Device Simulation Laboratory

(EE5195)

Problem Sheet-7

Q.1: Numerical solution of Time dependent Diffusion equation

(a) Describe the formalism to solve time dependent diffusion equation using backward Euler scheme.

(b) Consider a region of length 10 μm. Assume perfectly absorbing boundary conditions at x=0 and at x=10 μm. At time t=0, assume that particles are injected at x=5 μm is such that the density is 10^6 cm^{-3} (i.e., the injection is a delta function in both space and time). Using the formalism described in (a) explore the evolution of particle density over the specified domain (use $D=10^{-4}$ cm^2/s). Compare with analytical results. Explore the significance of the parameter.

Q.2: Random Walk simulations:

(a) Discretize the time dependent diffusion equation and arrive at a scheme for solving the time dependent diffusion equation through random walk simulations. For $D=10^{-4}$ cm^2/s and $\Delta x=10$ nm, what should be the Δt, the time step in such simulations?

(b) Assume that N=100 particles are released at x=5 μm at t=0. Explore the evolution of particle density profile as a function of time using random walk simulations. Compare with analytical results. Explore the density function for N=1000, and N=10000 particles.