Fuzzy Programming Approaches to Robust Optimization

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Abstract. In the real world problems, we may face the cases when parameters of linear programming problems are not known exactly. In such cases, parameters can be treated as random variables or possibilistic variables. The probability distribution which random variables obey are not always easily obtained because they are assumed to be obtained by strict measurement owing to the cardinality of the probability. On the other hand, the possibility distribution restricting possibilistic variables can be obtained rather easily because they are assumed to be obtained from experts' perception owing to the ordinality of possibility. Then possibilistic programming approach would be convenient as an optimization technique under uncertainty.

In this talk, we review possibilistic linear programming approaches to robust optimization. Possibilistic linear programming approaches can be classified into three cases: optimizing approach, satisficing approach and two-stage approach [1]. Because the third approach has not yet been very developed, we focus on the other two approaches. First we review the optimization approach. We describe a necessarily optimal solution [2] as a robust optimal solution in the optimization approach. Because a necessarily optimal solution do not always exist, necessarily soft optimal solutions [3] have been proposed. In the necessarily soft optimal solutions, the optimality conditions is relaxed to an approximate optimality conditions. The relation to minimax regret solution [4,5] is shown and a solution procedure for obtaining a best necessarily soft optimal solution is briefly described.

Next we talk about the modality constrained programming approach [6]. A robust treatment of constraints are introduced. Then the necessity measure optimization model and necessity fractile optimization model are described as treatments of an objective function. They are models from the viewpoint of robust optimization. The simple models can preserve the linearity of the original problems. We describe how much we can generalize the simple models without great loss of linearity. A modality goal programming approach [7] is briefly introduced. By this approach, we can control the distribution of objective function values by a given goal.

Finally, we conclude this talk by giving future topics in possibilistic linear programming [8,9,10].

Keywords: robust optimization, fuzzy programming, necessity measure, optimization approach, satisficing approach.

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