

# Accepted Manuscript

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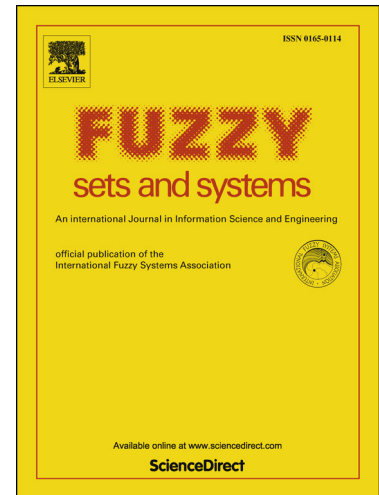
PII: S0165-0114(17)30308-1  
DOI: <http://dx.doi.org/10.1016/j.fss.2017.08.001>  
Reference: FSS 7281

To appear in: *Fuzzy Sets and Systems*

Received date: 21 March 2015  
Revised date: 12 July 2017  
Accepted date: 7 August 2017

Please cite this article in press as: X.-P. Yang et al., Lexicographic optimal solution of the multi-objective programming problem subject to max-product fuzzy relation inequalities, *Fuzzy Sets Syst.* (2017), <http://dx.doi.org/10.1016/j.fss.2017.08.001>

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# Lexicographic optimal solution of the multi-objective programming problem subject to max-product fuzzy relation inequalities \*

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## Abstract

It is shown in this paper that the emission base stations in wireless communication can be reduced into a system of fuzzy relation inequalities with max-product composition. For optimal management in such system, we introduce the fuzzy relation multi-objective programming. Concept of feasible index set (FIS) is defined, based on which a novel algorithm, named FIS algorithm, is developed to find the unique lexicographic optimal solution of the proposed problem with polynomial computational complexity. Applying this method, we needn't to find out all the minimal solutions of the constraint. A numerical application example is provided to illustrate the feasibility and efficiency of the FIS algorithm.

**Keywords:** Fuzzy relation inequality; Multi-objective programming; Lexicographic order; Feasible index set; Fuzzy relation equation; Wireless communication

## 1 Introduction

Fuzzy relation equation was introduced by E. Sanchez for the first time [1]. The author discussed some properties the solution. Moreover, the concept of maximum solution and minimal solution were introduced to describe the solution set of max-min fuzzy relation equations. Later various solution methods were proposed to enrich its theoretical results [2]-[5] and the max-min composition was generalize to max- $T$ , addition-min [23, 24, 25] and other operations.

Optimization problem with fuzzy relation equations or inequalities constraint is said to be fuzzy relation mathematical programming (or optimization problem). One of the early works in this aspect was written by P.Z. Wang et. al. [6]. The authors introduced the fuzzy relation latticized linear programming problem with respect to max-min composition. A latticized linear programming is an optimization problem with all variables and parameters belonging to the

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\*Supported by the Natural Science Foundation of Guangdong Province (2016A030307037); Innovation and Building Strong School Project of Colleges of Guangdong Province (2015KQNCX094) and the Projects from Guangdong Province (2015B090922014, 2015A030401101).

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