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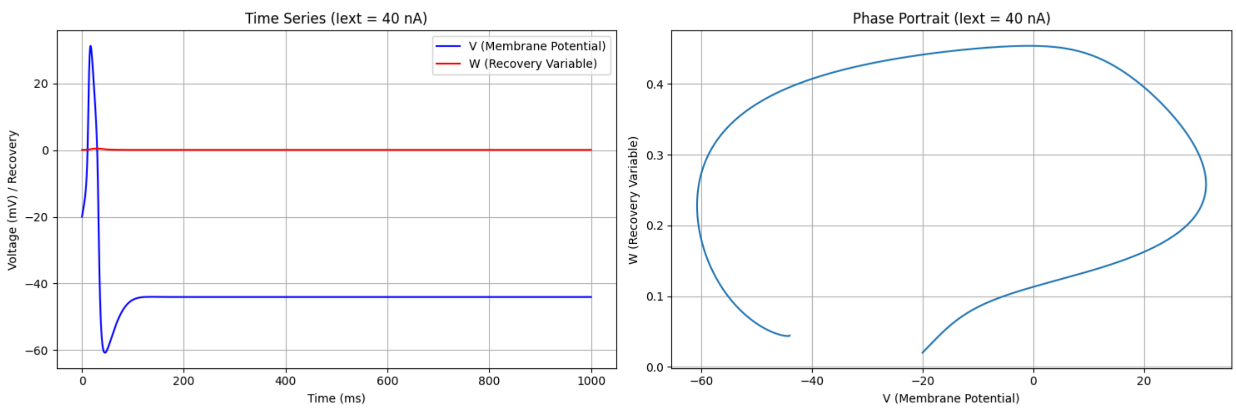
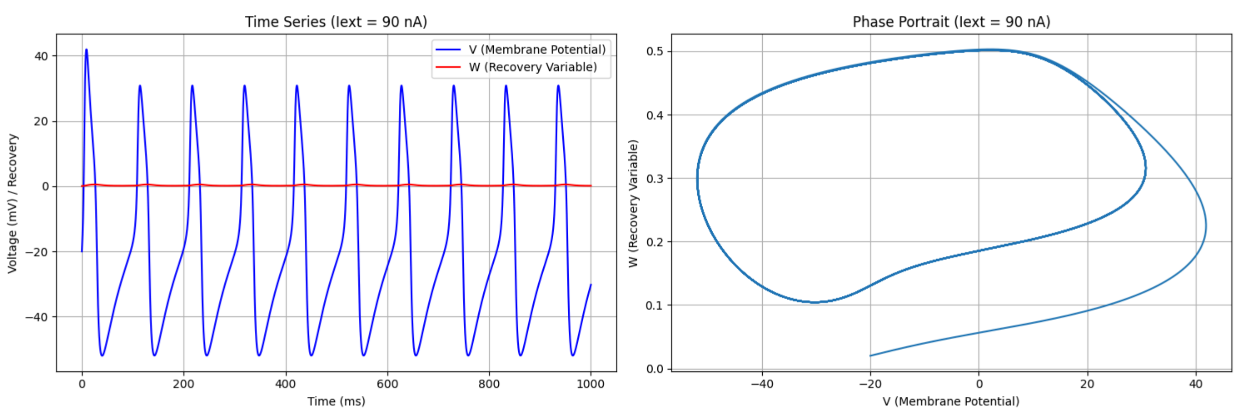
Subject: Theory of neural dynamics and applications to machine learning based on reservoir computing

