

HW9: DUE TUESDAY, NOVEMBER 11

“On becoming a true technology designer”

Using simulation programs is a pervasive part of engineering, but they can make a person lazy, and they can get you in trouble. In semiconductor technology development, computer simulation is known as “TCAD” for Technology Computer Aided Design. Here are some thoughts from a colleague about the difference between those who truly understand how to use a simulation program and those who don’t.

“The basic difference between an ordinary TCAD user and a true technology designer is that the former is relaxed, accepting on faith the program’s results, the latter is concerned and busy checking them in sufficient depth to satisfy him or herself that the software developer did not make dangerous assumptions. It takes years of training in good schools, followed by hands-on design practice to develop this capability. It cannot be acquired with short courses, or with miracle push-button simulation tools that absolve the engineer of understanding in detail what he or she is doing.”

Paraphrased from: Constantin Bulucea, “Process and Device Simulation in the Era of Multi-Million-Transistor VLSI - A Technology Developer’s View,” IEEE Workshop on Simulation and Characterization, Mexico City, Sept. 7-8, 1998.

When you use a simulation program, you should always be checking to be sure that the answers make sense. For this assignment, you are asked to check one aspect of the MOSFET simulation tool in the ABACUS suite on nanoHUB.org.

- 1) Locate the MOSFET simulation tool in the ABACUS suite of tools on nanoHUB.org. Run a default MOSFET simulation and examine the plot: “Surface charge vs. V_g .” The vertical axis of this plot is labeled “Exposed Dopants + Carriers (C/cm^2).”

There is some question about exactly what this plot is; is the vertical axis is labeled correctly?

Determine what is being plotted and convince me of your conclusion.

Hints: You may change the simulation to make it run faster or to make the results easier to interpret. I am only interested in what this quantity is – not the value for the default MOSFET. Since you cannot look at the source code to see what is being done, you will need to use your knowledge of device physics to solve this problem.