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EXISTENCE, UNIQUENESS AND CONVERGENCE OF SOLUTIONS OF FUZZY INTEGRAL EQUATIONS BY USING A RECURSIVE SCHEME BASED ON HOMOTOPY PERTURBATION METHOD

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Abstract. In this work, we analyze the numerical scheme using homotopy perturbation method (HPM) for handling linear fuzzy integral equations of the second kind with continuous kernels. This approach involves simple iteration technique and needs no discretization that results in the form of series so that the computations can be easily implemented. The uniqueness of the solution and convergence properties of the approach are discussed which is reliable enough to estimate the maximum absolute error of the quite noticeable fuzzy approximate solutions. Furthermore a couple of numerical examples are provided to illustrate the performance of the presented technique in which we compare the obtained results with homotopy analysis method so as to reveal its effectiveness and precision.

Keywords. Homotopy perturbation method, Fuzzy integral equations, Numerical algorithm, Homotopy analysis method, Existence, Uniqueness, Convergence.

AMS (MOS) subject classification: 03B52, 45A05, 45B05, 45D05.

1 Introduction

Integral equations have attracted much attention in recent years because of their frequent appearance in various applications and involves in the study of population dynamics, parabolic boundary value problems, fluid dynamics, heat and mass transfer, turbulence, image processing, game theory, filtration theory, control theory etc., and these real world problems are easy to be defined in accurate terms and imprecision is often involved. Hence, in order to analyze such problems, fuzzy approximation is required. Therefore the fuzzy concept proposed by Zadeh [43] is deemed to be quite useful in many applications. The concept of integration of fuzzy functions has been introduced by Dubois and Prade [7], Goetschel and Voxman [15], Kaleva [24] and others. However, if the fuzzy functions are continuous, all various procedures yield the same result and the properties of fuzzy numbers were recently studied