Projects for High-Speed Semiconductor Devices

Spring 1996

Here is the list of possible projects. What I expect is that you pick your the topic and research that area/problem thoroughly and present your findings in a report of 15-20 pages minimum (including figures). You will also have to prepare a 20 minute presentation of your results, to be followed by my questions regarding your report. Topics mention "simulation" — by that I mean any use of computers (in this case using Medici) to analyze device operation and properties: in principle, you can use whatever you have at your disposal and are familiar with. If you want to stick to analytical experssions at least run a few calculations to verify their validity.

Reports are due by June 8, noon. The presentations will be held on Tuesday, June 13, in my office.

1. Effects of gate length reduction on SOI n-channel MOSFET operation (so called, short-channel effects). Pick one of the many effects and illustrate it via simulation. For example, you can look into threshold voltage reduction with gate reducion and investigate the possible solutions to this problem. How is the approach different from bulk case? Use medici to investigate different options. Write up a report on all the other effects, based on your search of the literature. Why do we reduce gate length in the first place? etc.

2. Same as above, but in bulk MOSFET. Have you come across some nice idea in the literature and can you explain why it seems promising?

3. Special issues in scaling of n-channel SOI MOSFET in Si/Ge technology. How does design of p-channel device affect the n-channel device? (you'll have to read a M.S. thesis for this one and do quite a bit of simulating)

4. Implementing a SPICE model for SOI

5. Why SOI? Search the literature and check out various claims made for SOI. Critically examine them, both analytically and by using simulation. Which claims have been substantiated and which not?

6. Operation and characteristics of heterojunction FETs (HFET, MODFET, etc.). Analysis, simulation, review. (tonnes of literature!)