1. Record Nr. UNISA996203223003316

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Titolo	Theory and design of charged particle beams / / Martin Reiser
Pubbl/distr/stampa	Weinheim, [Germany] : , : Wiley-VCH Verlag GmbH & Co. KGaA, , 2004 ©2004
ISBN	1-281-84313-X 9786611843137 3-527-61762-0 3-527-61763-9
Descrizione fisica	1 online resource (637 p.)
Collana	Wiley Series in Beam Physics and Accelerator Technology
Disciplina	535.32 539.73
Soggetti	Particle beams
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Theory and Design of Charged Particle Beams; Contents; Preface; Acknowledgments; 1 Introduction; 1.1 Exposition; 1.2 Historical Developments and Applications; 1.3 Sources of Charged Particles; References; 2 Review of Charged Particle Dynamics; 2.1 The Lorentz Force and the Equation of Motion; 2.2 The Energy Integral and Some General Formulas; 2.3 The Lagrangian and Hamiltonian Formalisms; 2.3.1 Hamilton's Principle and Lagrange's Equations; 2.3.2 Generalized Potential and Lagrangian for Charged Particle Motion in an Electromagnetic Field; 2.3.3 Hamilton's Equations of Motion 2.3.4 The Hamiltonian for Charged Particles and Some Conservation Theorems2.4 The Euler Trajectory Equations; 2.4.1 The Principle of Least Action and the Euler Equations; 2.4.2 Relativistic Euler Equations in Axially Symmetric Fields; 2.5 Analytic Examples of Charged Particle Motion; 2.5.1 Planar Diode without Space Charge; 2.5.2 Planar Diode with Space Charge (Child-Langmuir Law); 2.5.3 Charged-Particle Motion in a Uniform Magnetic Field; 2.5.4 Charged Particle Motion in a Radial Electric Field; 2.5.5 The Harmonic Oscillator; Reference; Problems 3 Beam Optics and Focusing Systems without Space Charge3.1 Beam

Emittance and Brightness; 3.2 Liouville's Theorem; 3.3 The Paraxial Ray Equation for Axially Symmetric Systems; 3.3.1 Series Representation of Axisymmetric Electric and Magnetic Fields; 3.3.2 Derivation of the Paraxial Ray Equation; 3.3.3 General Properties of the Solutions of the Paraxial Ray Equations; 3.4 Axially Symmetric Fields as Lenses; 3.4.1 General Parameters and Transfer Matrix of a Lens; 3.4.2 Image Formation and Magnification; 3.4.3 Electrostatic Lenses; 3.4.4 Solenoidal Magnetic Lenses
3.4.5 Effects of a Lens on the Trace-Space Ellipse and Beam Envelope3.4.6 Aberrations in Axially Symmetric Lenses; 3.5 Focusing by Quadrupole Lenses; 3.6 Constant-Gradient Focusing in Circular Systems; 3.6.1 Betatron Oscillations; 3.6.2 The Trace-Space Ellipse and Beam Envelope in a Betatron-type Field; 3.6.3 Focusing in Axisymmetric ExB Fields; 3.6.4 Energy Spread, Momentum Compaction, and Effective Mass; 3.7 Sector Magnets and Edge Focusing; 3.8 Periodic Focusing; 3.8.1 Periodic Focusing with Thin Lenses; 3.8.2 General Theory of Courant and Snyder; 3.8.3 The FODO Quadrupole Channel 3.8.4 Sector-Focusing Cyclotrons3.8.5 Strong-Focusing Synchrotrons; 3.8.6 Resonances in Circular Accelerators; 3.9 Adiabatic Damping of the Betatron Oscillation Amplitudes; References; Problems; 4 Linear Beam Optics with Space Charge; 4.1 Theoretical Models of Beams with Space Charge; 4.2 Axisymmetric Beams in Drift Space; 4.2.1 Laminar Beam with Uniform Density Profile; 4.2.2 Beam Envelope with Self Fields and Finite Emittance; 4.2.3 Limitations of the Uniform Beam Model and Limiting Currents; 4.2.4 Self-Focusing of a Charge-Neutralized Beam (Bennett Pinch)
4.3 Axisymmetric Beams with Applied and Self Fields

Sommario/riassunto

Although particle accelerators are the book's main thrust, it offers a broad synoptic description of beams which applies to a wide range of other devices such as low-energy focusing and transport systems and high-power microwave sources. Develops material from first principles, basic equations and theorems in a systematic way. Assumptions and approximations are clearly indicated. Discusses underlying physics and validity of theoretical relationships, design formulas and scaling laws. Features a significant amount of recent work including image effects and the Boltzmann line charge density prof