

Preface

The operational principle of modern semiconductor nanostructures, such as quantum wells, quantum wires, or quantum dots, relies on quantum mechanical effects. The goal of numerical simulations using quantum mechanical models in the development of semiconductor nanostructures is threefold: First, they are needed for a deeper understanding of experimental data and of the operational principle. Second, is to predict and optimize in advance qualitative and quantitative properties of new devices in order to minimize the number of prototypes needed. Semiconductor nanostructures are embedded as an active region in semiconductor devices. Finally, the results of quantum mechanical simulations of semiconductor nanostructures can be used by upscaling methods to deliver parameters needed in semi-classical models for semiconductor devices such as quantum well lasers. This book covers in detail all these three aspects using a variety of illustrating examples.

Multi-band effective mass approximations have been increasingly attracting interest over the last decades, since it is an essential tool for effective models in semiconductor materials. This book is concerned with several mathematical models from the most relevant class of $\mathbf{k}\cdot\mathbf{p}$ -Schrödinger Systems. We will present both mathematical models and state-of-the-art numerical methods to solve adequately the arising systems of differential equations. The designated audience is graduate and Ph.D. students of mathematical physics, theoretical physics and people working in quantum mechanical research or semiconductor/opto-electronic industry who are interested in new mathematical aspects.

The principal audience of this book is graduate and Ph.D. students of (mathematical) physics, research lecturer of mathematical physics, and research people working in semiconductor, opto-electronic industry for a professional reference.

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