Exercise 4C

1.The external current is Iext = 40 nA

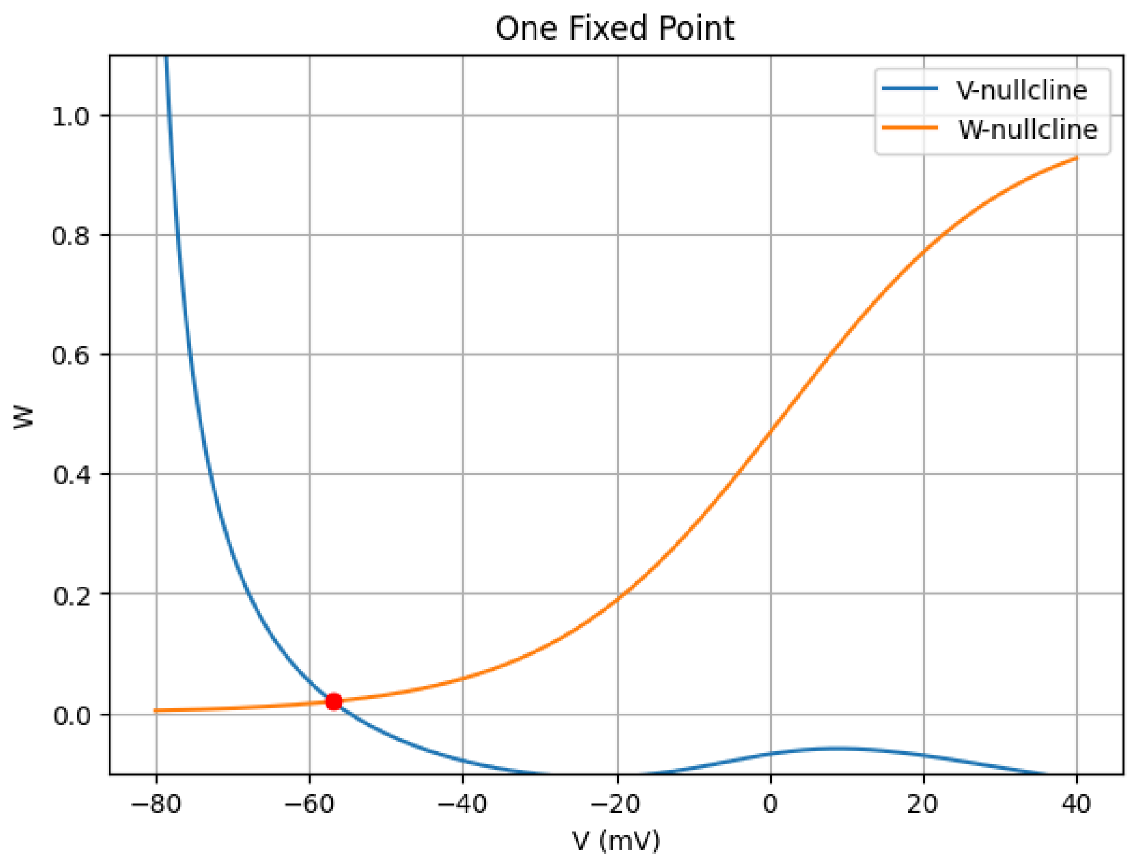


2.The external current is Iext = 90 nA

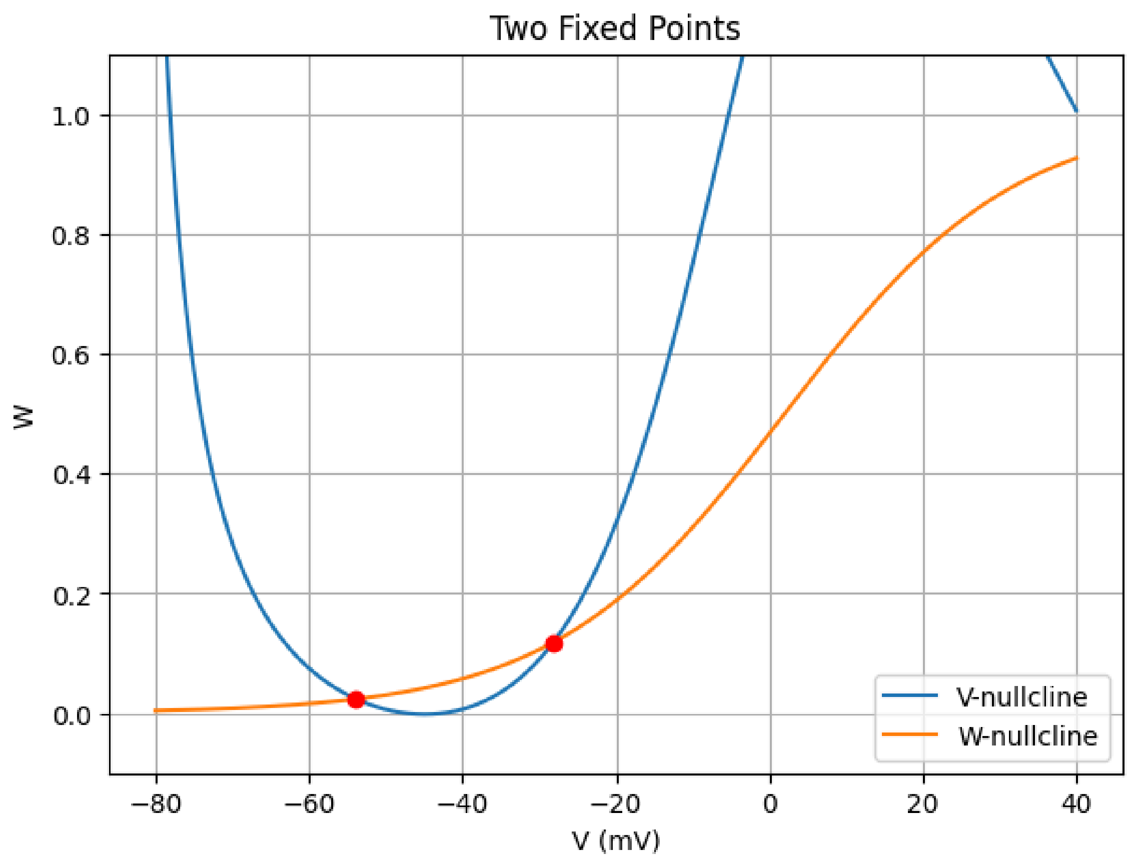


Exercise 4B

1. **One Fixed point**
   Intersection 1: V = -56.91, W = 0.02
   gca=1.0, Iext=10



2. **Two Fixed point**
   Intersection 1: V = -53.85, W = 0.02
   Intersection 2: V = -28.14, W = 0.12
   gca=15.0, Iext=10.5



