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Implementation of Fuzzy Version of Block Backward Differentiation Formulas for Solving Fuzzy Differential Equations

Authors : Z. B. Ibrahim, N. Ismail, K. I. Othman

Abstract : Fuzzy Differential Equations (FDEs) play an important role in modelling many real life phenomena. The FDEs are used to model the behaviour of the problems that are subjected to uncertainty, vague or imprecise information that constantly arise in mathematical models in various branches of science and engineering. These uncertainties have to be taken into account in order to obtain a more realistic model and many of these models are often difficult and sometimes impossible to obtain the analytic solutions. Thus, many authors have attempted to extend or modified the existing numerical methods developed for solving Ordinary Differential Equations (ODEs) into fuzzy version in order to suit for solving the FDEs. Therefore, in this paper, we proposed the development of a fuzzy version of three-point block method based on Block Backward Differentiation Formulas (FBBDF) for the numerical solution of first order FDEs. The three-point block FBBDF method are implemented in uniform step size produces three new approximations simultaneously at each integration step using the same back values. Newton iteration of the FBBDF is formulated and the implementation is based on the predictor and corrector formulas in the PECE mode. For greater efficiency of the block method, the coefficients of the FBBDF are stored at the start of the program. The proposed FBBDF is validated through numerical results on some standard problems found in the literature and comparisons are made with the existing fuzzy version of the Modified Simpson and Euler methods in terms of the accuracy of the approximated solutions. The numerical results show that the FBBDF method performs better in terms of accuracy when compared to the Euler method when solving the FDEs.

Keywords : block, backward differentiation formulas, first order, fuzzy differential equations
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