Active and Passive Compartmental Modeling in Matlab

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Problem 1: Install Neuron Simulator Install the compartmental simulator Neuron `https://www.neuron.yale.edu/neuron/` on a computer you have access to for upcoming lectures. You can use Linux,WIN, or MAC for this. Take a look at the Genesis simulator `http://www.genesis-sim.org/`. It works on linux, claims to work on the MAC. Install that also if your OS accepts it.

Problem 2: Write a simple passive compartmental solver Write matlab code to solve, using the MNA method, a compartmental model. Start with a single compartment, containing an axial resistor, a current source, and a membrane capacitance. You can use the stub cableMNA_stub.m on the homework site. This stub contains a detailed explanation of the MNA method equations, in html format (you can view by using the "Publish" feature of matlab). The circuit diagram, with edges and nodes labeled is shown in the html. This program is missing the Euler integration loop, but is otherwise complete (look for "insert code here". So all you need to do is insert an Euler loop wrapped around the MNA equation. Show that the code produces the expected RC charging curve.

Problem 3: Write code (MNA) to add a second compartment Use the same resistances and caps as the first (no battery needed in the second compartment).

Problem 4: Show how you might add active channels to this model Write code to insert a Hodgkin Huxley like Na and K channel to one or the other of the two compartments from above. Assume that the conductances

$G_{Na}(V_m, t)$ and $G_K(V_m, t)$ are supplied from a pair of functions that you will consider to be DUMMY FUNCTIONS — you actually have HH code from last weeks assignment, but do not try, at this point, to use that code – just write this problem with respect to these dummy functions – this will make the assignment easier, but show you the structure of the compartmental modeler.

So, in summary, all you need to do is write some code to add two new edges (for the HH Na and K conductance) to the matrixes A,G,C and two voltage sources (batteries) to the vector $\vec{b}$.