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Nota di contenuto	Cover; Title Page; Contents; Preface; PART 1. MATHEMATICAL PRELIMINARIES, DEFINITIONS AND PROPERTIES OF FRACTIONAL INTEGRALS AND DERIVATIVES; Chapter 1. Mathematical Preliminaries; 1.1. Notation and definitions; 1.2. Laplace transform of a function; 1.3. Spaces of distributions; 1.4. Fundamental solution; 1.5. Some special functions; Chapter 2. Basic Definitions and Properties of Fractional Integrals and Derivatives; 2.1. Definitions of fractional integrals and derivatives; 2.1.1. Riemann-Liouville fractional integrals and derivatives 2.1.2. Riemann-Liouville fractional integrals and derivatives on the real half-axis2.1.3. Caputo fractional derivatives; 2.1.4. Riesz potentials and Riesz derivatives; 2.1.5. Symmetrized Caputo derivative; 2.1.6. Other types of fractional derivatives; 2.2. Some additional properties of fractional derivatives; 2.2.1. Fermat theorem for fractional derivative; 2.2.2. Taylor theorem for fractional derivatives; 2.3. Fractional derivatives in distributional setting; 2.3.1. Definition of the fractional integral and derivative; 2.3.2. Dependence of fractional derivative on order 2.3.3. Distributed-order fractional derivativePART 2. MECHANICAL SYSTEMS; Chapter 3. Restrictions Following from the Thermodynamics

for Fractional Derivative Models of a Viscoelastic Body; 3.1. Method based on the Fourier transform; 3.1.1. Linear fractional model; 3.1.2. Distributed-order fractional model; 3.1.3. Constitutive equations for rod bending; 3.1.4. Stress relaxation and creep for two special cases of viscoelastic bodies; 3.1.5. Variable-order fractional derivative: application to stress relaxation problem
3.1.6. Linear constitutive equation with fractional derivatives of complex order3.2. Thermodynamical restrictions via the internal variable theory; 3.2.1. Case I; 3.2.2. Case II; Chapter 4. Vibrations with Fractional Dissipation; 4.1. Linear vibrations with fractional dissipation; 4.1.1. Linear vibrations with the single fractional dissipation term; 4.1.2. Fractional derivative-type creeping motion; 4.1.3. Linear vibrations with the multiterm fractional dissipation; 4.1.4. Linear fractional two-compartmental model with fractional derivatives of different order; 4.2. Bagley-Torvik equation
4.2.1. Solution procedure4.2.2. Numerical examples; 4.3. Nonlinear vibrations with symmetrized fractional dissipation; 4.3.1. Solvability and dissipativity of [4.58]; 4.3.2. Stability of the solution; 4.4. Nonlinear vibrations with distributed-order fractional dissipation; 4.4.1. Existence of solutions; 4.4.2. Uniqueness of solutions; 4.4.3. Nonlinear vibrations with single term of fractional dissipation; Chapter 5. Lateral Vibrations and Stability of Viscoelastic Rods; 5.1. Lateral vibrations and creep of a fractional type viscoelastic rod
5.1.1. Rod made of fractional Kelvin-Voigt-type material

Sommario/riassunto

This book contains mathematical preliminaries in which basic definitions of fractional derivatives and spaces are presented. The central part of the book contains various applications in classical mechanics including fields such as: viscoelasticity, heat conduction, wave propagation and variational Hamilton-type principles. Mathematical rigor will be observed in the applications. The authors provide some problems formulated in the classical setting and some in the distributional setting. The solutions to these problems are presented in analytical form and these solutions are then analyzed n