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Fuzzy goal programming technique for multi-objective indefinite quadratic bilevel programming problem

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Bilevel programming problem is a non-convex two stage decision making process in which the constraint region of upper level is determined by the lower level problem. In this paper, a multi-objective indefinite quadratic bilevel programming problem (MOIQBP) is presented. The defined problem (MOIQBP) has multi-objective functions at both the levels. The followers are independent at the lower level. A fuzzy goal programming methodology is employed which minimizes the sum of the negative deviational variables of both the levels to obtain highest membership value of each of the fuzzy goal. The membership function for the objective functions at each level is defined. As these membership functions are quadratic they are linearized by Taylor series approximation. The membership function for the decision variables at both levels is also determined. The individual optimal solution of objective functions at each level is used for formulating an integrated pay-off matrix. The aspiration levels for the decision makers are ascertained from this matrix. An algorithm is developed to obtain a compromise optimal solution for (MOIQBP). A numerical example is exhibited to evince the algorithm. The computing software LINGO 17.0 has been used for solving this problem.

Key words: bilevel programming, indefinite quadratic programming, multi-objective programming, pay-off matrix, Taylor series approximation, LINGO 17.0

1. Introduction

Fuzzy programming is a tool to find compromise optimal solution for multi-objective mathematical problem. Fuzzy mathematical programming was developed by Tanaka et al. [9]. Thereafter, Zimmermann in 1978 [8] elaborated the method of fuzzy programming for linear programming problem with several ob-

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