

Index

A

abbreviated action
 9.2: Hamilton's Principle of Stationary Action
 absorptive amplitude
 3.S: Linear Oscillators (Summary)
 action
 9.1: Introduction to Hamilton's Action Principle
 action functional
 9.1: Introduction to Hamilton's Action Principle
 action phase integral
 15.5: Action-angle Variables
 Angular momentum
 2.9: Angular Momentum of a Many-Body System
 11.3: Angular Momentum
 angular velocity
 13.14: Angular Velocity
 antisymmetric mode
 14.3: Normal Modes
 asymmetric top
 13.10: General Properties of the Inertia Tensor
 attractor
 4.5: Harmonically-driven, linearly-damped, plane pendulum
 Atwood's machine
 7.3: Invariant Transformations and Noether's Theorem

B

Bernoulli's equation
 16.7: Ideal Fluid Dynamics
 bifurcation
 4.3: Bifurcation and Point Attractors
 Binet coordinate transformation
 11.5: Differential Orbit Equation
 black holes
 17.8: The General Theory of Relativity
 Brachistochrone problem
 5.3: Applications of Euler's Equation

C

calculus of variations
 5: Calculus of Variations
 canonical momentum
 7.2: Generalized Momentum
 canonical transformations
 15.3: Canonical Transformations in Hamiltonian Mechanics
 Catenary
 5.9: Lagrange multipliers for Holonomic Constraints
 Center of mass
 2.7: Center of Mass of a Many-Body System
 14.4: Center of Mass Oscillations
 Centrifugal force
 12.7: Centrifugal Force
 chaos
 4: Nonlinear Systems and Chaos
 characteristic equation
 13.7: Diagonalize the Inertia Tensor
 Chasles' theorem
 13.2: Rigid-body Coordinates
 conjugate momentum
 7.2: Generalized Momentum

Conservation of angular momentum
 7.4: Rotational invariance and conservation of angular momentum
 conservative force
 2.10: Work and Kinetic Energy for a Many-Body System
 Continuity equation
 16.7: Ideal Fluid Dynamics
 contraction
 19.6: Appendix - Tensor Algebra
 contravariant vector
 19.6: Appendix - Tensor Algebra
 Coriolis Force
 12.8: Coriolis Force
 12.11: Free Motion on the Earth
 correspondence principle
 18.2: Brief summary of the origins of quantum theory
 18.5: Correspondence Principle
 covariant vector
 19.6: Appendix - Tensor Algebra
 curl
 19.9: Appendix - Vector Integral Calculus
 cyclic coordinate
 7.5: Cyclic Coordinates
 Cyclic Coordinates
 7.5: Cyclic Coordinates
 cyclic variables
 8.6: Routhian Reduction

D

d'Alembert's principle
 6.3: Lagrange Equations from d'Alembert's Principle
 Differential Orbit
 11.5: Differential Orbit Equation
 digital signal processing
 19.10: Appendix - Waveform analysis
 Discrete Lattice Chain
 14.10: Discrete Lattice Chain
 14.11: Damped Coupled Linear Oscillators
 14.12: Collective Synchronization of Coupled Oscillators
 14.E: Coupled linear oscillators (Exercises)
 14.S: Coupled linear oscillators (Summary)

dissipative Lagrangians
 10.5: Dissipative Lagrangians
 divergence theorem
 19.9: Appendix - Vector Integral Calculus
 Dot product
 19.3: Appendix - Vector algebra
 drive strength
 4.5: Harmonically-driven, linearly-damped, plane pendulum

E

eccentricity vector
 15.2: Poisson bracket Representation of Hamiltonian Mechanics
 elastic amplitude
 3.S: Linear Oscillators (Summary)
 elastic solids
 16.5: Linear Elastic Solids

Equations of Motion
 11.4: Equations of Motion
 Equivalence Principle
 17.8: The General Theory of Relativity
 Euler angles
 13.13: Euler Angles
 Euler's differential equation
 5.2: Euler's Differential Equation
 Euler's differential equations
 6.1: Introduction to Lagrangian Dynamics
 Euler's equations
 5.3: Applications of Euler's Equation
 Euler's hydrodynamic equation
 16.7: Ideal Fluid Dynamics

F

Fermat's principle
 5.5: Functions with Several Independent Variables
 Foucault pendulum
 12.13: Foucault pendulum
 Fourier analysis
 19.10: Appendix - Waveform analysis
 fractal
 4.6: Differentiation Between Ordered and Chaotic Motion
 functionals
 9.1: Introduction to Hamilton's Action Principle
 fundamental Poisson brackets
 15.2: Poisson bracket Representation of Hamiltonian Mechanics