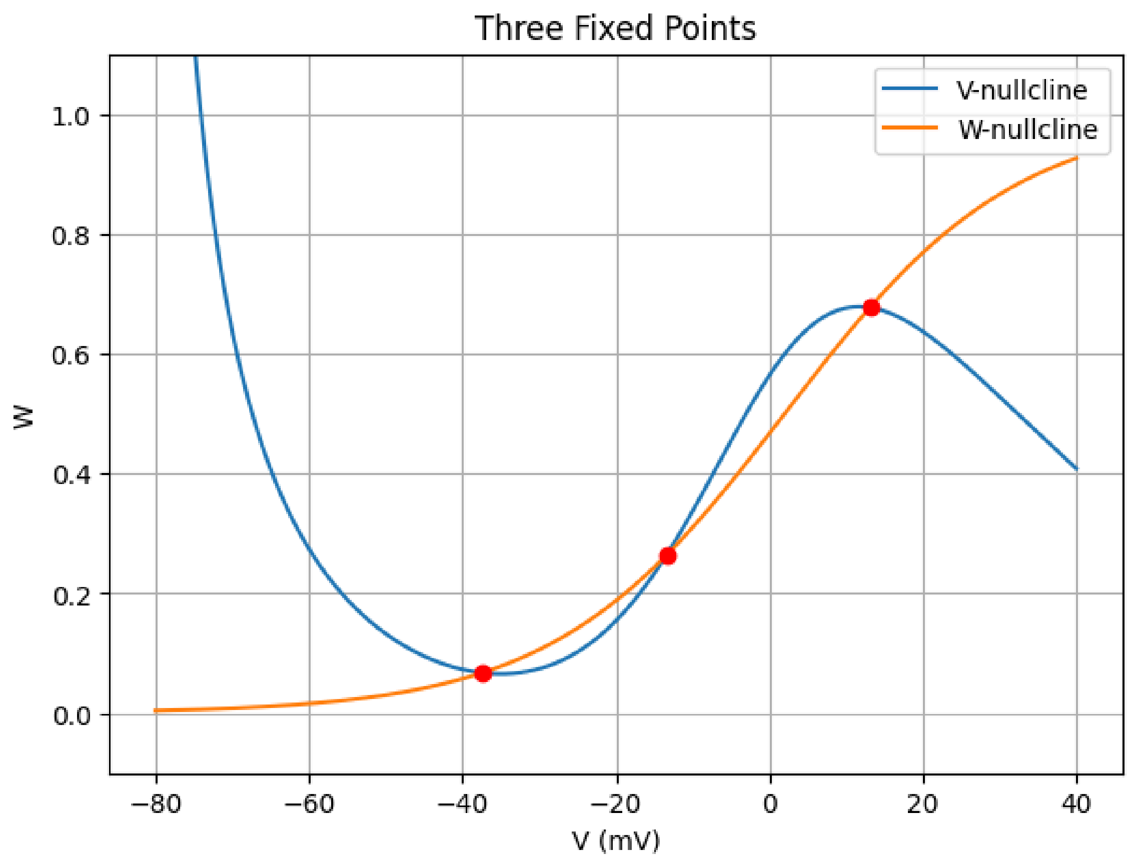
3. **Three Fixed Point**

Intersection 1: V = -37.44, W = 0.07

Intersection 2: V = -13.42, W = 0.26

Intersection 3: V = 13.12, W = 0.68

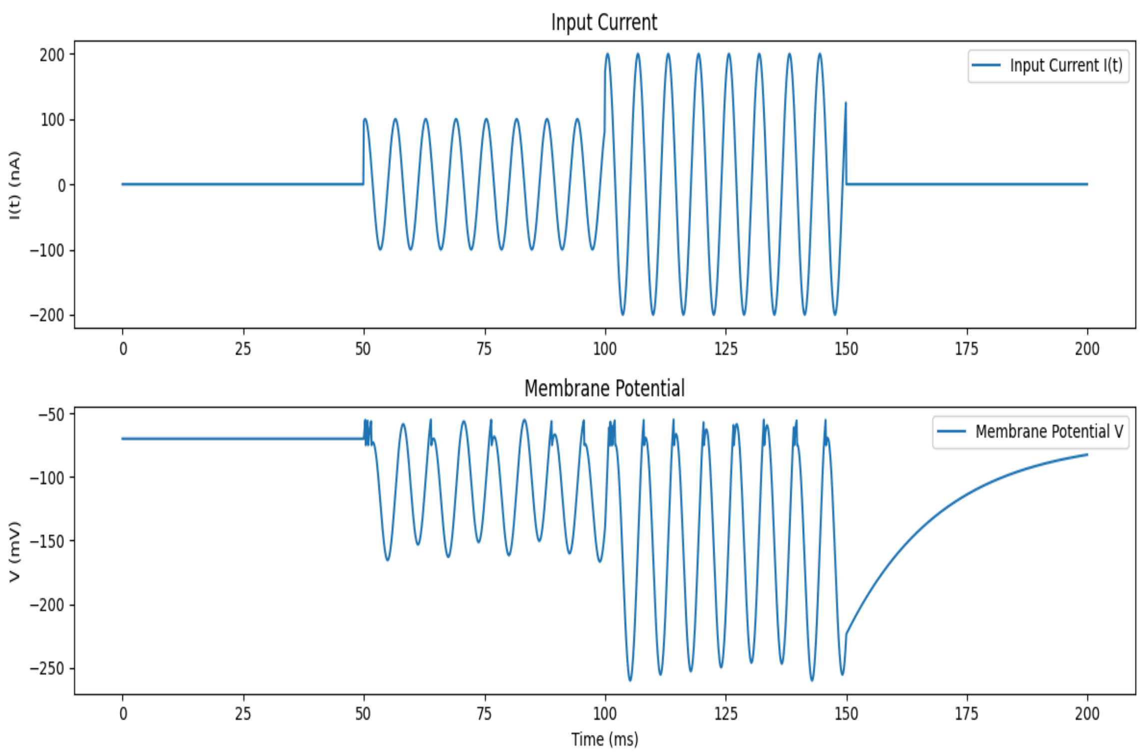
gca=7.0, Iext=50.86



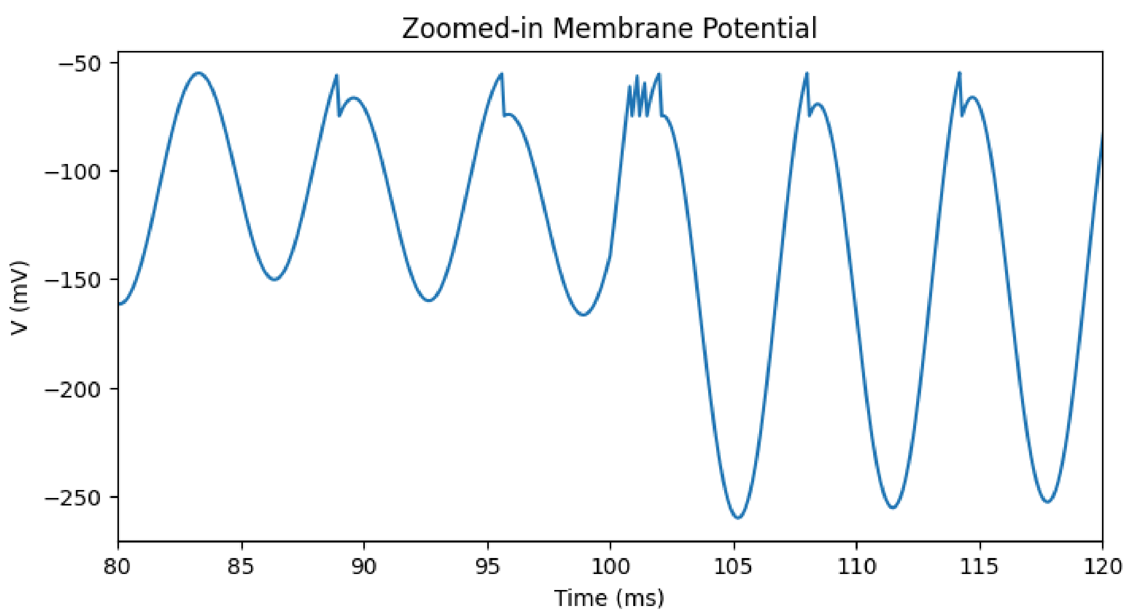
Exercise 4A

1. **The time series for the duration of T = 200 ms of both the membrane potential V and the input current I(t) = Acos(ωt), when for the first 