International Journal of Innovative Computing, Information and Control
Volume **3**, Number **1**, February **2007**

ICIC International ©2007 ISSN 1349-4198
pp. 71–83

FUZZY CONSTRAINTS LINEAR PROGRAMMING: A GENETIC ALGORITHM APPROACH

Feng-Tse Lin and Ming-Gar Lee

Department of Applied Mathematics
Chinese Culture University
Yangminshan, Taipei 111, Taiwan
{ ftlin; lmj}@faculty.pccu.edu.tw

Received June 2006; revised September 2006

Abstract. *This paper presents a genetic algorithm (GA) approach to solving fuzzy constraints linear programming (FCLP) problem. We use GAs to solve this fuzzy problem without defining the membership function for fuzzy numbers or using a penalty method for constraint violations. The proposed approach simulates every fuzzy number by distributing it into certain partition points. The final values obtained after the evolutionary process represent the membership grade of that fuzzy number. The computation of fuzzy equations by GAs does not require the conventional extension principle or interval arithmetic and α -cuts for solving FCLP. Instead, GAs use the usual evolutionary process. The empirical results show that the proposed approach obtains very good solutions within the given bounds of each fuzzy coefficient compared with other fuzzy methods. The fuzzy concept of the GA approach is different but gives better results than other traditional fuzzy methods.*

Keywords: Fuzzy constraints linear programming, Fuzzy numbers, Mathematical programming, Genetic algorithms

1. **Introduction.** Mathematical programming refers to techniques for solving a general class of optimization problems dealing with the interaction of many variables subject to a set of restraining conditions. Significant progress has been made in developing techniques for solving a subclass involving linear functions and linear constraints; this is the technique of linear programming [7]. Linear programming has long proved its merit as a significant model for numerous allocations, operations research, economic problem, and so forth. In many practical applications, however, the exact values of the constraint coefficients are either vague or ambiguous due to imprecise information or unknown resources limits. Thus, the constraint coefficients of the original problem will be replaced with fuzzy numbers that produce the fuzzy constraints linear programming (FCLP) problem to be solved. The first method for solving fuzzy linear programming problems was proposed by Zimmermann [15]. Over the past decades, we have witnessed the numerous and diverse applications of fuzzy linear programming. For example, water supply planning [11], farm structure optimization problem in agricultural economics [4], aggregate production planning problem [13], machine optimization problems in manufacturing and production [12], and capital asset pricing model in banking and finance [9].