A Numerical Algorithm for the Solutions of ABC Singular Lane–Emden Type Models Arising in Astrophysics Using Reproducing Kernel Discretization Method

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Abstract:

This paper deals with the numerical solutions and convergence analysis for general singular Lane–Emden type models of fractional order, with appropriate constraint initial conditions. A modified reproducing kernel discretization technique is used for dealing with the fractional Atangana–Baleanu–Caputo operator. In this tendency, novel operational algorithms are built and discussed for covering such singular models in spite of the operator optimality used. Several numerical applications using the well-known fractional Lane–Emden type models are examined, to expound the feasibility and suitability of the approach. From a numerical viewpoint, the obtained results indicate that the method is intelligent and has several features stability for dealing with many fractional models emerging in physics and mathematics, using the new presented derivative.

Keywords:

Atangana–Baleanu–Caputo fractional derivative; fractional Lane–Emden type models; reproducing kernel discretization method

Published In:

Mathematics, Vol.8, Issue 6, NULL