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This book presents a systematic, comprehensive and up-to-date description of the physical basis of the balance equation transport theory and its applications in bulk and low-dimensional semiconductors. The different aspects of the balance equation method, originally proposed by C S Ting and the author of the present book, were reviewed in the volume entitled Physics of Hot Electron Transport in Semiconductors (edited by C S Ting, World Scientific, 1992). Since then, this method has been extensively developed and applied to various new fields, such as transport in nonparabolic systems, spatially nonuniform systems and semiconductor devices, miniband conduction of superlattices, hot-electron magnetotransport, effects of impact ionization in transport, microwave-induced magnetoresistance oscillation, radiation-driven transport and electron cooling, etc. Due to its simplicity and effectiveness, the balance equation approach has become a useful tool to tackle the many transport phenomena in semiconductors, and provides a reliable basis for developing theories, modeling devices and explaining experiments.
The book may be used as a textbook by graduate students. It will also benefit researchers in the field by helping them grasp the basic principles and techniques of the method, without having to spend a lot of time digging out the information from widespread literature covering a period of 30 years.