Application of Chebyshev Collocation Method for Numerical Solution of Volterra-Fredholm Equations

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Abstract

In this article, the chebyshev collocation method is presented for the solutions of Volterra-Fredholm integral equations. This method is based on approximating unknown function with shifted Chebyshev polynomials. The method is using a simple computations manner to obtain a quite acceptable approximate solution. We also get an upper bound for the error of this algorithm. Finally, one example is presented to show the applicability of our method with compare to the four well known algorithms in the literature

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1 Introduction

In recent years, many different basic functions have used to estimate the solution of linear and nonlinear Volterrae-Fredholm integral equations. Our aim in this article is to propose a method to approximate solution of a class of Volterra-Fredholm integral equations on the interval $[0,1]$ by using the shifted Chebyshev polynomials. The problems under consideration are nonlinear Volterra-Fredholm integral equations defined as follows:

$$\begin{aligned}\sum_{j=0}^{m}(A_j(x)\,y(x)+B_j(x)\,y(h(x))) = & f(x)\\ & + \lambda_1\int_0^x k_1(x,\ t)\,y(t)\,dt\\ & + \lambda_2\int_0^1 k_2(x,\ t)\,y(h(t))\,dt, \qquad (1)\end{aligned}$$

where$k_1(x,\ t)$ and $k_2(x,\ t)$ are known kernel functions on the interval $[0,\ 1]\times\ [0,\ 1]$ also $u(x)$ and $f(x)$ are known functions defined on the interval $[0,\ 1]$ and $0\le h(x)<\infty$. $y(x)$. is unknown function and $\lambda_1,\ \lambda_2$ are real constants such that ${\lambda_1}^2+{\lambda_2}^2\neq 0$.. When $h(x)$ is

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