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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : PROSIDING INTERNASIONAL

Judul Prosiding (Artikel) : Optimal solution of full fuzzy transportation problems using total integral ranking
Nama/ Jumlah Penulis : M Sam'an, Farikhin, **Susilo Hariyanto**, B Surarso
Status Pengusul : penulis ke-3
Identitas Prosiding :
a. Nama Prosiding : Journal of Physics: Conference Series
b. Nomor ISSN : Online ISSN: 1742-6596 Print ISSN: 1742-6588
c. Vol, No., Bln Thn : **983** 012075 (2018)
d. Penerbit : IOP Publishing
e. DOI artikel (jika ada) : 10.1088/1742-6596/983/1/012075
f. Alamat web penerbit : <https://iopscience.iop.org/article/10.1088/1742-6596/983/1/012075>
g. Terindex : Scopus

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Semarang, Maret 2023
Reviewer 1



Nama : Prof. Dr. Sunarsih, M.Si
NIP. 195809011986032002
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

Reviewer 2



Nama : Dr. Titi Udjiani S.R.R.M, M.Si
NIP. 19640223 199102 2 001
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

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..

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Ruang lingkup materi yang dibahas adalah masalah transportasi yang dikombinasikan dengan teori fuzzy dan ditentukan nilai optimalnya.

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Reviewer 1

Nama : Prof. Dr. Sunarsih, M.Si
NIP. : 195809011986032002
Unit Kerja : FSM Undip
Bidang Ilmu: Matematika

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- 2. Ruang lingkup dan kedalaman pembahasan:**
Lingkup pembahasan artikel ini merupakan optimasi pada masalah transportasi dengan menggunakan teori fuzzy. Dibahas dengan mendalam solusi maslah transportasi fuzzy dengan bantuan suatu metode pada system pendukung keputusan. Pembahasan diperdalam dengan memberikan ilustrasi aplikasi menggunakan perhitungan numerik.
- 3. Kecukupan dan kemutakhiran data/informasi dan metodologi:**
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Semarang, Februari 2023
Reviewer 2



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Bidang Ilmu: Matematika

Journal of Physics: Conference Series • Open Access • Volume 983, Issue 1 • 6 April 2018 • Article number 012075 • 4th International Conference on Mathematics, Science, and Education, ICMSE 2017 • Semarang, Central Java • 18 September 2017 through 19 September 2017 • Code 135773

Document type

Conference Paper • Gold Open Access

Source type

Conference Proceedings

ISSN

17426588

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10.1088/1742-6596/983/1/012075

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Optimal solution of full fuzzy transportation problems using total integral ranking

[Sam'An M.^a](#) ; [Farikhin^b](#); [Hariyanto S.^b](#); [Surarso B.^b](#)

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^a Mathematics Study Program, Faculty of Sains and Mathematics, Diponegoro University, Indonesia

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Abstract

Full fuzzy transportation problem (FFTP) is a transportation problem where transport costs, demand, supply and decision variables are expressed in form of fuzzy numbers. To solve fuzzy transportation problem, fuzzy number parameter must be converted to a crisp number called defuzzification method. In this new total integral ranking method with fuzzy numbers from conversion of trapezoidal fuzzy numbers to hexagonal fuzzy numbers obtained result of consistency defuzzification on symmetrical fuzzy hexagonal and non symmetrical type 2 numbers with fuzzy triangular numbers. To calculate of optimum solution FTP used fuzzy transportation algorithm with least cost method. From this optimum solution, it is found that use of fuzzy number form total integral ranking with index of optimism gives different optimum value. In addition, total integral ranking value using hexagonal fuzzy numbers has an optimal value better than the total integral ranking value using trapezoidal fuzzy numbers. © Published under licence by IOP Publishing Ltd.

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References (11)

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Source details

Journal of Physics: Conference Series

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ISSN: 1742-6588 E-ISSN: 1742-6596

Subject area: [Physics and Astronomy: General Physics and Astronomy](#)

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Preface

It is a very great privilege for Faculty of Mathematics and Natural Science (FMIPA) Universitas Negeri Semarang to host the 4th International Conference on Mathematics, Science, and Education (ICMSE 2017) in Semarang, Central Java, Indonesia on 18-19 September 2017. We are honored to have the opportunity to work with Indonesian Chemical Society, Indonesian Physical Society, Indonesian Biology Society, Association of Computer Science Higher Education, Indonesian Mathematical Society, and Indonesian Educator Science in this forum. In 2017, our theme of “Roles of Mathematics and Science Research in Supporting Growth of Sustainable Natural Resources-based Industries” celebrates the annual conference to provide a platform to the researchers, experts and practitioners from academia, governments, NGOs, research institutes, and industries to meet and share cutting-edge progress in the field of mathematics, natural science, and science education. Also, this event provides an opportunity to enhance understanding of relationships between knowledge and research in the scope of Mathematics, Biology, Chemistry, Physics, and Science Education.

