Due: Wednesday March 16th

Purpose: Together with your chosen partner, propose a class project!

Basics: The basic idea is to design, analyze, and simulate a novel analog (or hybrid analog/digital) circuit that improves an existing circuit from the research literature or creates a new solution for a challenging analog processing application. Projects should be limited in scope (i.e. N transistors, where 10 < N < 100). Ideally, you should be focused on circuits that have been published in the recent past (since 2000).

What you need to turn in:
A two-page proposal (one per project group) with at least one transistor-level drawing of the “starting-point” circuit or example subcircuit. At the top of the proposal, you should include the names of you and your partner and your email addresses.

Your proposal should have sections on:

1) Introduction/Motivation (why this is an interesting research area / circuit)
2) Background (references! – more detail on what has come before, minimum 2 references)
3) Circuits (specific examples of circuits)
4) Proposed Analyses / Design Changes / Improvements (what you plan to do)
5) Division of Labor – you need to evenly split the workload and indicate how you are planning to do this.

The expectation is that for the project you will do any relevant mathematical circuit analysis needed, both DC and AC and any specialized analysis needed to understand the circuit in its application domain. This analysis should lead to explanations of any short-comings or needed improvements to the circuit.

Ways to get started:
1) Take a topic that you are already interested in or know something about and find example papers (journal or conference proceedings) in the literature (at least two) that describe existing work.
4) Use the list below to stimulate ideas.

example ideas:

A paper by Chicca et al., (http://www.enee.umd.edu/class/enee611/project/chicca_etal.pdf) describes a design for a “synapse” circuit that converts a brief digital pulse into a longer-lasting decaying current. What is interesting about this synapse circuit is that it tries to mimic newly discovered adaptive properties of real neurobiological synapses. One of several difficulties with this specific circuit is that the voltage used to control time constants in the system affects more than just the time constants. One of the voltage parameters needs to be set very precisely (order 10mV). Can you design a better circuit that is easier to control? What will this likely cost? power? transistor size? transistor number? Alternatively, you could propose to find a different way to accomplish the same task or more closely mimic the biological data.

A paper by Clapp et al., (http://www.enee.umd.edu/class/enee611/project/clapp_etal.pdf) - a better version will appear soon) describes a chip that contains a circuit that computes the centroid of image brightening for use in tracking systems. Is the centroid of image change is nice, but what happens if you are looking at a scene that contains a TV or a window that continually produces changes in the image? How could this circuit be augmented to solve this problem? Design and simulate part of this system to demonstrate how to make it work.