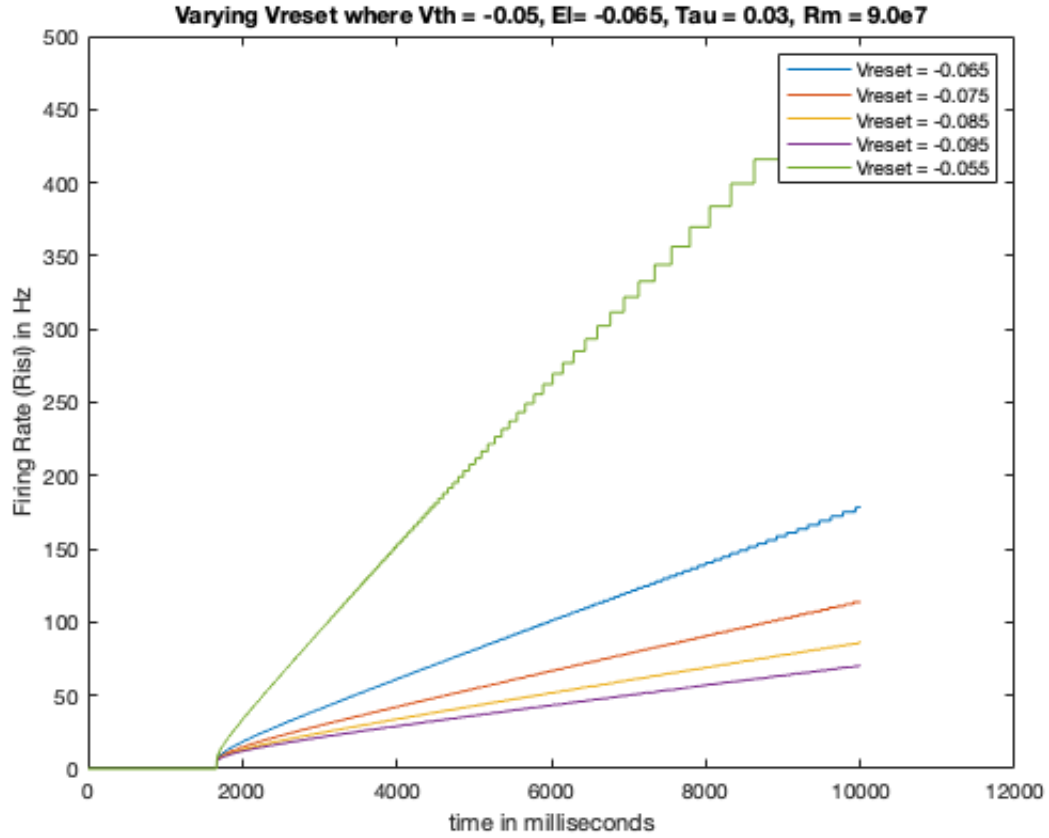


Figure 3: Average Risi with varying Vreset values

4 Varying El

In Figure 4 we can see the changes in the neuron model when we modify El. Though El does not change the slope of the curve representing the firing rate, With higher El values the neuron begin firing earlier. At $El = -0.05\text{mV}$, the neuron begins firing almost immediately.

