

Modern Introductory Mechanics

Part 2

Chapter 8: The Two Body Central Force Problem

Relative coordinates
Runge-Lenz treatment of Coulomb force
Lagrangian equations of motion
Celestial mechanics
General Relativity modification
Orbital stability
Virial theorem

Chapter 9: Scattering and Collisions of Particles

Multi-particle conservation laws
Coulomb scattering
Differential cross sections
Rutherford scattering in the center of mass frame
Simple treatment of light deflection
Cross section cookbook
Connection between Lab and CM frames
A kinematical example in the Lab frame
Rutherford scattering in the Lab frame
Total cross section

Chapter 10: Non inertial Reference Frames

Finite displacements and rotations
Instantaneous relations for velocity, acceleration
Useful Earth coordinate choices
Deflection of projectiles near Earth's surface
Deflections for dropped objects
Focault pendulum

Chapter 11: Rigid Body Motion

Concept of a rigid body

Instantaneous kinetic energy in body frame

Angular momentum and the inertia tensor

Transformation properties of the inertia tensor

Principal axes

Parallel axis theorem

Euler angles

Euler's equations of motion

Symmetrical top - Euler solution

Symmetrical top - Lagrangian solution

Chapter 12: Coupled Oscillations

Coupled dynamical equations

Eigenvalue/eigenvector solution

Example

Weak/strong coupling

Example using mechanical/electrical analogy

Chapter 13: Special Relativity

Invariance and covariance

Two postulates of special relativity

Lorentz transformations deduced

Alternate notation for Lorentz transformations

The "light cone" and tachyons

Mathematical properties of Lorentz transformations

Consequences of relativity

Velocity addition law

Momentum and energy united

Four short points