G

Galilean invariance
 2.3: Inertial Frames of reference
 17.2: Galilean Invariance
 gauge invariance
 9.3: Lagrangian
 Gaussian surface
 19.9: Appendix - Vector Integral Calculus
 general theory of relativity
 17.8: The General Theory of Relativity
 generalized coordinates
 5.8: Generalized coordinates in Variational Calculus
 Generalized Energy
 7.7: Generalized Energy and the Hamiltonian Function
 Generalized energy theorem
 7.8: Generalized energy theorem
 8.3: Hamilton's Equations of Motion
 generalized forces
 6.3: Lagrange Equations from d'Alembert's Principle
 6.5: Constrained Systems
 generalized momentum
 7.2: Generalized Momentum
 17.6: Lorentz-Invariant Formulation of Lagrangian Mechanics
 geodesic
 5.10: Geodesic
 grand piano
 14.5: Weak Coupling
 group velocity
 3.11: Wave Propagation

H

Hamilton's action principle

6.4: Lagrange equations from Hamilton's Principle

Hamilton's equations of motion

8.3: Hamilton's Equations of Motion

Hamilton's Principal Function

9.1: Introduction to Hamilton's Action Principle

Hamiltonian Function (Classical)

7.7: Generalized Energy and the Hamiltonian Function

8.2: Legendre Transformation between Lagrangian and Hamiltonian mechanics

Hamiltonian mechanics

8: Hamiltonian Mechanics

harmonic decomposition

3.9: Waveform Analysis

Heisenberg uncertainty principle

3.11: Wave Propagation

Heisenberg's representation

18.3: Hamiltonian in Quantum Theory

holonomic constraint

5.7: Constrained Variational Systems

5.9: Lagrange multipliers for Holonomic Constraints

6.8: Applications to systems involving holonomic constraints

Hooke's law

2.12: Applications of Newton's Equations of Motion

I

ignorable variables

7.11: Hamiltonian for Cyclic Coordinates

8.6: Routhian Reduction

improper rotation

19.5: Appendix - Coordinate transformations

impulse response

3.10: Signal Processing

impulsive forces

6.12: Impulsive Forces

inertia tensor

13.4: Inertia Tensor

13.7: Diagonalize the Inertia Tensor

inertial frame of reference

2.3: Inertial Frames of reference

inner product

19.2: Appendix - Matrix Algebra

19.6: Appendix - Tensor Algebra

invariant transformations

7.3: Invariant Transformations and Noether's Theorem

irrotational flow

16.7: Ideal Fluid Dynamics

J

Jacobi identity

15.2: Poisson bracket Representation of Hamiltonian Mechanics

Jacobi's complete integral

15.4: Hamilton-Jacobi Theory

Jacobians

19.7: Appendix - Aspects of Multivariate Calculus

K

kinetic energy

2.10: Work and Kinetic Energy for a Many-Body System

Kuramoto model

14.12: Collective Synchronization of Coupled Oscillators

L

Lagrange equations

6.5: Constrained Systems

Lagrange multipliers

6.5: Constrained Systems

Lagrange points

11.11: The Three-Body Problem

Lamé parameter

16.7: Ideal Fluid Dynamics

lattice chain

14.10: Discrete Lattice Chain

Leibniz rules

15.2: Poisson bracket Representation of Hamiltonian Mechanics

Length contraction

17.3: Special Theory of Relativity

light cone

17.5: Geometry of Space-time

Limit Cycles

4.4: Limit Cycles

Linear momentum

2.2: Newton's Laws of motion

Lissajous figures

3.4: Geometrical Representations of Dynamical Motion

Lorentz transformations

17.3: Special Theory of Relativity

Lyapunov exponent

4.6: Differentiation Between Ordered and Chaotic Motion

M

Mach's Principle

17.8: The General Theory of Relativity

Minkowski metric

17.5: Geometry of Space-time

modulus of elasticity

16.5: Linear Elastic Solids

N

Newton's law of gravitation

2.14: Newton's Law of Gravitation

Newton's equations of motion

2.12: Applications of Newton's Equations of Motion

Noether's Theorem

7.3: Invariant Transformations and Noether's Theorem

nonconservative systems

10.3: Algebraic Mechanics for Nonconservative Systems

Nonlinear Systems

4: Nonlinear Systems and Chaos

normal mode

14.3: Normal Modes

O

outer product

