

# General fractional derivatives with applications in viscoelasticity

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*General Fractional Derivatives with Applications in Viscoelasticity* presents a comprehensive overview of the fractional derivatives and their applications in viscoelasticity. The monograph introduces the newly established fractional-order calculus operators with applications to fractional-order viscoelastic models from the calculus operator viewpoint. The monograph also presents anomalous relaxation and rheological models.

The authors systematically introduce special functions, fractional derivatives with singular, weakly singular, and nonsingular kernels; variable-order fractional derivatives with singular, weakly singular, and nonsingular kernels; and general derivatives. Different viscoelastic models (dashpot, Maxwell-like, Kelvin–Voigt-like, Burgers-like, and Zener-like elements) are carefully discussed and investigated.

The monograph is divided into seven chapters. Chapter 1 introduces special functions required and used in the taxonomy of the fractional derivatives. Chapter 2 investigates the fractional derivative and integral operators with singular kernels. Chapter 3 presents the history of the fractional derivatives with nonsingular kernels and general fractional derivatives with nonsingular kernels. Chapter 4 discusses the concepts of different variable-order fractional integrals and derivatives with singular kernel, including the Riemann–Liouville-type, Hilfer-type, Liouville–Weyl-type, Riesz-type, Feller-type, and Herrmann-type integrals and derivatives. Chapter 5 illustrates a variety of the variable-order general fractional derivatives. Chapter 6 addresses the general derivatives and integrals with respect to another function. Finally, Chapter 7 presents a variety of viscoelastic models with the different derivatives.

Fractional calculus and its applications have gained considerable popularity and importance in diverse fields of science and engineering. This monograph is a timely and an excellent contribution to the diverse field of general fractional derivatives. As an encyclopedic book in the field, it will help students and researchers in mathematics, physics, chemistry, and engineering understand general fractional derivatives and their applications.

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