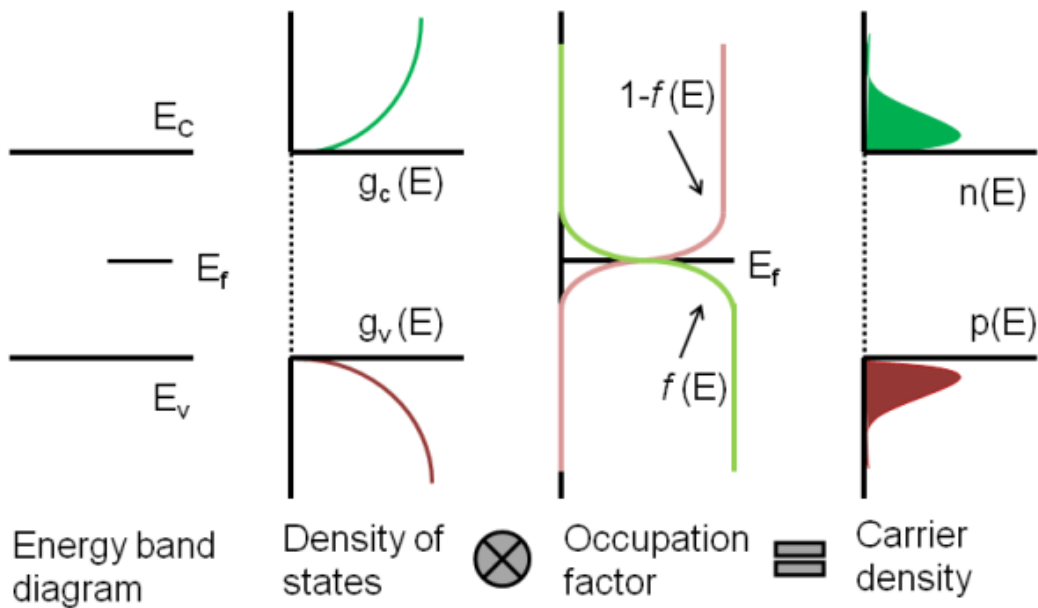
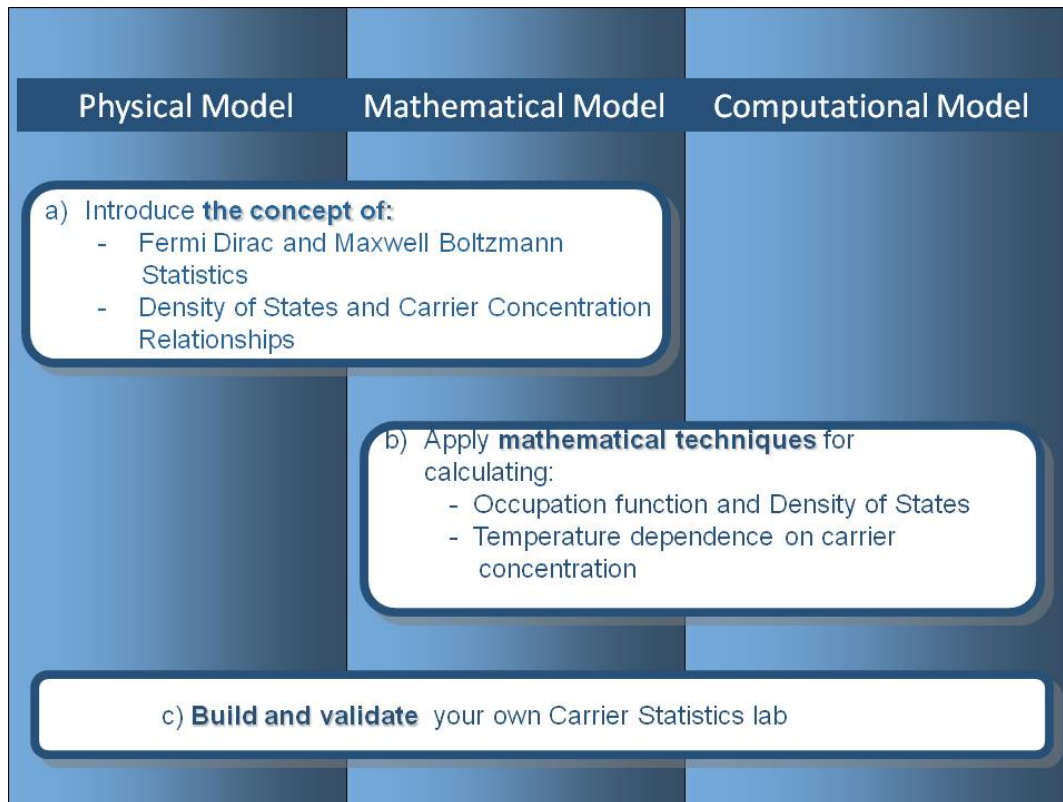


