EE 591L – Neuromorphic Analog VLSI
Project 8 – Current-Mode Neuromorphic Circuits

Objective
To become familiar with some of the current-mode circuits that are typically used in building neuromorphic systems.

Special Instructions for This Project
Please turn in an electronic copy of the SPICE deck for both parts.

Part 1 – Diffusor
Simulate a current-mode diffusor with at least ten nodes. First, you must simulate the diffusor with subthreshold bias voltages on the axial-resistance transistors (V_R) and the conductance transistors (V_G). Then, leave V_G the same and change V_R. Put V_R back to its initial voltage and then change V_G. For each of these cases, input a subthreshold current only at the middle node.
- Find the output current for each of the nodes for each case.
- Plot the output current versus the position for each case.
- Find the electrotonic length for each case. How does the electrotonic length vary when you change the bias voltages?

Now, using the original bias voltages, place an input current at the first and last node of 1nA. Also, place an input current of 10nA at the middle node. Plot the output currents versus position. Describe the effect that is happening here.

Part 2 – Bump Circuit
Simulate a bump circuit, as described in class, and plot the output (bump) current.
- Move the center of the bump to be at 0.5V, 1.65V, and 2.8V, and plot all the outputs on the same plot. Explain how you did this.
- Are you able to change the width of the bump? If so, how, and if not, why?