ÇANKAYA UNIVERSITY
FACULTY OF ARTS AND SCIENCES
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCES

SEMINAR

Non-integer variable order dynamic equations on time scales involving Caputo-Fabrizio type differential operator

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Abstract

In the present paper, having a look at the anomalous diffusion phenomena, by extending the concept of fractional differential operator of Caputo-Fabrizio type, to include a class of variable orders, a time-scale counterpart of the non-integer order differential operator is introduced. Implementing the measure theory on time scales and introducing Dirac delta functional, based on the left density property of a given point, it has been deduced that, regarding left density property of a point, the both limit cases, namely, when the order is approaching 0 or 1, give the well-known delta-derivative and a shifted zero-th derivative respectively. By making use of the Laplace transform and direct delta-calculus based approach, the associated integral for constant and variable orders are discussed. To illustrate the theory, some dynamic equations on time scales are studied and a dynamic problem, which governs a class of viscoelastic oscillation phenomena and involving the new introduced derivative is studied.

Keywords: Time scales, Fractional calculus, Caputo-Fabrizio derivative, Non-integer variable order derivative and integral.

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