

## ABSTRACT

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The objective of this thesis is to explore the applicability of the fuzzy framework in developing mathematical models for realistic decision making problems. In general, a decision making process consists of four stages, namely information gathering, mathematical modeling, simulation and decision/action. Thus, in the first stage it is essential to acquire as much information as possible and to quantify the information to a mathematically usable form. In this process, linguistic data become important when we are unable to express the imprecise observations mathematically due to complexity of the studied system. Fuzzy set theory is capable of quantifying the linguistic expressions and thus, has a mathematical potential for tackling this complex scenario. The goal of the thesis is, therefore, to develop different tools and techniques for information processing and subsequent modeling with a view to achieve a suitable decision under linguistic framework.

In order to achieve the objective, our work consists of mathematical representation, aggregation, distance, matching or similarity, ranking of fuzzy numbers and finally inference. Intuitionistic fuzzy sets, regarded as the generalization of fuzzy sets are also studied in the thesis. In view of developing fuzzy decision making schemes, the principal investigations carried out in the thesis are presented as follows:

- Multi-attribute decision making schemes with single and multiple experts considering the degrees of confidence of the experts
- Study of intuitionistic fuzzy numbers with the universe of discourse as the real line
- An approach for estimating priority-based weights of the alternatives under intuitionistic fuzzy environment
- Solution of multi-objective optimization problem under fuzzy rule constraints
- Development of fuzzy linear regression model in a linguistic framework
- Applications to real-life problems

## **KEYWORDS**

Generalized fuzzy number ◦ Intuitionistic fuzzy number ◦ Fuzzy similarity ◦ Logistic membership function ◦ Multi-criteria decision making