

GENOCCHI COLLOCATION APPROACH FOR SOLVING LINEAR VOLTERRA-FREDHOLM INTEGRO-DIFFERENTIAL EQUATIONS

Barkahoum Chebabhi¹, Noui Djaidja^{2*} and Mostefa Nadir ³

¹Laboratory of Pure and Applied Mathematics,
University of M'sila, University Pole, Road Bourdj Bou Arreiridj, M'sila, Algeria.
E-mail: barkahoum.chebabhi@univ-msila.dz

^{2*}Faculty Of Mathematics And Computer Science,
University of M'sila, University Pole, Road Bourdj Bou Arreiridj, M'sila, Algeria.

*Corresponding author: E-mail: noui.djaidja@univ-msila.dz

³Faculty Of Mathematics And Computer Science,
University of M'sila, University Pole, Road Bourdj Bou Arreiridj, M'sila, Algeria.
E-mail: mostefa.nadir@univ-msila.dz

Abstract. This paper presents a collocation method founded on Genocchi polynomials and their corresponding operational matrix of derivatives for the numerical solution of linear Volterra-Fredholm integro-differential equations (VFIDEs). The proposed approach converts the original Volterra-Fredholm integro-differential equation into a matrix formulation, resulting in a system of linear algebraic equations. Moreover, convergence analysis is conducted within the framework of the standard L^2 norm. Numerical experiments are subsequently performed to demonstrate the accuracy, efficiency, and applicability of the method. Comparisons were made between our results and those obtained using other established methods.

Keywords. Volterra-Fredholm integro-differential equations; collocation method; Genocchi polynomials.

AMS (MOS) subject classification: This is optional. But please supply them whenever possible.

1 Introduction

Integro-differential equations, particularly those of Volterra-Fredholm type, are widely encountered in mathematical modeling of physical, biological, and engineering systems. These equations involve both integral and differential operators, representing memory effects and dynamic behavior simultaneously. Applications include viscoelasticity, population models, heat transfer, and control theory. Due to their inherent complexity, analytical solutions are rarely obtainable, which underscores the necessity for efficient and accurate numerical methods. A substantial body of research has been dedicated to analyzing the existence, uniqueness, and stability of solutions to these