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Nota di contenuto	Chapter I: Introduction -- Why Nonlinear Oscillations? -- Brief Review of Nonlinear Oscillations History -- Overview of the Book -- Nonlinear Dynamical Systems -- Conservative Oscillatory Systems -- Non-Conservative Oscillatory Systems -- Parametrically Excited Vibration -- Resonance in Nonlinear Systems -- Chapter II: Classical Methods -- Nonlinear Differential Equations -- Perturbation Methods -- Parametric Excitation and Hill's Equation -- Practice Problems -- Chapter III: Energy Balance Methods -- Part I Approach -- Fundamentals of the Energy Balance Method -- Modified Energy Balance Method: Galerkin Approach -- Modified Energy Balance Method: Least Square Method -- Hamiltonian Approach -- Modified Hamiltonian Approach -- Rational Energy Balance Method -- Part II Applications -- Generalized Duffing Equation -- Nonlinear Dynamic Buckling of an Elastic Column -- Vibrations of Cracked Rectangular Plate -- Relativistic Oscillator -- Plasma Physics Equation -- Nonlinear Oscillator with Discontinuity -- Nonlinear Oscillator with Fractional-Power Restoring Force --

Generalized Conservative Oscillatory Systems (Type 1) -- Generalized Conservative Oscillatory Systems (Type 2) -- Duffing Harmonic Oscillator -- Helmholtz Duffing Oscillator -- Autonomous Conservative Oscillatory System -- Nonlinear Oscillation of Rigid Bar on Semi-Circular Surface -- Nonlinear Oscillations of Centrifugal Governor Systems -- Nonlinear Lateral Sloshing in Partially-Filled Elliptical Tankers -- Nonlinear Oscillations of Elevator Cable in in a Drum Drive Elevator -- Chapter IV: Residual Methods -- Part I Approach -- Basic Idea -- Frequency Amplitude Formulation -- Max-Min Approach -- Part II Applications -- Generalized Duffing Equation -- Generalized Conservative Oscillatory Systems (Type 1) -- Generalized Conservative Oscillatory Systems (Type 2) -- Nonlinear Oscillator with Fractional Power -- Nonlinear Oscillation of a Mass Attached to a Stretched Elastic Wire -- Nonlinear Schrödinger Equation -- A Rigid Frame Rotates at a Fixed Rate -- Conservative Lienard Type Equation -- Part III Practice Problems -- Chapter V: Semi-Inverse and Variational Methods -- Semi-Inverse and Variational Approaches -- Part I Approach -- Variational Principle.-Semi-Inverse Method -- Variational Approach.-Hamiltonian Approach -- Relationship between Hamiltonian and Variational Approaches -- Part II Applications -- Generalized Duffing Equation -- Elastic Force with Rational Characteristic Equation -- Elastic Force with Non-integer Fractional Characteristic Equation -- Higher-Order Hamiltonian Approach to Duffing Equations -- Hamiltonian Approach to Rational and Irrational Oscillator -- Hamiltonian Approach to Nonlinear Oscillator with Discontinuity -- Nonlinear Oscillator with Quintic Nonlinearity -- Nonlinear Schrodinger’s Equation -- Thomas-Fermi Equation -- Heat Conduction Equation -- Lane-Edmen Type Equation -- Dynamic Analysis of Centrifugal Governor System -- Duffing Harmonic Equation -- Part III Practice Problems -- Chapter VI: Ingegral Based Methods -- Part I Approaches -- Adomian Decomposition Method -- Variational Iteration Method -- Homotopy Analysis Method -- Part II Applications -- Volterra-Integro Differential Equations -- Nonlinear Schrödinger Equations -- Van der Pol Equation -- Korteweg-de Vries Equation -- Part III Practice Problems -- Chapter VII:Nonlinearities in Nano and Micro Systems -- Duffing Equation in NEMS and MEMS -- Parametric and Self-Excited Oscillations -- Nonlinear Coupled Oscillators -- Other Types of Nonlinearities -- Part III Practice Problems.

Sommario/riassunto

This book covers both classical and modern analytical methods in nonlinear systems. A wide range of applications from fundamental research to engineering problems are addressed. The book contains seven chapters, each with miscellaneous problems and their detailed solutions. More than 100 practice problems are illustrated, which might be useful for students and researchers in the areas of nonlinear oscillations and applied mathematics. With providing real world examples, this book shows the multidisciplinary emergence of nonlinear dynamical systems in a wide range of applications including mechanical and electrical oscillators, micro/nano resonators and sensors, and also modelling of global warming, epidemic diseases, sociology, chemical reactions, biology and ecology.