Project Proposal - Simple Diode Model

Sonya Stuhec - Leonard 100963181

February 28, 2018

1 The Model

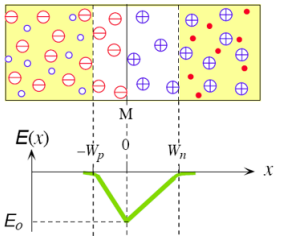
1. Define electrons charge, mass, and mean scattering time.
2. Create area for diode (75X50 units) using periodic boundary condition for the sides (x=0, x=75) and reflective conditions for the top and bottom (y=0, y=50). Use a 20 unit central region as the depletion region.
3. Use Monte Carlo method from assignment 1 to initialize electrons in the area.
4. Create a conductivity map using [**?**]

$$\sigma = \frac{e^2 n \tau}{m_e} \tag{1}$$

5. Apply the depletion approximation electric field, using F=ma to move the electrons (F=Eq)[**?**]

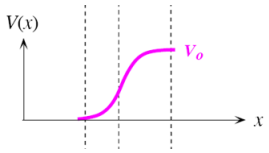
$$E(x) = \frac{1}{\epsilon} \int_{-W_p}^{x} \rho_{net}(x) dx \tag{2}$$

where W_p is the expansion into the p junction, and ρ_{net} is the resistivity (or 1/conductance)[**?**]



$$N_a W_p = N_d W_n$$

6. Using the finite difference method, find the equilibrium solution for the potential applied.
7. Plot the potential as a function of position. You expect to see [**?**]



2 Apply a voltage

Simulate the effect of applying an electric field in forward and reversed bias. Using FD to reach new equilibrium.

1. Change the left and right boundary conditions to be reflective. Set the left side equal to 0V and the right side to 1V.
2. Use the FD method to solve for the new boundary conditions, plotting the electrons as a movie.
3. Plot the electron current.
4. Repeat for 0.4V and 0.7V.

References

[1] TJ Smy, *The Physics and Modeling of Advanced Devices and Technologies*, [Accessed: Febuary 28, 2018] WWW Document, (`http://www.doe.carleton.ca/~tjs/4700.html`).