

CONTENTS

EDITORS' INTRODUCTION	vii
LIST OF SYMBOLS	ix
INTRODUCTION	1
1. ACCELERATION AND PHASE STABILITY OF CHARGED PARTICLES	11
1.1 Equilibrium Particle Dynamics	11
1.2 Phase Space. Capture of Particles into the Acceleration Regime	27
1.3 Small Longitudinal Oscillations	41
1.4 Longitudinal Oscillations in a Nonideal Accelerating System	51
2. FOCUSING OF CHARGED PARTICLE BEAMS	67
2.1 Defocusing Factors in a Linear Accelerator	67
2.2 Quadrupole Focusing	81
2.3 Transverse-Oscillation Equations. Floquet Functions	95
2.4 Beam Envelopes in a Quadrupole Focusing Channel	107
2.5 A Matrix Method of Calculating the Floquet Functions for a Focusing Channel	122
2.6 Floquet Functions in a Smooth Approximation. Parametric Resonances	147
2.7 Transverse Oscillations in a Nonideal Focusing System	161
2.8 Alternating-Phase Focusing	184
2.9 Radio Frequency Quadrupole Focusing with a Spatially Periodic Structure	199
2.10 Spatially Uniform Quadrupole Focusing	214

3.	THE EFFECT OF SPACE CHARGE ON THE FOCUSING OF CONTINUOUS BEAMS	237
3.1	Self-Consistent Self-Field of the Beam	237
3.2	Quadrupole Beam Focusing in the Case of “Microcanonical” Distribution of the Phase Density	247
3.3	Focusing of Matched Beams in the Case of Different Stationary Phase Density Distributions	273
3.4	Beam Focusing by a Longitudinal Magnet Field	294
3.5	Current Limitation in Straight Focusing Channels	305
4.	COLLECTIVE PROCESSES IN LINEAR ACCELERATORS	315
4.1	The Self-Consistent Field of a Bunch in Restricted Phase Distributions	315
4.2	Beam Bunching When the Variables in the Integrals of Motion Can Be Separated	323
4.3	Dependence of the Limiting Current Determined by Longitudinal Repulsion on the Accelerator Parameters	341
4.4	Electrostatic Interaction of a Sequence of Charged Bunches	353
4.5	Expansion of the Phase Space of the Beam During Acceleration	360
	REFERENCES	387