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An efficient numerical method for variable order fractional functional differential equation

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Abstract

In this paper, we consider a new technique for variable order fractional functional differential equations (FDE for short). The proposed method relies on the reproducing kernel splines method (RKSM). The method can lessen computation cost and provide highly precise approximate solutions. Numerical results demonstrates that the algorithm is more effective and efficient.

Keywords: Variable fractional order; Functional differential equations; Reproducing kernel splines method

1 Introduction

Recently, fractional calculus provides an promising mathematical framework for the description of complex phenomenons such as nonlinear oscillations of earthquakes, electrodynamics of complex media, frequency dependent damping behavior of various viscoelastic materials, statistical mechanics, probability theory on algebraic structure, noise reduction, signal processing, signature verification and controller design. Variable order fractional derivatives and the discussion on variable order fractional differential equations is a research hotspot in recent years.

The large amount of works are done on the theoretical aspects of the existence and multiplicity of solutions of FDE (see[1,2]). Many exceeding numerical methods for solving fractional order differential equations were proposed, such as combining Legendre wavelets functions and operational matrices[3], finite difference method[4], Laplace transform method[5], Bernstein polynomials[6], hybrid function method[7], m-step methods[8], a quadrature method[9], Lagrange multipliers method[10], reproducing kernel method[11-14]. In contrast to the case of constant FDEs, not

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