



Solving a fuzzy fixed charge solid transportation problem using batch transferring by new approaches in meta-heuristic

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Abstract

Nowadays finding effective solution for transportation problem is one of the main issues both in industries and academia. According to the real world, in this paper it is assumed that the products are transferred in batches in a fixed charge transportation problem. Furthermore, the fuzzy values are used according to the parameters value in the real world. In addition, six meta-heuristics are utilized in order to solve the presented model. Most of these algorithms are firstly used for a mathematical model in transportation problem literature. Because of the importance of tuning the parameters in solving the given problem, the Taguchi method is used. Finally, computational results with different problem sizes are studied and analyzed.

Keywords: Fixed charge, batch transferring, fuzzy values, meta-heuristics.

1 Introduction

One of the most important fields of supply chain management is the transportation network. Transportation problem (TP) is an optimization problem which propose great potential to decrease costs and it is necessary to transporting units of a product from several supply elements of original to several demand elements. Balinski [4] firstly formulated a fixed-charge transportation problem (FCTP) for the first time, provided its special features, and proposed an approximate method for solving it. Various solution methods have been proposed for the fixed cost problems in the optimization literature[1].

Hajiaghahi-Keshteli et al.[7] considered the nonlinear fixed cost transportation problem and proposed a new method to design chromosomes in the genetic algorithm (GA) based on Prüfer number spanning tree. Also, Lotfi and Tavakkoli-Moghaddam [9] utilized a new chromosome based on priority in GA. An electromagnetism algorithm is employed for solving FCTP by Sanei et al. (2013)[12]. Molla-Alizadeh-Zavardehi et al. [11] used three metaheuristics and hybrid VNS. Also various new neighborhood structures were proposed for the first time. In a recent research [3], a multi-purposes multi-stages problem is studied. Solving this problem using grey number theory is under conditions of uncertainty.

In this paper, we study the fuzzy fixed charge solid transportation problem (FFCSTP) considering the variable cost for transporting a batch of products. Products can be carried to each customer from any supplier that have a variable cost for each transported batch and a fixed fee for opening of the route. Rest of the paper is organized as follows. The proposed model is described in section 2. In sections 3-6, we briefly describe solving algorithms. The solution in different sizes, and the adopted results will be displayed in section 7. Section 8 proposes some suggestions for future researches along with conclusion.

2 Mathematical Formulation and Description

In this section, inspired by the logical relationships between parameters, a mathematical model has been presented. This transportation network is considered a symmetric one. The possibility of vehicles destruction is not considered in this study and the values of demand, supply and product in each category is definite. In this model, we have m suppliers, n customers and k conveyances. Commodities can be transported from any origin to any destination by any vehicle, which has a variable cost c_{ijk} per unit and a fixed fee f_{ijk} for use of each route. The model formulation is expressed as follows.

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