Solving a System of Nonlinear Fractional Partial Differential Equations Using the Sinc-Muntz Collocation Method

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Abstract: We present a new numerical method for solving a system of nonlinear fractional partial differential equations (SNFPDEs). This technique is based on the Sinc functions and the fractional Muntz-Legendre polynomials together with the collocation method. The proposed approximation reduces the solution of the SNFPDEs to the solution of a system of nonlinear algebraic equations. In some numerical examples, we show that approximate solutions also agree with exact solutions.

1 Introduction

Fractional partial differential equations (FPDEs) are used in many physical models and engineering research, see [1–3]. Recently, several numerical techniques have been proposed by researchers for solving the FPDEs. For example, Chen, Sun, and Liu [4] used the generalized fractional-order Legendre function for solving FPDEs. Al-Khaled [5] used the Sinc–Legendre collocation method for the non-linear Burger's fractional equation. Abbasbandy et al. [6] applied an operational matrix of fractional-order Legendre functions for solving the time-fractional convection-diffusion equation. Other numerical methods can be found in [7–11].

In this paper, we apply a numerical method for solving a system of nonlinear fractional partial differential equations (SNFPDEs) of the following form:

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