50 ms the amplitude of the input current is A =0, for the next 50 ms A = 100, the next 50 ms A = 200, and the last 50 ms A = 0. Assume that the frequency of the input current is ω = 0.25 Hz or any other number that you should indicate in your figures.**

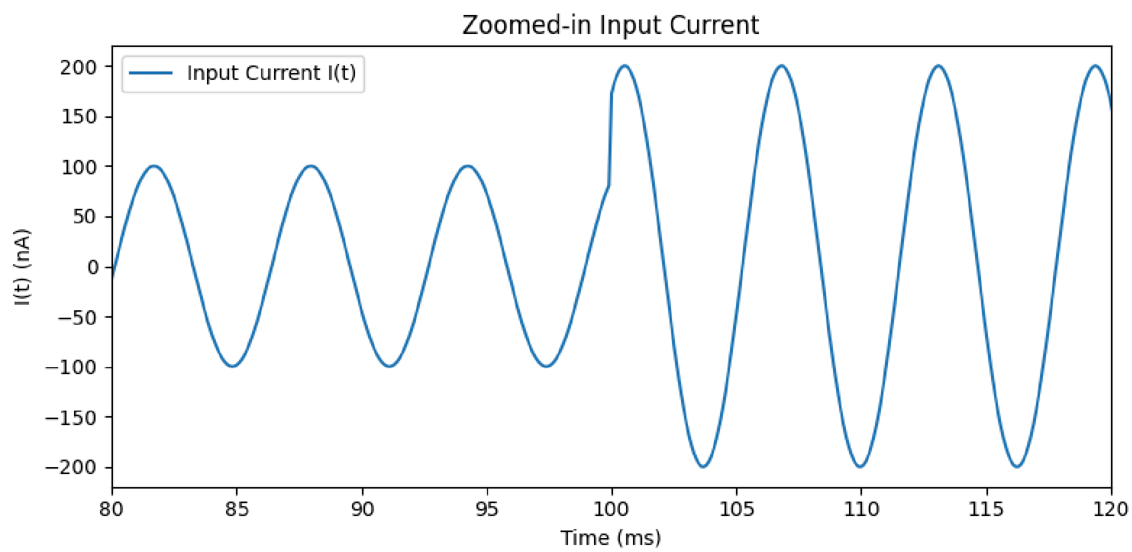
Full graph from interval 0-200ms **,ω = 1.0 Hz**



Membrane potential Graph from 80 to 120 ms ,ω = 1.0 Hz



Input Current Graph from 80 to 120 ms ,ω = 1.0 Hz



2. **From the results of your simulations, explain why you think the LIF is a Type I and not Type II neuron model.**

The LIF model shows continuous firing as long as the input current remains above a certain threshold.The firing rate changes proportionally to the intensity of the input stimulus.The LIF model as implemented here doesn't include a refractory period, which is often associated with Type II neurons.