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| Nota di contenuto | Preface to the Second Edition; Preface to the First Edition; Acknowledgments; Contents; List of Exercises; 1. Introduction; 2. Functions; 2.1 Gamma function; 2.2 Mittag-Leffler functions; 2.3 Hypergeometric functions; 2.4 Miscellaneous functions; 3. The Fractional Derivative; 3.1 Basics; 3.2 The fractional Leibniz product rule; 3.3 The fractional derivative in terms of finite differences - the Grunwald-Letnikov derivative; 3.4 Discussion; 3.4.1 Orthogonal polynomials; 3.4.2 Differential representation of the Riemann and Caputo fractional derivative; 4. Friction Forces<br>4.1 Classical description4.2 Fractional friction; 5. Fractional Calculus; 5.1 The Fourier transform; 5.2 The fractional integral; 5.2.1 The Liouville fractional integral; 5.2.2 The Riemann fractional integral; 5.3 Correlation of fractional integration and differentiation; 5.3.1 The Liouville fractional derivative; 5.3.2 The Riemann fractional derivative; 5.3.3 The Liouville fractional derivative with inverted operator sequence - the Liouville-Caputo fractional derivative; 5.3.4 The Riemann fractional derivative with inverted operator sequence - the Caputo fractional derivative<br>5.4 Fractional derivative of second order5.4.1 The Riesz fractional derivative; 5.4.2 The Feller fractional derivative; 5.5 Fractional derivatives of higher orders - the Marchaud fractional derivative; 5.6 Erdelyi-Kober operators of fractional integration; 5.7 Geometric interpretation of the fractional integral; 5.8 Low level fractionality; 5.9 Discussion; 5.9.1 Semi-group property of the fractional integral; 6. The |

Fractional Harmonic Oscillator; 6.1 The fractional harmonic oscillator; 6.2 The harmonic oscillator according to Fourier; 6.3 The harmonic oscillator according to Riemann
6.4 The harmonic oscillator according to Caputo7. Wave Equations and Parity; 7.1 Fractional wave equations; 7.2 Parity and time-reversal; 7.3 Solutions of the free regularized fractional wave equation; 8. Nonlocality and Memory Effects; 8.1 A short history of nonlocal concepts; 8.2 From local to nonlocal operators; 8.3 Memory effects; 9. Fractional Calculus in Multidimensional Space - 2D-Image Processing; 9.1 The generalized fractional derivative; 9.2 Shape recovery - the local approach; 9.3 Shape recovery - the nonlocal approach
10. Fractional Calculus in Multidimensional Space - 3D-Folded Potentials in Cluster Physics10.1 Folded potentials in fragmentation theory; 10.2 The Riesz potential as smooth transition between Coulomb and folded Yukawa potential; 10.3 Discussion; 10.3.1 Calculation of a fission yield; 11. Quantum Mechanics; 11.1 Canonical quantization; 11.2 Quantization of the classical Hamilton function and free solutions; 11.3 Temperature dependence of a fission yield and determination of the corresponding fission potential; 11.4 The fractional Schrodinger equation with an infinite well potential
11.5 Radial solutions of the fractional Schrodinger equation

Sommario/riassunto

The book presents a concise introduction to the basic methods and strategies in fractional calculus and enables the reader to catch up with the state of the art in this field as well as to participate and contribute in the development of this exciting research area. The contents are devoted to the application of fractional calculus to physical problems. The fractional concept is applied to subjects in classical mechanics, group theory, quantum mechanics, nuclear physics, hadron spectroscopy and quantum field theory and it will surprise the reader with new intriguing insights. This new, extende