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Abstract

This paper studies the symmetry analysis, explicit solutions, convergence analysis, and conservation laws (Cls) for two different space-time fractional nonlinear evolution equations with Riemann-Liouville (RL) derivative. The governing equations are reduced to nonlinear ordinary differential equation (ODE) of fractional order using their Lie point symmetries. In the reduced equations, the derivative is in Erdelyi-Kober (EK) sense, power series technique is applied to derive an explicit solutions for the reduced fractional ODEs. The convergence of the obtained power series solutions is also presented. Moreover, the new conservation theorem and the generalization of the Noether operators are developed to construct the nonlocal Cls for the equations . Some interesting figures for the obtained explicit solutions are presented.

Keywords:space-time nonlinear evolution equations, Lie symmetry, RL fractional derivative, Explicit solutions, Cls..

1 Introduction

Fractional differential equations (FDEs) are generalizations of classical differential equations of integer order. FDEs are caused by both the development of the theory of fractional calculus itself and by the applications of such constructions in various sciences. FDEs have been studied nowadays to describe several physical aspects and procedure in natural conditions. For instance, they are used for modeling diffusion and wave propagation in medium with memory, hereditary or nonlocal behavior, physics, engineering, electromagnetics,