Contents

Preface			5
Introduction			9
General References			13
Part I	Basic equations		15
	1	Hydrodynamic plasma description	15
	2	Basic equations for high-frequency processes	19
	3	Basic equations for low-frequency processes	25
		References	28
Part II	Elements of linear wave propagation		31
	4	Linear wave propagation in plasmas	31
		4.1 Linear wave equation	
		4.2 Penetration of a plasma by an electromagnetic wave	34
		4.3 Resonance absorption	38
		References	43
	5	Structure resonances	45
		5.1 Resonances at s-polarization	46
		5.2 Surface wave resonances	56
		5.3 Electrostatic structure resonances	60
		References	62
Part III	High-frequency nonlinear processes		63
	6	Harmonic generation	63
		6.1 Calculation of nonlinear source terms	65
		6.2 Linear density profile	67
		6.3 Non-monotoneous density profiles	72
		6.4 Harmonic generation by anharmonic electron motion	75
		6.5 Self-interaction of transverse waves in a homogeneous plasma	76
		References	78

7 Stimulated Raman scattering (SRS) and two-plasmon-decay (TPD) 81
7.1 Parametric instabilities and three-wave coupling 81
7.2 SRS and TPD in a homogeneous plasma 83
7.3 SRS and TPD in an inhomogeneous plasma 92
7.4 Mode coupling equations for SRS and TPD in an inhomogeneous plasma 95
7.5 Results of mode coupling analysis of SRS, TPD 98
7.6 Odd-integer half-harmonic radiation 105
References 107

Part IV Low-frequency nonlinear processes 111

8 Linearized plasma dynamics 113
8.1 Ion acoustic waves 113
8.2 Zakharov system, nonlinear Schrödinger equation 118
References 121

9 Stimulated Mandelstam-Brillouin scattering (SBS) 123
9.1 SBS in a homogeneous infinite plasma (temporal problem) 126
9.2 Space-time development of SBS in a plasma of finite length 134
9.3 SBS as steady-state spatial problem 141
9.4 Convective SBS instability 145
9.5 Brillouin backscatter pulsations 148
9.6 Strong-coupling effects 155
9.7 SBS saturation by ion acoustic nonlinearities 158
9.8 The influence of plasma flow on SBS 161
References 167

10 Strongly nonlinear stationary waves 173
10.1 Basic equations 174
10.2 Equilibrium states (envelope solitions, nonlinear skin effect) 178
10.3 Nonlinear stationary waves with plasma flow 183
10.4 Double-humped solitons, shock-like structures 185
References 189

11 Strongly nonlinear instationary interaction 191
11.1 Profile deformation at resonance absorption 194
11.2 Nonlinear stage of stimulated Mandelstam-Brillouin scattering 199
11.3 Superreflection 203
11.4 Nonstationary skin-effect; plasma acceleration; plasma confinement 208
References 210

Appendix 213
References 219

Subject index 221