Chapter 7
The Theory and Applications of the Software-Based PSK Method for Solving Intuitionistic Fuzzy Solid Transportation Problems

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ABSTRACT

It proposes the PSK (P. Senthil Kumar) method for solving intuitionistic fuzzy solid transportation problems (IFSTPs). In our daily life, uncertainty comes in many ways, e.g., the transportation cost (TC) is not a fixed one, it varies from time to time due to market conditions (i.e., the price of diesel is depending on the cost of crude oil), mode of the transportation, etc. So, to deal with the TP having uncertainty and hesitation in TC, in this chapter, the author divided IFSTP into 4 categories and solved type II- IFSTP by using TIFNs. The model of type II- IFSTP and its relevant CSTP both are presented. The PSK method is presented clearly with the proof of some theorems and corollary. To illustrate the PSK method with proposed models, the numerical experiment and its related graphs are presented. Real-life problems are identified and solved by the PSK method with MATLAB and LINGO software. Analysis, discussion, merits, and demerits of the PSK method are all presented. A valid conclusion and recommendations are given. Finally, some of the future research areas are also suggested.

INTRODUCTION

The linear programming problem (LPP), widely used in the areas of transportation, energy industry, agriculture, manufacturing, engineering, and so forth, In that, the transportation problem (TP) is the most important and special case of LPP. It is used in a variety of fields. Some of them are listed below.

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1. Aggregate planning
2. Personal management
3. Economics
4. Communication network
5. Inventory control
6. Employment scheduling
7. Business, etc.

Linear programming (LP) is also called linear optimization. It is a technique for the optimization of a linear objective function, subject to linear equality (=) and linear inequality (i.e., less than (<), greater than (>), less than or equal to (≤) and greater than or equal to (≥)) constraints. Generally, LP is a special case of mathematical programming. It is also known as mathematical optimization. As we know, the TP is one of the optimization problems. Its objective is to determine the optimum schedule subject to the given set of constraints. It deals with transportation of homogeneous commodities from several number of sources to different number of destinations. In that, the constraints are all should be linear type. Similarly, the objective function is also linear. These two are the major assumptions of TP. The allocations should be satisfies the supply points constraints and demand points constraints as well as non-negative restrictions. By this way we need to optimize the objective function. The term 'optimization' can be defined as either 'maximization' or 'minimization'. If the cost/time involving the objective function then our aim is to minimize the cost/time. Such a problem is called minimization problem. Similarly, if the profit/production involving the objective function then our aim is to maximize the profit/production. Such kind of problem is called a maximization problem. Cost minimization TP and profit maximization TP both are the examples of minimization and maximization problems. Shipping the raw material from several sources to different destinations is unavoidable one. Therefore, the study of TP is also unavoidable one.

In traditional TP, there are three parameters, which are:

1. Supply/availability (the amounts available at the supply points are known as supply).
2. Demand/requirement (the amounts required at the demand points are known as demand).
3. Cost (the unit costs, i.e., the cost of transporting one unit from a particular supply point to a particular demand point).

BACKGROUND

Historical background of TP, STP, fuzzy set, FSTP, IFS and IFSTP are given in this section.

Historical Background of TP and STP

In 1941, Hitchcock introduced the TP. Further, Dantzig (1963) solved the TP by using Simplex method. Swarup et al. (1997) have solved the TP with the name of 'tracts in operations research' under the assumptions that all the parameters are crisp numbers. Xie et al. (2017) discussed TP with varying demands and supplies in crisp environment. Similarly, Quddoos (2018) introduced a mathematical model for reliable transportation problem with crisp parameters. Furthermore, some of the recent literature related to this topic is specified within these brackets (Lee, 2021; Xie & Li, 2021; Bhadane et al., 2021; Hussain et al.,