

## A FUZZY INTERACTIVE APPROACH FOR DECENTRALIZED BILEVEL PROGRAMMING PROBLEM WITH A COMMON DECISION VARIABLE

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**Abstract.** This paper studies a decentralized bilevel programming problem with a common decision variable, in which there is a decision maker at the upper level (the leader) and multiple ones at the lower level (the followers). We propose a fuzzy interactive decision making (DM) approach to derive a satisfactory solution for decision makers by introducing fuzzy goals for objective functions of all decision makers and consulting the ratios of satisfaction between the leader and the followers. Finally, a numerical example illustrates the feasibility and efficiency of the proposed algorithm.

**Keywords.** bilevel programming, fuzzy interactive approach, decision making.

## 1 Introduction

In this paper, we consider a decentralized bilevel programming problem with a common decision variable, in which there is a decision maker at the upper level (the leader) and multiple ones at the lower level (the followers). The bilevel programming is a nested optimization problem with two levels in a hierarchy, namely the upper and lower level decision maker (namely the leader and the follower, respectively), who have their own objective functions and constraint functions. So it is a practical and useful tool for solving hierarchical decision making problems. The bilevel programming is used so extensively that many researchers devote themselves into this field [3,5,9,11,12,18]. Some of them survey the bilevel programming with respecting to the theory, solution approaches and applications [6,20,23]. And various methods, which have been proposed to solve the bilevel and multilevel programming problems, can be roughly classified into five categories [18]: extreme-point search; transformation approach; descent and heuristic; intelligent computation and interior point.

In a bilevel programming, the leader optimizes his/her objective function independently and is affected by the reaction of the follower who makes