

Existence and Uniqueness Results for Hilfer-Generalized Proportional Derivatives with Nonlocal Conditions

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Abstract

In this paper, motivated by Hilfer and Hilfer-Katugampola fractional derivatives, we introduce new Hilfer-generalized proportional derivatives which interpolate the classical fractional derivatives of Hilfer, Riemann-Liouville, Caputo and generalized proportional fractional derivatives. We also present some important properties of the proposed derivatives. Furthermore, as an application, we show that this equation is equivalent to the Volterra integral equation and prove the existence, uniqueness of the solution to the Cauchy problem with the nonlocal initial condition. Finally, two examples were given to illustrate the results.

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