

Contents

Preface	v
Nomenclature	vii
Chapter I	Fundamental Considerations
	1
Chapter II	Collisionless and Transitional Electric Probes
	8
2.0	Introduction
	8
2.1	Early Theories
	9
2.2	Orbital Motion Limit
	10
2.3	The Cold-Ion Approximation
	14
2.4	Exact Theories for Current Collection by Spherical and Cylindrical Probes in the Collisionless Limit
	16
2.5	Collisional Effects on Probe Response
	23
2.6	Effect of Flow on Aligned Cylindrical Probes under Collisionless Conditions
	27
2.7	Summary
	35
	References
	37
Chapter III	Continuum Electric Probes
	39
3.0	Introduction
	39
3.1	Some Physical Considerations
	40
3.2	Governing Equations and Boundary Conditions
	42
3.2.1	Nondimensional Equations
	44
3.2.2	Definition of Parameters
	45
3.3	Specific Applications to Probe Theory
	47
3.3.1	Small Convection Limit, $ReSc_i \rightarrow 0$
	48
3.3.2	Large Convection Limit, $ReSc_i \gg 1$
	56
3.4	The Collisionless Thin Sheath (Dense) Case
	78
3.5	Summary
	81
	References
	85
Chapter IV	Special Topics
	88
4.0	Introduction
	88
4.1	Probe-Surface Phenomena
	88
4.1.1	Effect of Surface Deposit Layers
	89
4.1.2	Effect of Electron Emission
	91
4.2	Negative Ions
	93
4.3	Strongly Ionized Plasmas
	97

4.4	Turbulent Plasmas	100
4.4.1	Collisionless Regime	101
4.4.2	Continuum Regime	106
4.4.3	Transient Response (Laminar Plasmas)	110
4.5	Electric Probes in Magnetic Fields	110
4.5.1	Weak B -Field Case	111
4.5.2	Moderate B -Field Case	111
4.5.3	Induced B -Field Effects	117
4.5.4	Strong B -Field Case	118
	References	118
Appendix	Introduction	121
A.1	Nondimensionalization of Boltzmann and Poisson Equations	121
A.2	General Behavior of the Boltzmann Equation	124
A.3	Distribution Function for Continuum Plasma	129
A.4	Electron-Diffusion and Energy-Transport Vectors for Continuum Plasma	134
A.5	Moment Equations of the Boltzmann Equations	140
A.6	Noncontinuum Regimes (Collisionless and Transitional)	146
	References	147
Index		149