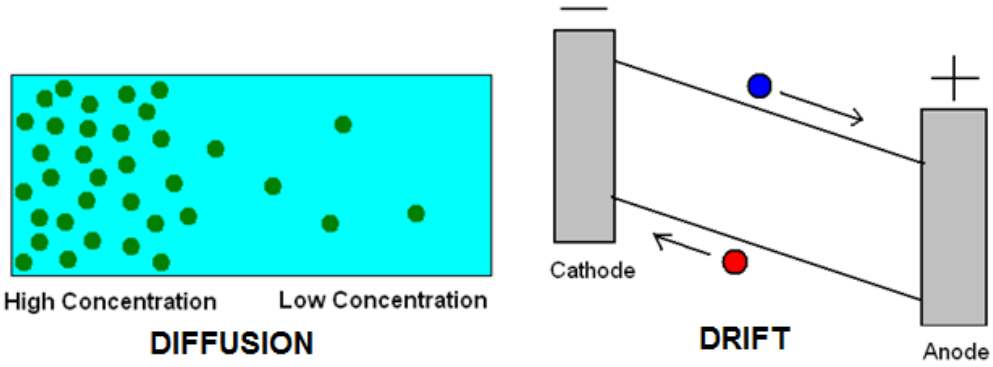
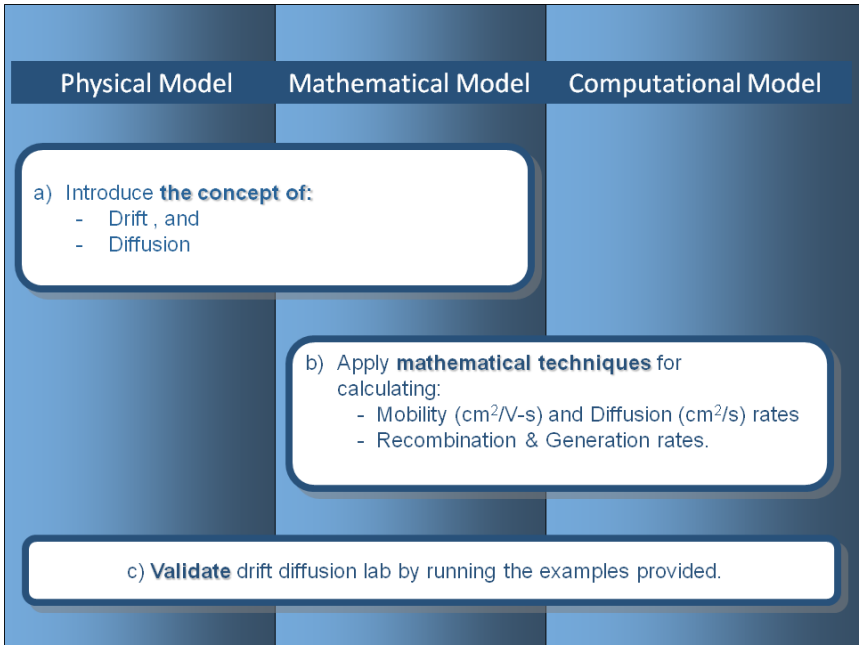
Drift-Diffusion Lab Learning Materials



By completing the Drift-Diffusion Lab in ABACUS - Assembly of Basic Applications for Coordinated Understanding of Semiconductors, users will be able to: a) understand the phenomenon of drift and diffusion, b) physically and mathematically describe the basic drift and diffusion mechanisms, and c) perform light excitation experiments on a semiconductor bar.

The specific objectives of the Drift-Diffusion Lab are:



Recommended Reading

Users who are new to drift and diffusion mechanisms should consult the following resource:

1. Rober F. Pierret. (1996). Semiconductor Device Fundamentals. Reading, MA: Addison-Wesley. (See especially chapter 3)

Demo

* Drift Diffusion Lab: First-Time User Guide

* Drift Diffusion Video Demonstration

Theoretical Descriptions

* Illinois ECE 440 Solid State Electronic Devices, Lectures 8 and 9: Drift Mobility

* Illinois ECE 440 Solid State Electronic Devices, Lecture 10-11: Optical Absorption and Direct Recombination

* Illinois ECE 440 Solid State Electronic Devices, Lecture 12: Quasi-Fermi Levels; Photoconductivity

* Illinois ECE 440 Solid State Electronic Devices, Lecture 13: Diffusion

* Illinois ECE 440 Solid State Electronic Devices, Lecture 14-15: Diffusion with Recombination

* Drift-Diffusion Modeling and Numerical Implementation Details (Implementation details and source code dissemination)

Tool Verification

* Verification of the Validity of the Drift-Diffusion Lab Tool

Examples

* Drift Diffusion Lab Worked out problems (Drift)

* Drift Diffusion Lab Worked out problems (Diffusion)

Exercises and Homework Assignments

1. Homework Exercise on Drift & Diffusion in Bulk Semiconductors

2. Homework Exercise on Drift & Diffusion in Bulk Semiconductors - considerations of lifetime

3. Illinois ECE 440: Introduction to Carrier Drift and Mobility Homework

Solutions to Exercises

Solutions to the exercises are available only to instructors!

Evaluation

* ABACUS: Test for Drift Diffusion Lab

Challenge

In this final challenge users will integrate all what they have learned about basic Drift and Diffusion mechanisms.

* Drift Diffusion - Temperature Sensor