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A semi-analytical approach to solve integro-differential equations

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Abstract

In this work, we present a semi-analytical method for solving integro-differential equations under multi-point or mixed boundary conditions. The proposed method solves linear and nonlinear Fredholm-Volterra integro-differential equations. A convergence analysis of the proposed method is directly examined. Numerical examples are worked out to demonstrate the main results. Moreover, proper graphs are provided to confirm the efficiency and the accuracy of the proposed scheme. We show that with a few number of obtained approximating terms, we achieve a high accuracy level of the obtained results. However, increasing the number of approximating terms, yields a significant decrease of the error of the approximation. The proposed method is very useful, reliable, and flexible for solving different kinds of integro-differential equations.

Keywords: Integro-differential equation; Multi-point boundary condition; Residual function; Error function

1. Introduction

A combination of integral and differential equations is called the integro-differential equations (IDEs). They are very important mathematical modelling in real-life problems. Integro-differential equations arise in many applied areas including physics, mechanics, engineering, chemistry, economics, electronics, electrostatics, potential theory etc. (for more details, see [1, 2, 3, 4, 5, 6]). There are two original branches of these

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