Carrier Statistics Lab Learning Materials



By completing the Carrier-Statistics Lab in [ABACUS - Assembly of Basic Applications for Coordinated Understanding of Semiconductors](#), users will be able to a) understand Fermi-Dirac and Maxwell-Boltzmann statistics, b) describe the effects of doping (shifting the Fermi level) and density of states on carrier distribution (electrons and holes), and c) study the dependence of carrier concentration on temperature.

The specific objectives of the Carrier Statistics Lab are:



Recommended Reading

Users who are new to carrier statistics should consult the following resources:

Robert F. Pierret. (1996). *Semiconductor Device Fundamentals*. Reading, MA: Addison-Wesley. (See especially chapter 2)

Demo

[Carrier Statistics Lab: First-Time User Guide](#)

[Carrier Statistics Lab Video Demonstration](#)

Theoretical Descriptions

* [Illinois ECE 440 Solid State Electronic Devices, Lecture 3: Energy Bands, Carrier Statistics, Drift](#)

* [Illinois ECE 440 Solid State Electronic Devices, Lecture 4: Energy Bands, Carrier Statistics, Drift](#)

* [Illinois ECE 440 Solid State Electronic Devices, Lecture 5: Doping Semiconductors](#)

- * [Illinois ECE 440 Solid State Electronic Devices, Lecture 5: Intrinsic Material, Doping, Carrier Concentrations](#)
- * [Illinois ECE 440 Solid State Electronic Devices, Lecture 5, Part 2 : Doping, Carrier Concentrations](#)
- * [Illinois ECE 440 Solid State Electronic Devices, Lecture 6: Doping, Fermi Level, Density of States](#)
- * [Illinois ECE 440 Solid State Electronic Devices, Lecture 7: Temperature Dependence of Carrier Concentrations](#)
- * [ECE 606 Lecture 9: Fermi-Dirac Statistics](#) (Graduate level)
- * [ECE 606 Lecture 11: Equilibrium Statistics](#) (Graduate level)
- * [ECE 606 Lecture 12: Equilibrium Concentrations](#) (Graduate level)
- * [Statistical Mechanics](#) (Advanced)

Tool Verification

[Carrier Statistics Tool Verification](#)

Examples

- * [Worked Examples for Carrier Statistics \(basic\)](#)
- * [Worked Examples for Carrier Statistics \(advanced\)](#)

Exercises and Homework Assignments

1. [Homework Exercise on Fermi-Dirac and Maxwell-Boltzmann Distributions](#)
2. [ABACUS Exercise: Carrier Statistics](#)
3. [ABACUS Exercise: Conductivity and Carrier Concentration](#)
4. [ABACUS Problem Carrier Distribution.pdf](#)

Solutions to Exercises

Solutions are provided only to instructors!

Evaluation

- * [ABACUS: Test for Carrier Statistics Tool](#)

Challenge

In this final challenge users will integrate what they have learned about Carrier Statistics.

- * [Carrier Statistics - Temperature Effects](#)