AN EFFICIENT FRACTIONAL INTEGRATION OPERATIONAL MATRIX OF THE CHEBYSHEV WAVELETS AND ITS APPLICATIONS FOR MULTI-ORDER FRACTIONAL DIFFERENTIAL EQUATIONS

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Abstract: In this paper, a new fractional integration operational matrix of the Chebyshev Wavelets is derived and is used to solve multi-order fractional differential equations. The greater advantage behind the proposed matrix is that any fractional differential equation is reduced into a system of algebraic equations. We show the simplicity, the efficiency and the appropriateness of the proposed technique with some numerical examples.

Keywords and Phrases: Fractional derivatives and integrals, Chebyshev wavelets, Fractional differential equations, Operational matrix.

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1. Introduction

Fractional differential equations are effectively used in mathematical modelling of many present marvels such as dynamical systems [3], optimal control problems [7], diffusion processes [5] and chaotic systems [12]. Owing to the difficulty of finding exact solutions for many fractional differential equations, several numerical methods are employed, such as Adomian decomposition method [11], Variational iteration method [17], Homotopy Analysis Method [4], Homotopy Perturbation Method [8] and so on.