
CONTENTS

1. High-Energy Accelerators as Tools for Nuclear Research	1
1-1 Introduction.....	1
1-2 Unstable Particles and Threshold Energies.....	3
1-3 Meson-producing Accelerators.....	13
1-4 Multi-Bev Accelerators.....	14
2. Principles of Acceleration to High Energies	16
2-1 Relativistic Equations of Motion.....	17
2-2 Orbital Stability.....	23
2-3 Free Oscillations.....	27
2-4 Particle Energy.....	30
2-5 Phase Stability in Circular Motion.....	33
2-6 Coupling between Oscillations.....	41
2-7 Description of Particle Motions.....	42
3. The Electron Synchrotron	45
3-1 Early Development.....	45
3-2 Principle of Operation.....	48
3-3 Magnet.....	50
3-4 Injection.....	52
3-5 Radiofrequency Acceleration.....	54
3-6 Target Arrangements.....	56
4. The Synchrocyclotron	60
4-1 Early Development.....	60
4-2 Principle of Operation.....	62
4-3 The Magnetic Field.....	66
4-4 Capture Efficiency.....	70
4-5 Radiofrequency Oscillator.....	70
4-6 Vacuum Chamber.....	74
4-7 Target Arrangements and Beam Properties.....	75

5. Linear Accelerators	79
5-1 Characteristics of Linear Acceleration	79
5-2 Early Designs	81
5-3 Phase Stability	83
5-4 The Linac	86
5-5 The Focusing Problem	91
5-6 Electron Linear Accelerators	92
6. The Proton Synchrotron	97
6-1 Historical Development	98
6-2 Principle of Operation	101
6-3 Design Features	103
6-4 The Ring Magnet	108
6-5 Radiofrequency Accelerator	113
6-6 Vacuum Chamber	116
6-7 Target Arrangements and Shielding	118
7. Alternating Gradient Focusing	123
7-1 The Stability Principle	123
7-2 The A-G Magnetic Lens	127
7-3 The A-G Synchrotron	132
7-4 Design Studies for Multi-Bev Accelerators	139
7-5 Principles of Design	142
7-6 Conclusion	149
References	153
Index	155