

Contents

1	Introduction	1
1.1	A Brief History	1
1.2	Negative Resistance Regimes	4
1.3	Summary and Emphasis	5
2	High-Field Domains	7
2.1	Field-of-Direction Analysis	7
2.1.1	Electron Mobility as Function of the Field	16
2.1.2	Drift Velocity Saturation at Higher Fields	18
2.2	Pseudo-Cathodes and the Field of Directions	19
2.2.1	Doping-dependence of the Field Quenching	22
2.2.2	Work Function Dependence on Photoconductivity	26
2.3	Summary and Emphasis	27
3	Moving High-Field Domains	31
3.1	Stationary and Moving High-Field Domains	31
3.1.1	Self-Sustained Free Moving High-Field Domains	33
3.1.2	Unstable Moving High-Field Domains	35
3.2	Stability Criteria and Moving High-Field Domains	42
3.2.1	Trap-Controlled Kinetics	43
3.3	Summary and Emphasis	50
4	Negative Differential Conductivity Caused by Mobility	53
4.1	Gunn Domains	53
4.1.1	The Gunn Effect	55
4.2	Summary and Emphasis	58
5	Negative Differential Conductivity in Other Materials	59
5.1	Domain Instability	61
5.2	Field Domains in Superlattices	64

5.3	Other Examples of Stationary and Moving High-Field Domains	69
5.4	Summary and Emphasis	71
6	Current Channels	73
6.1	Initiation of Current Channels	74
6.1.1	Current Channels in Dielectrics and Devices	76
6.1.2	Thermo-Optical Method to View Current Channels	76
6.1.3	Current Channel Modeling	78
6.2	General Discussion of Current Channels or Filaments	83
6.2.1	Filamentary Instability	84
6.2.2	Stationary Filaments	85
6.2.3	Spatiotemporal Dynamics of Filaments	88
6.3	Examples of More Complex Filament Formation	91
6.3.1	Impurity Breakdown in n-GaAs	91
6.4	Summary and Emphasis	97
A	Educational Films	99
	High-Field Domain and Current Channel Kinetics	99
A.1	High-Field Domain Analysis	99
A.1.1	Electro-Optical Tools	99
A.1.2	Model Semiconductor Cadmium Sulfide	100
A.2	The Film	101
A.2.1	Field Inhomogeneities	101
A.2.2	Current Distributions	101
	References	105
	Index	119