

Accepted Manuscript

An effective numerical method for solving fractional pantograph differential equations using modification of hat functions

S. Nemati, P. Lima, S. Sedaghat

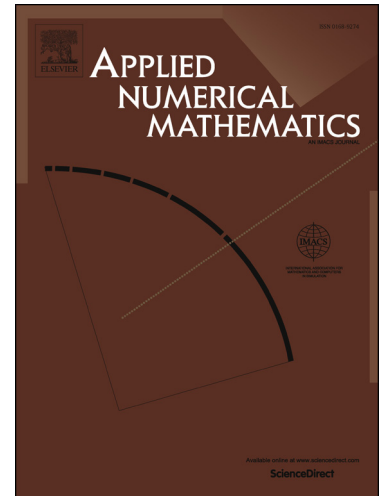
PII: S0168-9274(18)30115-6
DOI: <https://doi.org/10.1016/j.apnum.2018.05.005>
Reference: APNUM 3372

To appear in: *Applied Numerical Mathematics*

Received date: 25 February 2017
Revised date: 12 January 2018
Accepted date: 8 May 2018

Please cite this article in press as: S. Nemati et al., An effective numerical method for solving fractional pantograph differential equations using modification of hat functions, *Appl. Numer. Math.* (2018), <https://doi.org/10.1016/j.apnum.2018.05.005>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



An effective numerical method for solving fractional pantograph differential equations using modification of hat functions

S. Nemati^{a,1}, P. Lima^b, S. Sedaghat^c

^a*Department of Mathematics, Faculty of Mathematical Sciences, University of Mazandaran, Babolsar, Iran*

^b*Centro de Matemática e Aplicações, Instituto Superior Técnico, Universidade Técnica de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal*

^c*Buein Zahra Technical University, Buein Zahra, Qazvin, Iran*

Abstract

In this work, a spectral method based on a modification of hat functions (MHFs) is proposed to solve the fractional pantograph differential equations. Some basic properties of fractional calculus and the operational matrices of MHFs are utilized to reduce the considered problem to a system of linear algebraic equations. The greatest advantage of using MHFs is the large number of zeros in their operational matrix of fractional integration, product operational matrix and also pantograph operational matrix. This property makes these functions computationally attractive. Some illustrative examples are included to show the high performance and applicability of the proposed method and a comparison is made with the existing results. These examples confirm that the method leads to the results of convergence order $\mathcal{O}(h^3)$.

Keywords: fractional pantograph differential equations, modification of hat functions, operational matrix, Caputo derivative, Riemann-Liouville integral

1. Introduction

In recent years, fractional calculus has been regarded as an effective tool for investigating the behavior of many phenomena in science and engineer-

¹Corresponding author. Email address: s.nemati@umz.ac.ir

Download English Version:

<https://daneshyari.com/en/article/8902583>

Download Persian Version:

<https://daneshyari.com/article/8902583>

[Daneshyari.com](https://daneshyari.com)