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INTERACTIVE DECISION MAKING FOR MULTIOBJECTIVE PROGRAMMING PROBLEMS WITH FUZZY DOMINATION STRUCTURES

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Abstract. *In order to deal with multiobjective programming problems, the concept of domination structures based on convex cones were introduced, which can be regarded as a generalization of Pareto optimal concept. Since domination structures are deeply related to the decision maker's preference in objective space, it seems to be very difficult for the decision maker to supply precise information that makes it possible to find a sharp borderline of a domination structure. From such a point of view, Takeda and Nishida proposed the concept of fuzzy domination structures based on fuzzy convex cones. In this paper, we focus on multiobjective programming problems with fuzzy domination structures and propose an interactive decision making method to obtain a satisfactory solution. An interactive process is demonstrated by means of an illustrative numerical example.*
Keywords: Multiobjective programming, Λ-extreme points, Fuzzy domination structures, Satisfactory solution

1. **Introduction.** In multiobjective programming problems (MOPs), multiple objectives usually conflict with each other in that any improvement of one objective function can be achieved only at the expense of another. Consequently, Pareto optimality concept has been introduced, and many kinds of decision making methods [7, 10, 13, 19] have been proposed to obtain the satisfactory solution of the decision maker from among Pareto optimal solution set. By considering the imprecise nature of the decision maker's judgment and/or the experts' understanding in MOPs, fuzzy multiobjective programming approaches [7, 20] have been proposed. The applications of such multiobjective approaches have been accomplished in the area of water resources planning [2, 3], regional planning [6, 11], environmental planning [4, 5, 8], engineering [12], data envelopment analysis (DEA) [16, 17] and so on.

On the other hand, as a generalized concept of Pareto optimality in MOPs, Yu [18] discussed domination structures and proposed methods to obtain the set of all nondominated solution. Since domination structures are deeply related to the decision maker's preference in objective space, it seems to be very difficult for the decision maker to supply precise information that makes it possible to find a sharp borderline of a domination structure. From such a point of view, Takeda and Nishida [14] proposed the concept of fuzzy domination structures based on fuzzy convex cones. If the decision maker can specify his/her membership functions of fuzzy domination structures as fuzzy convex cones according to his/her preference, the concept of fuzzy domination structures seems to be very useful because the nondominated solution set for the α-level set of the fuzzy convex cones is a subset of Pareto optimal solutions. This means that the search area of the