The committee of ICMSE 2017 would like to express the sincere gratitude to the keynote speakers and all authors of the contributed papers in the conference proceedings. Moreover, would like to thank the expert reviewers for reviewing the manuscripts. We also highly appreciate the assistance offered by many volunteers in the preparation of the conference and the proceedings, and of course, to the sponsors assisting in funding this conference.

The committee selected 205 papers from 253 papers and reports findings presented in this forum to be published in **Journal of Physics: Conference Series (Institute of Physics Publisher)** indexed in some databases, including the Conference citation index, Scopus, Inspec, Chemical Abstracts Service, and Astrophysics Data System. We hope that this program will expand the mutual understanding and respect in stimulating research in Mathematics, Science, and Education; share research interest and information, and create a form of collaboration and build a trust relationship. We are delighted to be able to show the world what recent developments in the field of Mathematics, Natural Science, and Science Education through this fruitful program.

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Accepted papers received: 23 February 2018

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Characteristic of critical and creative thinking of students of mathematics education study program

The density and compositional analysis of titanium doped sapphire single crystal grown by the Czochralski method

H H Kusuma^{1,*}, Z Ibrahim² and Z Othaman²

¹ Physics Department, Faculty of Sciences and Technology, Universitas Islam Negeri Walisongo Semarang, Central Java, Indonesia

² Department of Physics, Faculty of Science, Universiti Teknologi Malaysia, UTM Skudai, Johor, Malaysia

*Corresponding Author: hamdanhk@walisongo.ac.id

Abstract. Titanium doped sapphire (Ti:Al₂O₃) crystal has attracted attention not only as beautiful gemstones, but also due to their applications as high power laser action. It is very important crystal for tunable solid state laser. Ti:Al₂O₃ crystals have been success grown using the Czochralski method with automatic diameter control (ADC) system. The crystals were grown with different pull rates. The structure of the crystal was characterized with X-Ray Diffraction (XRD). The density of the crystal was measurement based on the Archimedes principle and the chemical composition of the crystal was confirmed by the Energy Dispersive X-ray (EDX) Spectroscopy. The XRD patterns of crystals are showed single main peak with a high intensity. Its shows that the samples are single crystal. The Ti:Al₂O₃ grown with different pull rate will affect the distribution of the concentration of dopant Ti³⁺ and densities on the sapphire crystals boules as well on the crystal growth process. The increment of the pull rate will increase the percentage distribution of Ti³⁺ and on the densities of the Ti:Al₂O₃ crystal boules. This may be attributed to the speed factor of the pull rate of the crystal that then caused changes in the heat flow in the furnace and then causes the homogeneities is changed of species distribution of atoms along crystal.

1. Introduction

Sapphire (Al₂O₃) single crystal is one of the most excellent and useful material for a number of high technology, optical and electro-optical applications [1]. As an optical material, sapphire has a broad transmission band spanning the ultraviolet, visible and infrared region. Sapphire has very good mechanical and physical properties, such as tensile strength, abrasion resistance, thermal conductivity and mechanical stability, which result in outstanding thermal shock resistance [2]. Doping sapphire with foreign ions can be used to modify the optical properties and makes the system useful for large variation application, such us tunable solid state laser [3-6] and optical waveguides [7-9].

Sapphire becomes a promising material for tunable lasers if doped with elements possessing wide absorption bands and wide emission regions [10]. The most interesting among such elements are Ti³⁺, Cu²⁺, V³⁺, Ni²⁺, Co²⁺, Cr³⁺ and Mn²⁺, where these elements are included in the transition metals. The transition-metal ions are also excellent alternatives and they are widely used in laser crystals [11]. Trivalent titanium (Ti³⁺) is a transition metal ion that has very desirable broad absorption and emission



Planning comparison between intensity modulated radiation therapy and intensity modulated proton therapy in a case of head and neck cancer

T T C Nguyen^{1,*}, B T Nguyen² and N V Mai¹

¹VNUHCM-University of Science, Vietnam National University, Ho Chi Minh City - 227 Nguyen Van Cu street, Ward 4, District 5, Ho Chi Minh City, **Vietnam**

²Prowess Inc., 1844 Clayton Road Concord CA 94520, US

*Corresponding author: ntcthu@hcmus.edu.vn

Abstract. In this work, we made the comparison between IMRT plan and IMPT plan for a head and neck case. We used Prowess Panther to perform IMRT plan and LAP- CERR for IMPT plan. The result showed that IMPT plan had better coverage than IMRT plan. In the IMRT plan, normal structures received higher dose with higher volume. Especially, the maximum dose of spinal cord is 31.5 Gy (RBE) using IMRT technique compared to 13.5 Gy (RBE) using IMPT technique. These results showed that IMPT is beneficial for head and neck cancer compared to IMRT technique.

