

FUZZY GENETIC ALGORITHM BASED ON PRINCIPAL INDICES OPERATION AND QUASI-LINEAR FUZZY NUMBER AND ITS PERFORMANCE

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ABSTRACT. *Fuzzy optimization is playing an increasing role in artificial intelligence, system control and manufacturing management etc.. In this paper, based on the structure of fuzzy information and the mechanism of fuzzy optimization, we propose the concept of quasi-linear fuzzy number, and discuss its approach properties. Further, combining the compound qualification strategy of fuzzy information, we give the comparison method based on synthesizing effect, and propose a new kind of fuzzy genetic algorithm based on principal indices operation and quasi-linear fuzzy number (denoted by BPO-FGA for short). Finally, by using Markov chain theory and simulation technology, we analyze the performance of BPO-FGA. All the results indicate that BPO-FGA not only has better convergence and higher computational efficiency, but also can effectively merge decision consciousness into the algorithm.*

Keywords: Fuzzy optimization, Quasi-linear fuzzy number, Indices, Fuzzy genetic algorithm, BPO-FGA, Markov chain

1. **Introduction.** Fuzziness is a widespread phenomenon existing in the real world and is unavoidable in many practical fields. In 1965, American cyberneticist Zadeh [1] proposed the concept of fuzzy sets and established fuzzy sets theory, which formed the foundation for describing and processing uncertain information. The theory of fuzzy numbers, an important part of fuzzy sets theory, was used in many fields such as fuzzy control, resource management and fuzzy data analysis etc., in which fuzzy optimization is the common problem. For fuzzy optimization, the good results mainly focus on fuzzy linear optimization [2-5], which were mostly obtained by transforming a fuzzy linear optimization problem to a classical one according to the structure properties of fuzzy numbers. With the development of computer science and evolutionary computation theory, genetic algorithms are becoming more and more important, for instance, they were used to deal with multi-resource constrained project scheduling problem with multiple modes in [6] and automatic human faces morphing based on control points selection in [7], and the optimization problems with fuzzy coefficients but real variables in [8, 9], and fuzzy linear optimization problems with fuzzy coefficients and fuzzy variables in [10], etc. Up to now, it can be said that there is no effective and common method for most general problems of fuzzy optimization, where the main difficulty involves the following aspects: 1) The