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Nota di contenuto	Cover -- Half-Title Page -- Dedication -- Title Page -- Copyright Page -- Contents -- Preface -- Chapter 1. Symplectic Manifolds -- 1.1. Introduction -- 1.2. Symplectic vector spaces -- 1.3. Symplectic manifolds -- 1.4. Vectors fields and flows -- 1.5. The Darboux theorem -- 1.6. Poisson brackets and Hamiltonian systems -- 1.7. Examples -- 1.8. Coadjoint orbits and their symplectic structures -- 1.9. Application to the group $SO(n)$ -- 1.9.1. Application to the group $SO(3)$ -- 1.9.2. Application to the group $SO(4)$ -- 1.10. Exercises -- Chapter 2. Hamilton-Jacobi Theory -- 2.1. Euler-Lagrange equation -- 2.2. Legendre transformation -- 2.3. Hamilton's canonical equations -- 2.4. Canonical transformations -- 2.5. Hamilton-Jacobi equation -- 2.6. Applications -- 2.6.1. Harmonic oscillator -- 2.6.2. The Kepler problem -- 2.6.3. Simple pendulum -- 2.7. Exercises -- Chapter 3. Integrable Systems -- 3.1. Hamiltonian systems and Arnold-Liouville theorem -- 3.2. Rotation of a rigid body about a fixed point -- 3.2.1. The Euler problem of a rigid body -- 3.2.2. The Lagrange top -- 3.2.3. The Kowalewski spinning top -- 3.2.4. Special cases -- 3.3. Motion of a solid through ideal fluid -- 3.3.1. Clebsch's case -- 3.3.2. Lyapunov-Steklov's case -- 3.4. Yang-Mills field with gauge group $SU(2)$ -- 3.5. Appendix (geodesic flow and Euler-Arnold equations) -- 3.6. Exercises -- Chapter 4. Spectral Methods for Solving Integrable Systems -- 4.1.

Lax equations and spectral curves -- 4.2. Integrable systems and Kac-Moody Lie algebras -- 4.3. Geodesic flow on $SO(n)$ -- 4.4. The Euler problem of a rigid body -- 4.5. The Manakov geodesic flow on the group $SO(4)$ -- 4.6. Jacobi geodesic flow on an ellipsoid and Neumann problem -- 4.7. The Lagrange top -- 4.8. Quartic potential, Garnier system -- 4.9. The coupled nonlinear Schrödinger equations -- 4.10. The Yang-Mills equations.

4.11. The Kowalewski top -- 4.12. The Goryachev-Chaplygin top -- 4.13. Periodic infinite band matrix -- 4.14. Exercises -- Chapter 5. The Spectrum of Jacobi Matrices and Algebraic Curves -- 5.1. Jacobi matrices and algebraic curves -- 5.2. Difference operators -- 5.3. Continued fraction, orthogonal polynomials and Abelian integrals -- 5.4. Exercises -- Chapter 6. Griffiths Linearization Flows on Jacobians -- 6.1. Spectral curves -- 6.2. Cohomological deformation theory -- 6.3. Mittag-Leffler problem -- 6.4. Linearizing flows -- 6.5. The Toda lattice -- 6.6. The Lagrange top -- 6.7. Nahm's equations -- 6.8. The n -dimensional rigid body -- 6.9. Exercises -- Chapter 7. Algebraically Integrable Systems -- 7.1. Meromorphic solutions -- 7.2. Algebraic complete integrability -- 7.3. The Liouville-Arnold-Adler-van Moerbeke theorem -- 7.4. The Euler problem of a rigid body -- 7.5. The Kowalewski top -- 7.6. The Hénon-Heiles system -- 7.7. The Manakov geodesic flow on the group $SO(4)$ -- 7.8. Geodesic flow on $SO(4)$ with a quartic invariant -- 7.9. The geodesic flow on $SO(n)$ for a left invariant metric -- 7.10. The periodic five-particle Kac-van Moerbeke lattice -- 7.11. Generalized periodic Toda systems -- 7.12. The Gross-Neveu system -- 7.13. The Kolosof potential -- 7.14. Exercises -- Chapter 8. Generalized Algebraic Completely Integrable Systems -- 8.1. Generalities -- 8.2. The RDG potential and a five-dimensional system -- 8.3. The Hénon-Heiles problem and a five-dimensional system -- 8.4. The Goryachev-Chaplygin top and a seven-dimensional system -- 8.5. The Lagrange top -- 8.6. Exercises -- Chapter 9. The Korteweg-de Vries Equation -- 9.1. Historical aspects and introduction -- 9.2. Stationary Schrödinger and integral Gelfand-Levitan equations -- 9.3. The inverse scattering method -- 9.4. Exercises.

Chapter 10. KP-KdV Hierarchy and Pseudo-differential Operators -- 10.1. Pseudo-differential operators and symplectic structures -- 10.2. KdV equation, Heisenberg and Virasoro algebras -- 10.3. KP hierarchy and vertex operators -- 10.4. Exercises -- References -- Index -- Other titles from iSTE in Mathematics and Statistics -- EULA.

Sommario/riassunto

This book illustrates the powerful interplay between topological, algebraic and complex analytical methods, within the field of integrable systems, by addressing several theoretical and practical aspects. Contemporary integrability results, discovered in the last few decades, are used within different areas of mathematics and physics. Integrable Systems incorporates numerous concrete examples and exercises, and covers a wealth of essential material, using a concise yet instructive approach. This book is intended for a broad audience, ranging from mathematicians and physicists to students pursuing graduate, Masters or further degrees in mathematics and mathematical physics. It also serves as an excellent guide to more advanced and detailed reading in this fundamental area of both classical and contemporary mathematics.