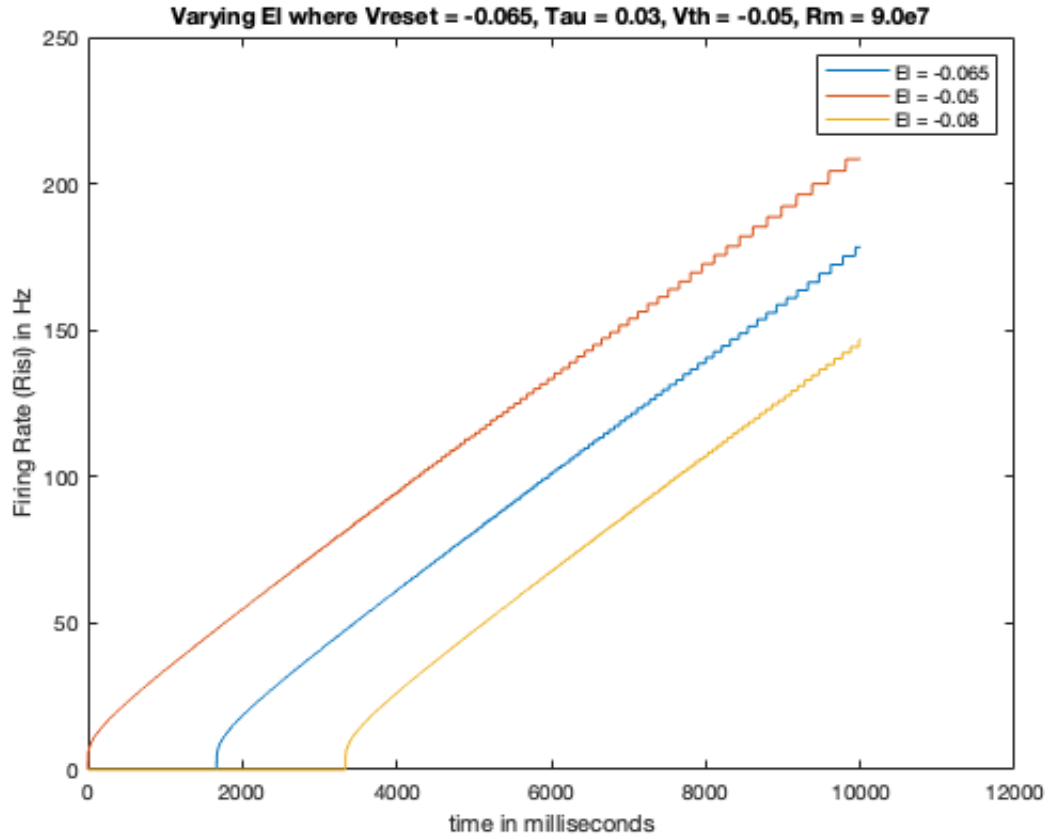


Figure 4: Average Risi with varying El values

5 Varying τ

Variations in τ can be seen in Figure 5. Higher values of τ can be seen to increase the slope of the curve representing the average firing rate.

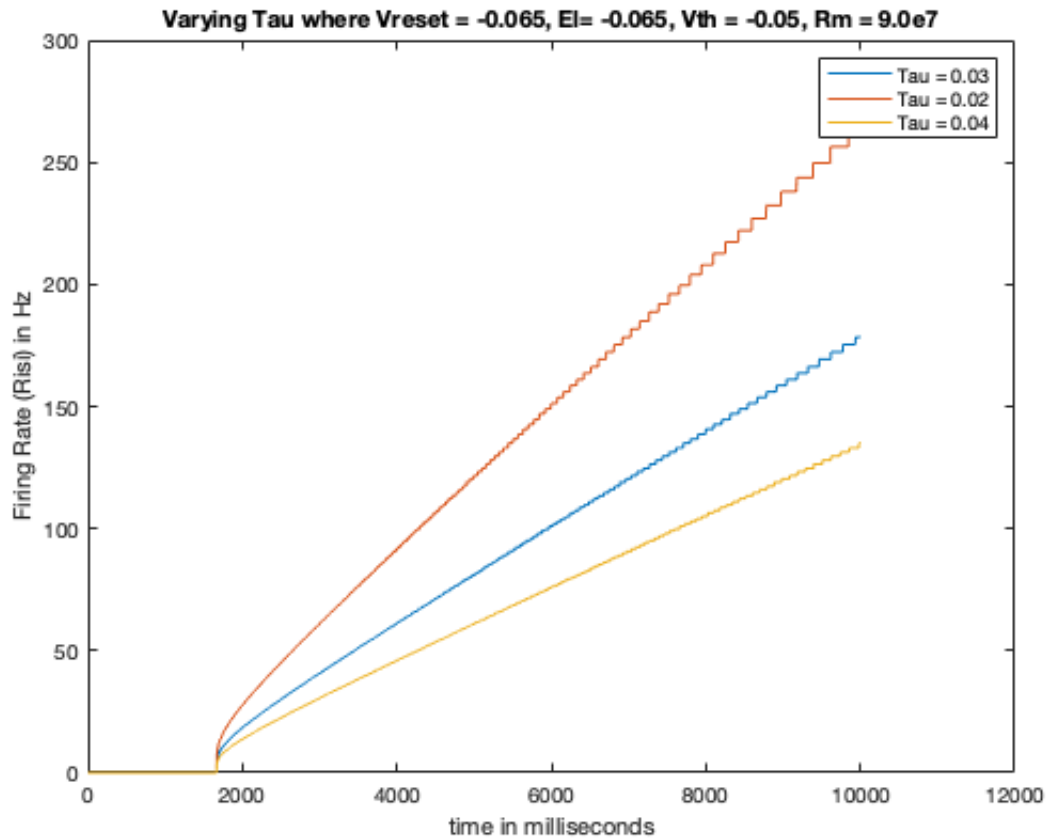


Figure 5: Average Risi with varying τ values