
Contents

Recent Developments in Hydrodynamical Modeling of Semiconductors

<i>A. M. Anile, G. Mascali and V. Romano</i>	1
1 Introduction	1
2 General Transport Properties in Semiconductors	2
3 H-Theorem and the Null Space of the Collision Operator	5
4 Macroscopic Models	7
4.1 Moment Equations	7
4.2 The Maximum Entropy Principle	8
5 Application of MEP to Silicon	11
5.1 Collision Term in Silicon	11
5.2 Balance Equations and Closure Relations	13
5.3 Simulations in Bulk Silicon	15
5.4 Simulation of a $n^+ - n - n^+$ Silicon Diode	21
5.5 Simulation of a Silicon MESFET	26
6 Application of MEP to GaAs	34
6.1 Collision Term in GaAs	34
6.2 Balance Equations and Closure Relations	36
6.3 Simulations in Bulk GaAs.	38
6.4 Simulation a GaAs $n^+ - n - n^+$ Diode	43
6.5 Gunn Oscillations	45
References	54

Drift-Diffusion Equations and Applications

<i>W. Allegretto</i>	57
1 The Classical Semiconductor Drift-Diffusion System	57
1.1 Derivation	57
1.2 Existence	58
1.3 Uniqueness and Asymptotics	63
2 Other Drift-Diffusion Equations	66
2.1 Small Devices	66

2.2	$C^{\alpha,\alpha/2}$ Solutions and the Amorphous Silicon System	68
2.3	Avalanche Generation	70
3	Degenerate Systems	70
3.1	Degenerate Problems: Limit Case of the Hydrodynamic Models .	70
3.2	Temperature Effects	73
3.3	Degenerate Problems: Thermistor Equations and Micromachined Structures	74
4	Related Problems	80
5	Approximations, Numerical Results and Applications	82
	References	89

Kinetic and Gas – Dynamic Models for Semiconductor Transport

<i>Christian Ringhofer</i>	97	
1	Multi-Body Equations and Effective Single Electron Models	98
1.1	Effective Single Particle Models – The BBGKY Hierarchy	101
1.2	The Relation Between Classical and Quantum Mechanical Models	104
2	Collisions and the Boltzmann Equation	107
3	Diffusion Approximations to Kinetic Equations	111
3.1	Diffusion Limits: The Hilbert Expansion	113
3.2	The Drift Diffusion Equations:	114
3.3	The Energy Equations:	115
3.4	The Energy Transport – or SHE Model	116
3.5	Parabolicity	118
4	Moment Methods and Hydrodynamic Models	120
	References	130