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Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references at the end of each chapters and index.
Nota di contenuto	Matrix-variation-of-constants formula -- Improved St ¨ormer-Verlet formulae with applications -- Improved Filon-type asymptotic methods for highly oscillatory differential equations -- Efficient energy-preserving integrators for multi-frequency oscillatory Hamiltonian systems -- An extended discrete gradient formula for multi-frequency oscillatory Hamiltonian systems -- Trigonometric Fourier collocation methods for multi-frequency oscillatory systems -- Error bounds for explicit ERKN integrators for multi-frequency oscillatory systems -- Error analysis of explicit TSERKN methods for highly oscillatory systems -- Highly accurate explicit symplectic ERKN methods for multi-frequency oscillatory Hamiltonian systems -- Multidimensional ARKN methods for general multi-frequency oscillatory second-order IVPs -- A simplified Nystr¨om-tree theory for ERKN integrators solving oscillatory systems -- An efficient high-order explicit scheme for solving Hamiltonian nonlinear wave equations.

Sommario/riassunto

This book describes a variety of highly effective and efficient structure-preserving algorithms for second-order oscillatory differential equations. Such systems arise in many branches of science and engineering, and the examples in the book include systems from quantum physics, celestial mechanics and electronics. To accurately simulate the true behavior of such systems, a numerical algorithm must preserve as much as possible their key structural properties: time-reversibility, oscillation, symplecticity, and energy and momentum conservation. The book describes novel advances in RKN methods, ERKN methods, Filon-type asymptotic methods, AVF methods, and trigonometric Fourier collocation methods. The accuracy and efficiency of each of these algorithms are tested via careful numerical simulations, and their structure-preserving properties are rigorously established by theoretical analysis. The book also gives insights into the practical implementation of the methods. This book is intended for engineers and scientists investigating oscillatory systems, as well as for teachers and students who are interested in structure-preserving algorithms for differential equations.