A STUDY OF SOME EFFECTIVE TECHNIQUES FOR SOLVING VOLTERRA-FREDHOLM INTEGRAL EQUATIONS

Ahmed A. Hamoud[1*], Nedal M. Mohammed[2] and Kirtiwant P. Ghadle[3]

[1,3]Department of Mathematics, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, 431004, India

[2]Department of Computer Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, 431004, India

Abstract. In this paper, based on a strictly convex fuzzy number space and the Riemann integral of fuzzy-number-valued function which is taken value in the space, we propose iterative procedures based on Adomian Decomposition Method (ADM), Modified Adomian Decomposition Method (MADM) and Modified Variational Iteration Method (MVIM) to solve fuzzy Volterra-Fredholm integral equations of the second kind. That, a fuzzy Volterra-Fredholm integral equation has been converted to a system of Volterra-Fredholm integral equations in crisp case. The approximated methods using to find the approximate solution of this system and hence obtain an approximation for the fuzzy solution of the fuzzy Volterra-Fredholm integral equation. Moreover, we will prove the uniqueness of the solution and convergence of the proposed methods. Also, some numerical examples are included to demonstrate the validity and applicability of the proposed techniques.

Keywords. Fuzzy Integral equation, Adomian decomposition method, modified Adomian decomposition method, modified variational iteration method.

AMS (MOS) subject classification: 45G15, 49M27, 65R20.

1   Introduction

The fuzzy integral equations are very useful for solving many problems in several applied fields such as mathematical economics, optimal control theory, electrical engineering, biology and medicine.

In recent years, the topics of fuzzy integral equations which attracted increasing interest, in particular in relation to fuzzy control, have been rapidly developed. The concept of fuzzy numbers and arithmetic operations firstly introduced by Zadeh [21, 23], and then by Dubois and Prade [23]. Also, they have introduced the concept of integration of fuzzy functions. The fuzzy mapping function was introduced by Cheng and Zadeh [21]. Moreover, [22] presented an elementary fuzzy calculus based on the extension principle. Later, Goetschel and Voxman [26] preferred a Riemann integral type approach. Kaleva [27] chose to define the integral of the fuzzy function, using