Preface

Optoelectronic devices have received great attention in recent years, as they are key components of the Internet and other optical communication systems. Other breakthrough developments, for instance with GaN-based light emitters, also contribute to the increased interest in optoelectronics. The complexity of physical mechanisms within such devices makes computer simulation an essential tool for performance analysis and design optimization. Advanced software tools have been developed for optoelectronic devices and several commercial software providers have emerged. These tools enable engineers and scientists to design and understand ever-more sophisticated nanostructure devices.

The specific challenge of optoelectronic device simulation lies in the combination of electronics and photonics, including the sophisticated interaction of electrons and light. The large variety of materials, devices, physical mechanisms, and modeling approaches often makes it difficult to select appropriate theoretical models or software packages. This book presents a review of devices and advanced simulation approaches written by leading researchers and software developers. The intended audience is scientists and device engineers in optoelectronics, who are interested in using advanced software tools. Each chapter describes the theoretical background as well as practical simulation results that help to better understand internal device physics. The software packages used are available to the public, on a commercial or noncommercial basis, so that interested readers can perform similar simulations on their own. Software providers and Internet addresses are given in each chapter.

The book starts with a chapter on electron–photon interaction, followed by several chapters on laser diodes, including Fabry–Perot lasers, distributed feedback lasers, multisection and tunable lasers, vertical-cavity lasers, as well as mode locking. Following GaN-based light-emitting diodes, three prominent types of light receivers are addressed (solar cells, image sensors, and infrared optical detectors). The book concludes with chapters on optoelectronic device integration and active photonic circuits. Various semiconductor material systems are involved, including structures grown on InP (Chaps. 1–7, 14, 15), GaAs (Chaps. 8–9), GaN (Chap. 10), Si (Chaps. 11–12), and CdTe (Chap. 13). A wide wavelength spectrum is covered, from the ultraviolet (340 nm) to the far infrared (10 μm), with a main focus on communication wavelengths from 850 nm to 1.55 μm.

I would like to sincerely thank all contributors to this book for their chapters. To further support and connect researchers in this rapidly developing field, I have started the website http://www.nusod.org as well as the annual international conference *Numerical Simulation of Optoelectronic Devices (NUSOD)*, which presents the latest research results and software tools. I encourage readers to contact me with questions and suggestions at piprek@nusod.org.

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