

Accepted Manuscript

Title: Solution of a system of delay differential equations of multi pantograph type

Author: Sara Davaeifar Jalil Rashidinia

PII: S1658-3655(17)30037-7

DOI: <http://dx.doi.org/doi:10.1016/j.jtusci.2017.03.005>

Reference: JTUSCI 374

To appear in:

Received date: 2-11-2016

Revised date: 17-1-2017

Accepted date: 9-3-2017



Please cite this article as: Sara Davaeifar, Jalil Rashidinia, Solution of a system of delay differential equations of multi pantograph type, *Journal of Taibah University for Science* (2017), <http://dx.doi.org/10.1016/j.jtusci.2017.03.005>

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.



ELSEVIER

Available online at www.sciencedirect.com



Journal of Taibah University for Science 00 (2017) 1–15

Journal of Taibah
University for Science

Solution of a system of delay differential equations of multi pantograph type

Sara Davaeifar, Jalil Rashidinia¹*Department of Mathematics, Central Tehran Branch, Islamic Azad University, Tehran, Iran.*

Abstract

A collocation method is proposed to obtain an approximate solution of a system of multi pantograph type delay differential equations with variable coefficients subject to the initial conditions. The general approach is that, first of all the solution of the system has been expanded according to First Boubaker polynomials (FBPs) basis. Then, by employing the matrix operations and collocation nodes, the original problem and the associated initial conditions are reduced to a nonlinear system. By solving such system, the unknown coefficients of the approximate solution can be determined. Convergence analysis of the proposed method has been proved. The presented method has been tested of three different examples. The computed results confirm the high accuracy of collocation method based on FBPs.

© 2011 Published by Elsevier Ltd.

Keywords: System of delay differential equations; First Boubaker polynomials; Approximate solution; Collocation method; Matrix equation

AMS subject Classification: 34k06; 34k28; 41A10; 65L05

1. Introduction

In 1851, it was the first time that a device named pantograph was used in the construction of the electric locomotive which this name was originated from that time. Pantograph was modeled mathematically in 1971 [1]. Pantograph equations are one of the most prominent kinds of functional differential equations with proportional delay and often appear in many scientific models such as number theory, nonlinear dynamical systems, electrodynamics, quantum mechanics, population studies and etc.

We consider the system of delay differential equations of multi pantograph type in the following general form:

$$\sum_{i_2=1}^M J_{i_1, i_2}(x) y_{i_2}^{(1)}(x) = \sum_{i_2=1}^M R_{i_1, i_2}^*(x) y_{i_2}(x) + \sum_{i_3=1}^{\varphi} \sum_{i_2=1}^M P_{i_1, i_2}^{i_3}(x) y_{i_2}(\mu_{i_3} x) + \sum_{q=2}^{\gamma} \sum_{i_4=1}^{\varpi} \sum_{i_2=1}^M P_{i_1, i_2}^{*i_4}(x) (y_{i_2}(\sigma_{i_4} x))^q + f_{i_1}(x), \quad (1)$$

$$M \geq 1, \quad i_1 = 1(1)M, \quad \varphi, \varpi \in \mathbb{N}, \quad \gamma \in \mathbb{N} - \{1\}, \quad x \in I = [0, 1],$$

¹Corresponding author. E-mail addresses: Rashidinia@iust.ac.ir(Jalil Rashidinia), sara.davaei@yahoo.com(Sara Davaeifar)

Download English Version:

<https://daneshyari.com/en/article/7698603>

Download Persian Version:

<https://daneshyari.com/article/7698603>

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