1. Introduction

Currently, traditional radiation therapy x-rays are still the most common type of radiation in curing cancer. However, the persisting problem is that significant dose delivered to normal tissue because of the characteristics of interaction of photons with matter even with the most advanced delivery technique. Proton therapy is the technique producing better conformity to target and better sparing to organs at risk. In this paper, Intensity Modulated Proton Therapy (IMPT) and Intensity Modulated Photon Therapy (IMRT) plans are generated for a head and neck patient. To make IMRT plans we used Prowess Panther, a commercial Treatment Planning System (TPS) and LAP-CERR (The Laser Accelerated Particle [1]- The Computational Environment for Radiotherapy Research [2]). The evaluation and comparison of the two kinds of radiation treatment plans were performed in term of physical quantity based on Dose Volume Histogram (DVH) and dose statistics for both target and organs at risk.

2. Methods

In this section, we will introduce some main features of dose algorithm and dose optimization of Prowess Panther and LAP-CERR. The definitions of PTV and PRVs and dose requirements also will be described here.

2.1. Prowess Panther

2.1.1. Dose calculation algorithm

Collapsed cone convolution of radiant energy for photon dose calculation in heterogeneous media [3, 4] has been used to calculate absorbed dose. This method assumed transported energy process



Optimal solution of full fuzzy transportation problems using total integral ranking

by Susilo Hariyanto

Submission date: 16-Feb-2023 04:24AM (UTC+0700)

Submission ID: 2015106975

File name: C-25_organized.pdf (312.67K)

Word count: 3111

Character count: 14506

Optimal solution of full fuzzy transportation problems using total integral ranking

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² Mathematics Departement, Faculty of Sains and Mathematics, Diponegoro
University

*Corresponding author: sammuhamad@students.unnes.ac.id

Abstract. Full fuzzy transportation problem (FFTP) is a transportation problem where transport costs, demand, supply and decision variables are expressed in form of fuzzy numbers. To solve fuzzy transportation problem, fuzzy number parameter must be converted to a crisp number called defuzzification method. In this new total integral ranking method with fuzzy numbers from conversion of trapezoidal fuzzy numbers to hexagonal fuzzy numbers obtained result of consistency defuzzification on symmetrical fuzzy hexagonal and non symmetrical type 2 numbers with fuzzy triangular numbers. To calculate of optimum solution FTP used fuzzy transportation algorithm with least cost method. From this optimum solution, it is found that use of fuzzy number form total integral ranking with index of optimism gives different optimum value. In addition, total integral ranking value using hexagonal fuzzy numbers has an optimal value better than the total integral ranking value using trapezoidal fuzzy numbers.

1. Introduction

Application of transportation model in real life is used in distributing a product from supplier to demand. The problem to be solved by transportation model is determination of item distribution of that will minimize distribution total cost with item quantity to be produced does not exceed limit capacity of production and still meet demand minimum number on each destination. Some parameters can be used in the transport model, ie transportation costs, demand and inventory value (both product and supply capacity). There are transportation problems, namely value unpredictability of transportation cost coefficient, inventory amount and demand number caused by uncontrollable factors of error situations in real life. In addition, in some cases supply amount is not equal to demand number. Therefore, to handle these uncertainties in making decisions, Bellman and Zadeh introduce fuzziness concept. The fuzzy transportation problem (FTP) is transportation problem where transportation cost, supply quantity and demand quantity that is fuzzyness [1].

The purpose of FTP is determine delivery schedules that minimize total fuzzy costs while still meeting inventory quantities and fuzzy supply limits [2]. To solve FTP, fuzzy number parameter previously, must be converted to a number parameter in crisp number or called defuzzification. Total integral ranking is one of defuzzification method with a convex combination based on right and left integral values through an optimism index [3]. The left integral value is used to reflect the pessimistic viewpoint and the right integral value is used to reflect the optimistic viewpoint of the decision maker [3]. Previous discussion of the fuzzy number defuzzification method has been found that total integral ranking is superior to previously proposed defuzzification methods, such as Gupta and Kumar [4], Pandian and Natarajan [5], Hatami-Marbini and Tavana [6], Chakraborty and Chakraborty [7],



Basirzadeh [8], Saati et al. [9] and Kumar et al. [10]. Ebrahimnejad [3] have used trapezoidal numbers for defuzzification of fuzzy numbers using total integral rankings with results indicating consistency in the ranking between the two fuzzy numbers. Therefore in this case it will discuss to use of total integral ranking with other fuzzy number.