19.6: Appendix - Tensor Algebra

P

partial differentiation

19.7: Appendix - Aspects of Multivariate Calculus

period doubling

4.5: Harmonically-driven, linearly-damped, plane pendulum

phase

3.11: Wave Propagation

phase velocity

3.11: Wave Propagation

Poincaré sections

4.6: Differentiation Between Ordered and Chaotic Motion

point attractor

4.3: Bifurcation and Point Attractors

Poisson Brackets

15.2: Poisson bracket Representation of Hamiltonian Mechanics

principal axes

13.6: Principal Axis System

principal axis system

13.1: Introduction to Rigid-body Rotation

13.6: Principal Axis System

principal moments of inertia

13.6: Principal Axis System

Principle of Least Action

9: Hamilton's Action Principle

9.1: Introduction to Hamilton's Action Principle

9.2: Hamilton's Principle of Stationary Action

Principle of Static Virtual Work

6.3: Lagrange Equations from d'Alembert's Principle

principle of superposition

3.3: Linearity and Superposition

products of inertia

13.4: Inertia Tensor

proper length

17.3: Special Theory of Relativity

proper rotation

19.5: Appendix - Coordinate transformations

proper time

17.5: Geometry of Space-time

pseudovector

19.5: Appendix - Coordinate transformations

Q

quality factor

3.5: Linearly-damped Free Linear Oscillator

R

Rayleigh dissipation function

10.4: Rayleigh's Dissipation Function

relativistic Doppler effect

17.3: Special Theory of Relativity

relativistic momentum

17.4: Relativistic Kinematics

rest energy

17.4: Relativistic Kinematics

restoring force

3.2: Linear Restoring Forces

Reynolds Number

16.8: Viscous Fluid Dynamics

rolling wheel

13.24: The Rolling Wheel

rotating reference frame

[12.3: Rotating Reference Frame](#)

rotation matrix

[19.5: Appendix - Coordinate transformations](#)

rotational invariance

[7.4: Rotational invariance and conservation of angular momentum](#)

Routhian

[8.6: Routhian Reduction](#)

Routhian Reduction

[8.6: Routhian Reduction](#)

[12.9: Routhian Reduction for Rotating Systems](#)

S

scalar field

[19.8: Appendix - Vector Differential Calculus](#)

Scalar product

[19.3: Appendix - Vector algebra](#)

Schrödinger's representation

[18.3: Hamiltonian in Quantum Theory](#)

secular equation

[13.7: Diagonalize the Inertia Tensor](#)

signal processing

[3.10: Signal Processing](#)

signal velocity

[3.11: Wave Propagation](#)

soliton

[4.7: Wave Propagation for Non-linear Systems](#)

Sommerfeld

[17.7: Lorentz-invariant formulations of Hamiltonian Mechanics](#)

special theory of relativity

[17.3: Special Theory of Relativity](#)

spherical top

[13.10: General Properties of the Inertia Tensor](#)

stable orbit

[11.10: Closed-orbit Stability](#)

standard boost

[17.5: Geometry of Space-time](#)

standard Lagrangian

[9.3: Lagrangian](#)

superposition

[3.3: Linearity and Superposition](#)

symmetric mode

[14.3: Normal Modes](#)

symmetric top

[13.10: General Properties of the Inertia Tensor](#)

T

tensor product

[19.6: Appendix - Tensor Algebra](#)

tensors

[19.6: Appendix - Tensor Algebra](#)

Time dilation

[17.3: Special Theory of Relativity](#)

transfer function

[3.10: Signal Processing](#)

translational transformations

[19.5: Appendix - Coordinate transformations](#)

twin paradox

[17.3: Special Theory of Relativity](#)

U

uncertainty principle

[3.11: Wave Propagation](#)

V

van der Pol damped harmonic oscillator

[4.4: Limit Cycles](#)

vector field

[19.8: Appendix - Vector Differential Calculus](#)

Virial theorem

[2.11: Virial Theorem](#)

virtual work

[6.3: Lagrange Equations from d'Alembert's Principle](#)

W

Wave equation

[3.7: Wave equation](#)

waveform analysis

[3.9: Waveform Analysis](#)

[19.10: Appendix - Waveform analysis](#)

Weak Coupling

[14.5: Weak Coupling](#)

Work

[2.10: Work and Kinetic Energy for a Many-Body System](#)

world line

[17.5: Geometry of Space-time](#)