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Numerical Solution of Fuzzy Linear Non-Autonomous Systems by AVK Method

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Abstract
In this paper, a new approach for numerical solution of fuzzy linear non-autonomous systems is considered. Fuzzy linear non-autonomous system is a subset of the Fuzzy Differential Equations [FDEs]. We introduce our approach to obtain a global optimal approximate solution for this class of FDEs using linear programming with introducing a problem in calculus of variations corresponding to our problem.

Keywords: AVK, Non-Autonomous Systems, Linear Programming, Fuzzy Differential Equations.

1. Introduction
Linear non-autonomous Systems are of great importance because it is very frequently used to represent the dynamic behavior of the physical systems encountered in engineering practice. Knowledge about the real system modeled by linear non-autonomous system is often consist some vagueness. Fuzzy set theory is a tool for modeling uncertainty and for processing vague or subjective information in mathematical models. Fuzzy linear non-autonomous system with fuzzy parameters, fuzzy states variables, or fuzzy initial conditions provide a better comprehension of dynamic systems. Fuzzy linear non-autonomous system is a subset of the Fuzzy Differential Equations [FDEs]. The concept of fuzzy derivative was first introduced by S.L.Chang, L.A.Zadeh [6]; it was followed up by Dubios and Prade [8] who used the extension principle in their approach. The derivative for fuzzy valued mappings was developed by Puri and Ralescu [15] that generalized and extended the concept of Hukuhara differentiability (H-derivative) for set-valued mappings to the class of fuzzy mappings [7]. Using the H-derivative, Kaleva [9] started to develop a theory for FDEs. A comprehensive approach to FDEs has been the work of Seikkala [16], especially its generalized form given by Buckley and Feuring [4]. Furthermore, Buckley and Feuring [5] have solved fuzzy first-order initial value problem in crisp case and then extended the solution to fuzzy case. Kandel and Byatt [10] applied the concept of FDEs to the analysis of fuzzy dynamical problems [11], [12]. In [3] the ordinary differential equation has been extended to an interval, a fuzzy-valued case and a case with fuzzy variable.

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