ABSTRACT

FORMULATION OF FUZZY LINEAR PROGRAMMING PROBLEM BASED ON FUZZY OBJECTIVE FUNCTION

Hideo TANAKA
University of Osaka Prefecture

Hidetomo ICHIHASHI
University of Osaka Prefecture

Kiyoji ASAI
University of Osaka Prefecture

This paper describes a formulation of Fuzzy Linear Programming (FLP) Problem with fuzzy coefficients by the extension principle. An order relation among fuzzy sets is defined by fuzzy max which is defined through the extension principle. Mathematically speaking, it means that

$$\underset{\sim}{a} \geq \underset{\sim}{b} \Longleftrightarrow \bar{a}_\alpha \geq \bar{b}_\alpha \quad \text{and} \quad \underline{a}_\alpha \geq \underline{b}_\alpha .$$

The constraints and the object are both fuzzified by fuzzy linear function. Two FLP problems are considered as follows: (i) Problem (A) is to decide the non-fuzzy solution x that maximizes $\underset{\sim}{y}=\underset{\sim}{c}x^t$ subject to $\underset{\sim}{A}x^t \leq \underset{\sim}{b}^t$ and (ii) Problem (B) is to decide the fuzzy solution $\underset{\sim}{x}$ that maximizes $\underset{\sim}{y}=\underset{\sim}{c}\underset{\sim}{x}^t$ subject to $\underset{\sim}{A}x^t \leq \underset{\sim}{b}^t$. This fuzzy solution means the possibility distribution of solution in the problem(B).

Two concepts of optimality are used as maximizing the fuzzy objective function in a whole sense of fuzzy set and minimizing its fuzziness. Since the FLP problem (A) takes the possibility distribution of coefficients into consideration, its solution is robust to the uncertainty of model, compared with the solution in conventional LP problem. The FLP problem (B) provides us with the possibility of solution which reflects the fuzziness of parameters. This formulation can be used as a model of top level decision problem in a fuzzy environment. This approach seems tractable and applicable to the real world decision problem where human estimation is influential.

Fuzzy sets are restricted to a class of trianguler membership functions. Owing to this simplification, the FLP problem can be turned into a conventional LP problem with twice numbers of constraints in the FLP problem. Numerical examples are discribed to explain our FLP problems.