

New Foundations for Classical Mechanics

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This book provides an *introduction to geometric algebra* as a unified language for physics and mathematics. It contains extensive applications to classical mechanics in a textbook format suitable for courses at an intermediate level. The text is supported by more than 200 diagrams to help develop geometrical and physical intuition. Besides covering the standard material for a course on the mechanics of particles and rigid bodies, the book introduces *new, coordinate-free methods for rotational dynamics and orbital mechanics*, developing these subjects to a level well beyond that of other textbooks. These methods have been widely applied in recent years to biomechanics and robotics, to computer vision and geometric design, to orbital mechanics in governmental and industrial space programs, as well as to other branches of physics. The book applies them to the major perturbations in the solar system, including the planetary perturbations of Mercury's perihelion.

Geometric algebra integrates conventional vector algebra (along with its established notations) into a system with all the advantages of quaternions and spinors. Thus, it increases the power of the mathematical language of classical mechanics while bringing it closer to the language of quantum mechanics. This book systematically develops purely mathematical applications of geometric algebra useful in physics, including extensive applications to linear algebra and transformation groups. It contains sufficient material for a course on mathematical topics alone.

The second edition has been expanded by nearly a hundred pages on relativistic mechanics. The treatment is unique in its exclusive use of geometric algebra and in its detailed treatment of spacetime maps, collisions, motion in uniform fields and relativistic precession. It conforms with Einstein's view that the Special Theory of Relativity is the culmination of developments in classical mechanics.

Table of Contents

Chapter 1: Origins of Geometric Algebra

- 1-1. Geometry as Physics
- 1-2. Numbers and magnitude
- 1-3. Directed Numbers
- 1-4. The Inner Product
- 1-5. The Outer Product
- 1-6. Synthesis and Simplification
- 1-7. Axioms for Geometric Algebra

Chapter 2: Developments in Geometric Algebra

- 2-1. Basic Identities and Definitions
- 2-2. The Algebra of a Euclidean Plane
- 2-3. The Algebra of a Euclidean 3-Space
- 2-4. Directions, Projections and Angles
- 2-5. The Exponential Function
- 2-6. Analytic Geometry
- 2-7. Functions of a Scalar Variable
- 2-8. Directional Derivatives and Line Integrals

Chapter 3: Mechanics of a Single Particle

- 3-1. Newton's Program
- 3-2. Constant Force
- 3-3. Constant Force with Linear Drag
- 3-4. Constant Force with Quadratic Drag
- 3-5. Fluid Resistance
- 3-6. Constant Magnetic Field
- 3-7. Uniform Electric and Magnetic Fields
- 3-8. Linear Binding Force
- 3-9. Forced Oscillations
- 3-10. Conservative Forces and Constraints

Chapter 4: Central Forces and Two-Particle Systems

- 4-1. Angular Momentum
- 4-2. Dynamics from Kinematics
- 4-3. The Kepler Problem
- 4-4. The Orbit in Time
- 4-5. Conservative Central Forces
- 4-6. Two-Particle Systems
- 4-7. Elastic Collisions
- 4-8. Scattering Cross Sections

Chapter 5: Operators and Transformations

- 5-1. Linear Operators and Matrices
- 5-2. Symmetric and Skewsymmetric Operators
- 5-3. The Arithmetic of Reflections and Rotations
- 5-4. Transformation Groups
- 5-5. Rigid Motions and Frames of Reference
- 5-6. Motion in Rotating Systems

Chapter 6: Many-Particle Systems

- 6-1. General Properties of Many-Particle Systems
- 6-2. The Method of Lagrange
- 6-3. Coupled Oscillations and Waves
- 6-4. Theory of Small Oscillations
- 6-5. The Newtonian Many Body Problem

Chapter 7: Rigid Body Mechanics

- 7-1. Rigid Body Modeling
- 7-2. Rigid Body Structure
- 7-3. The Symmetric Top
- 7-4. Integrable Cases of Rotational Motion
- 7-5. Rolling Motion
- 7-6. Impulsive Motion

Chapter 8: Celestial Mechanics

- 8-1. Gravitational Forces, Fields and Torques
- 8-2. Perturbations of Kepler Motion
- 8-3. Perturbations in the Solar System
- 8-4. Spinor Mechanics and Perturbation Theory

Chapter 9: Relativistic Mechanics

- 9-1. Spacetime and its Representations
- 9-2. Spacetime Maps and Measurements
- 9-3. Relativistic Particle Dynamics
- 9-4. Energy-Momentum Conservation
- 9-5. Relativistic Rigid Body Mechanics

Appendices

- A. Spherical Trigonometry
- B. Elliptic Functions
- C. Units, Constants and Data

Errata for Chapter 9 on Relativity

[Errata for Chapter 9](#)
[Pages658-660.pdf](#)