PREFACE

This book evolved from my earlier book of the same title. Chapters have been added (e.g., one on laser diodes); others have been completely rewritten (e.g., the chapter on the Boltzmann equation).

Semiconductor devices are now the substrates of information and computation—the substrates of Internet browsers that sift with great speed through a world of information and represent the information visually to the user, and the substrates of artificial intelligence. They form the basis of all computer chips, of solar cell arrays, and of the newer red lights on cars. They are essential in fiber communications, and laser diodes are among the most sophisticated semiconductor devices. They are truly ubiquitous and can be found in increasing numbers in cars, kitchens and even in electronic door locks. Trillions of the basic semiconductor devices, *p–n* junction diodes, are fabricated daily, and Moore's law of increasing the integration and reducing the device size every 18 months has been persistently obeyed.

My goal is to present a description of the theoretical concepts underlying device function and to cover device theory from the principles of condensed matter physics and chemistry to the numerical mathematics of device simulation tools, all in a form understandable for anyone who knows advanced calculus and some numerical algorithms important for the solution of the device equations, the Boltzmann equation, and the Schröedinger equation. This goal could not be achieved. Instead I have presented only an overview of some of the most important concepts of selected devices. To obtain a truly broad knowledge of device theory, the reader will need to study additional books that are referenced, particularly the *Solid State Theory* edited by Landsberg, the encyclopedic description of most devices by Sze, and the text on numerical device simulation by Selberherr.

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