MICHIGAN STATE UNIVERSITY
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A Workshop on Future Directions in Fractional Calculus Research and Applications

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On a Probabilistic Generalization of Fractional Derivatives

Abstract

In the appropriate analytical context, fractional differential operators of Caputo and Riemann-Liouville type of order $\beta \in (0,2)$ are generators of jump-type Lévy processes "interrupted" on the attempt of crossing a boundary.

We present a probabilistic generalization of these fractional derivatives that (i) allows to collect under a probabilistic framework a large class of operators, (ii) leading to multidimensional extension of fractional derivatives and (iii) to the application of probabilistic tools to questions concerning the wellposedness of boundary value problems and the properties of the stochastic representation of their solutions.