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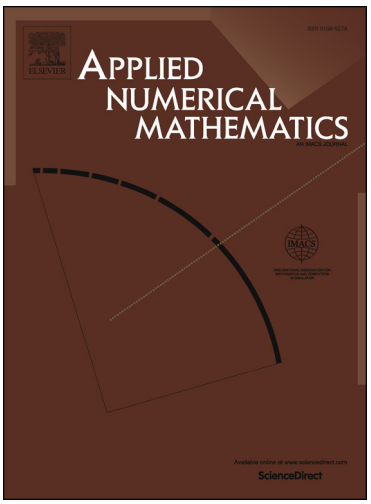

Spectral element technique for nonlinear fractional evolution equation, stability and convergence analysis

Mehdi Dehghan, Mostafa Abbaszadeh

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Spectral element technique for nonlinear fractional evolution equation, stability and convergence analysis

Mehdi Dehghan*, Mostafa Abbaszadeh

[a]Department of Applied Mathematics, Faculty of Mathematics and Computer Science,

Amirkabir University of Technology, No. 424, Hafez Ave.,15914, Tehran, Iran

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Abstract

In the current manuscript, we consider a fractional partial integro-differential equation that is called fractional evolution equation. The fractional evolution equation is based on the Riemann-Liouville fractional integral. The presented numerical algorithm is based on the following procedures: at first a difference scheme has been used to discrete the temporal direction and secondly the spectral element method is applied to discrete the spatial direction and finally these procedures are combined to obtain a full-discrete scheme. For the constructed numerical technique, we prove the unconditional stability and also obtain an error bound. We use the energy method to analysis the full-discrete scheme. We employ some test problems to show the accuracy of the proposed technique. Also, we compare the obtained numerical results using the present method with the existing methods in the literature.

Keywords: Fractional evolution equation, Fractional partial integro-differential equation, Spectral element method, Finite difference scheme, Stability analysis, Convergence analysis, Energy method.

1 Introduction

The fractional partial differential equations (FPDEs) are studied in several papers and books from the theoretical points of view such as [14, 35, 36, 37, 39, 41, 48]. The interested readers can find

*Corresponding author. *E-mail addresses:* mdehghan@aut.ac.ir , mdehghan.aut@gmail.com (M. Dehghan), m.abbaszadeh@aut.ac.ir (M.Abbaszadeh).