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Nota di contenuto	Nonlinear Wave Methods for Charge Transport; Contents; Preface; Acknowledgments; 1 Introduction; 1.1 Overview of Nonlinear Wave Phenomena; 1.2 Nonlinear Waves and Electronic Transport in Materials; 1.3 Structural Outline of the Book; 2 Dynamical Systems, Bifurcations, and the Chapman-Enskog Method; 2.1 Introduction; 2.2 Review of Dynamical Systems Concepts; 2.2.1 Attractors; 2.2.2 Bifurcations - Basic Definitions and Types; 2.3 Analysis of the Hopf Bifurcation:An Introduction to the Chapman--Enskog Method; 2.3.1 Multiple Scales and Chapman-Enskog Methods 2.3.2 General Formulation of the Hopf Problem Using CEM2.3.3 Utility of the CEM for Higher Order Bifurcations; 3 Excitable Media I: Continuum Systems; 3.1 Introduction; 3.2 Basic Excitability - the FitzHugh-Nagumo System; 3.3 Matched Asymptotics: Excitability and Oscillations; 3.4 The Scalar Bistable Equation; Wave Pulses as Heteroclinic Connections; 3.4.1 Wave Fronts Near $w=w_0$ and a Formula for dc/dw ; 3.4.2 Wave Fronts for a Cubic Source; 3.4.3 Linear Stability

of the Wave Fronts; 3.5 Traveling Waves of the FitzHugh-Nagumo System; 3.5.1 Wave Fronts; 3.5.2 Pulses of the FHN System 3.5.3 Wave Trains 4 Excitable Media II: Discrete Systems; 4.1 Introduction; 4.2 The Spatially Discrete Nagumo Equation; 4.2.1 Depinning Transition of Wave Fronts; 4.2.2 Construction of the Wave Front Profile Near the Depinning Transition; 4.2.3 Wave Front Velocity Far from the Depinning Transition; 4.3 Asymptotic Construction of Pulses; 4.4 Numerically Calculated Pulses; 4.5 Propagation Failure; 4.6 Pulse Generation at a Boundary; 4.7 Concluding Remarks; 5 Electronic Transport in Condensed Matter: From Quantum Kinetics to Drift-diffusion Models; 5.1 Introduction 5.1.1 Wigner Function for Non-interacting Particles in an External Potential 5.1.2 Classical Limit; 5.1.3 Boltzmann Transport Equation and BGK Collision Model; 5.1.4 Parabolic Scaling; 5.1.5 Derivation of a Drift-Diffusion Equation; 5.2 Superlattices; 5.2.1 Kinetic Theory Description of a Superlattice with a Single Populated Miniband; 5.2.2 Derivation of Reduced Equations for n and F ; 5.3 Concluding Remarks; 6 Electric Field Domains in Bulk Semiconductors I: the Gunn Effect; 6.1 Introduction; 6.2 N-shaped Current-Field Characteristics and Kroemer's Model; 6.2.1 Intervalley Transfer Mechanism 6.2.2 Kroemer's Drift-Diffusion Model 6.2.3 Boundary Conditions; 6.2.4 Nondimensionalization; 6.3 Stationary Solutions and Their Linear Stability in the Limit $L \rightarrow \infty$; 6.3.1 Stationary States and Their Linear Stability under Current Bias; 6.3.2 Construction of the Stationary Solution and of $\langle J \rangle$ under Voltage Bias; 6.3.3 Linear Stability of the Stationary Solution under Voltage Bias; 6.4 Onset of the Gunn Effect; 6.4.1 The Linear Inhomogeneous Problem and Secular Terms; 6.4.2 Hopf Bifurcation; 6.4.3 Amplitude Equation for $\langle n \rangle$ 6.5 Asymptotics of the Gunn Effect for Long Samples and N-shaped Electron Velocity

Sommario/riassunto

The present book introduces and develops mathematical techniques for the treatment of nonlinear waves and singular perturbation methods at a level that is suitable for graduate students, researchers and faculty throughout the natural sciences and engineering. The practice of implementing these techniques and their value are largely realized by showing their application to problems of nonlinear wave phenomena in electronic transport in solid state materials, especially bulk semiconductors and semiconductor superlattices. The authors are recognized leaders in this field, with more than 30 combin
