

# Contents

<b>Preface</b>	<b>ix</b>
<b>Acknowledgements</b>	<b>x</b>
<b>Author biography</b>	<b>xi</b>
<b>Acronyms</b>	<b>xii</b>
<b>Symbols</b>	<b>xiii</b>
<b>1 Introduction to the physical models for plasmas</b>	<b>1-1</b>
<b>2 Elements of plasma kinetic theory</b>	<b>2-1</b>
2.1 The Boltzmann equation	2-3
2.2 Relaxation model for molecular collisions	2-7
2.3 The Boltzmann collision integral	2-8
2.3.1 Qualitative derivation	2-8
2.3.2 Approximations	2-11
2.3.3 The Maxwell–Boltzmann distribution	2-11
2.4 Commentaries and further reading	2-12
References	2-12
<b>3 Hydrodynamic description of plasmas</b>	<b>3-1</b>
3.1 The moments of Boltzmann equation	3-4
3.1.1 The equation of continuity	3-9
3.1.2 The momentum transport equation	3-10
3.1.3 The friction force	3-13
3.1.4 The energy transport equation	3-15
3.2 The hydrodynamic plasma transport equations	3-18
3.2.1 The closure of the transport equations	3-19
3.2.2 The cold and warm plasma models	3-20
3.2.3 The diffusion approximation	3-22
3.3 Electron and ion waves	3-23
3.3.1 Neutral gas sound waves	3-24
3.3.2 Ion waves	3-25
3.3.3 Electron waves	3-27
3.4 The Langmuir sheath	3-29
3.4.1 Bohm criterion	3-31

3.4.2	Child–Langmuir law	3-33
3.4.3	Space-charge neutralization	3-34
3.5	Commentaries and further reading	3-35
	References	3-36
<b>4</b>	<b>Introduction to electric discharges</b>	<b>4-1</b>
4.1	DC electric discharges	4-2
4.1.1	Vacuum breakdown in DC fields	4-4
4.2	Microwave discharges	4-8
4.3	Breakdown in high frequency fields	4-9
4.4	Commentaries and further reading	4-11
	References	4-11
<b>5</b>	<b>The multipactor discharge</b>	<b>5-1</b>
5.1	The electron multipactor discharge	5-2
5.2	The multipactor discharge model	5-4
5.3	Commentaries and further reading	5-10
	References	5-11
<b>6</b>	<b>Introduction to plasma propulsion in space</b>	<b>6-1</b>
6.1	Basic orbital maneuvers	6-1
6.2	The Tsiolkovsky equation	6-3
6.3	Thrust and specific impulse	6-5
6.4	Electric propulsion principles	6-6
6.4.1	Efficiencies	6-9
6.5	Modified Tsiolkovsky equation	6-10
6.6	Classification of electric thrusters	6-13
6.6.1	Electrothermal	6-13
6.6.2	Electrostatic	6-15
6.6.3	Electromagnetic	6-19
6.7	Commentaries and further reading	6-20
	References	6-20
<b>Appendices</b>		
	<b>Appendix A</b>	<b>A-1</b>
	<b>Appendix B</b>	<b>B-1</b>