Base on graphic membership function of trapezoidal numbers, can still be done addition of point parameters in the interval fuzzy number. Therefore, in this paper shows the use of new fuzzy numbers on total integral ranking by adding parameter point of trapezoidal fuzzy number which has 4 parameter points to 6 point parameters known as hexagonal fuzzy number. In the use of a total integral ranking with hexagonal fuzzy numbers on FTP is expected to produce better optimum value fuzzy triangular and trapezoid numbers. Also in this paper, to determine the optimal solution of FTP using fuzzy transportation algorithm least cost method.

2. Preliminaries

This section presents the total integral ranking.

2.1. Total Integral Ranking

Definition 2 [3]. A is a fuzzy number with left membership function f_A^L and right membership function f_A^R . Suppose that g_A^L is the inverse function of f_A^L and g_A^R is the inverse function of f_A^R , then the left integral value of and the right integral value of A , respectively defined as,

$$I_L(A) = \int_0^1 g_A^L(y) dy \text{ and } I_R(A) = \int_0^1 g_A^R(y) dy.$$

Definition 3 [3]. If A is fuzzy number with membership function f_A , defined as in (Eq. 1), then the total integral ranking value with index of optimism α is defined as,

$$I_T^\alpha(A) = \alpha I_R(A) + (1 - \alpha) I_L(A) \quad (2)$$

where $I_R(A)$ and $I_L(A)$ are the right and left integral value of A , respectively, and $\alpha \in [0, 1]$.

3. The Total Integral Rangking Value of Triangular, Trapezoidal and Hexagonal Fuzzy Number

Definition 7 [8]. The fuzzy number is a hexagonal fuzzy number, if its membership function f_A is given by,

$$f_A = \begin{cases} \frac{1}{2} \left(\frac{x-a}{b-a} \right), & a \leq x \leq b \\ \frac{1}{2} + \frac{1}{2} \left(\frac{x-b}{c-b} \right), & b \leq x \leq c \\ 1, & c \leq x \leq d \\ 1 - \frac{1}{2} \left(\frac{x-d}{e-d} \right), & d \leq x \leq e \\ \frac{1}{2} \left(\frac{f-x}{f-e} \right), & e \leq x \leq f \end{cases}$$

Where $a \leq b \leq c \leq d \leq e \leq f$ is real number which satisfy $b-a \leq c-a$ and $e-d \leq f-e$.

Suppose on introduction that has been described above that in this discussion using hexagonal fuzzy number. The hexagonal fuzzy number is generated by adding two parameter points obtained from middle value between fuzzy numbers a and b along fuzzy number c and e . The graph of membership functions can be illustrated in Figure 1.

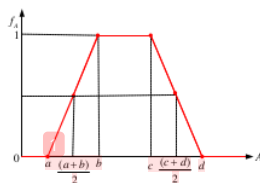


Figure 1. Conversion of trapezoidal fuzzy numbers to hexagonal

Therefore from the concept, then suppose on definitions 6 and 7 produced the following remark.

Remark 1. Fuzzy trapezoidal number A denoted by $(a, b, c, d; 1)$ to be fuzzy hexagonal number denoted by $(a, (a+b)/2, b, c, (c+d)/2, d; 1)$ with membership function f_A expressed as follows:

$$f_A = \begin{cases} \frac{1}{4} \left(\frac{x-a}{b-a} \right), & a \leq x \leq (a+b)/2 \\ \frac{1}{2} + \frac{1}{2} \left(\frac{2x-(a+b)}{b-a} \right), & (a+b)/2 \leq x \leq b \\ 1, & b \leq x \leq c \\ 1 - \frac{1}{4} \left(\frac{x-c}{d-c} \right), & c \leq x \leq (c+d)/2 \\ \frac{1}{4} \left(\frac{d-x}{d-c} \right), & (c+d)/2 \leq x \leq d \end{cases}$$

fuzzy hexagonal number A denoted by $(a, (a+b)/2, b, c, (c+d)/2, d; 1)$ then

$f_A^L(x) = (x-a)/(b-a) + 1/2 + 1/2(2x-(b+a)/2)/(b-a)$ and $f_A^R(x) = 1 - (x-d)/4(d-c) + (d-x)/(d-c)$, so

invers function from f_A^L and f_A^R can be expressed by $g_A^L(y) = 4y(b-a) + a + 1/2[(2y-1)(b-a) + (a+b)]$

and $g_A^R(y) = (4y+4)(d-c) + d + d - 4y(d-c)$, where $y \in [0, 1]$. so $I_L(A) = 7b+a/8$ and $I_R(A) = 4(d-c)$.

Thus based on (2) with $\alpha \in [0, 1]$, the total integral ranking value of fuzzy hexagonal numbers denoted by $A = (a, (a+b)/2, b, c, (c+d)/2, d; 1)$ is $I_T^\alpha(A) = 1/8[38\alpha(d-c) + (1-\alpha)(7b+a)]$ (5)

4. Comparison Consistency Defuzzyfication on Total Integral Ranking Based on Fuzzy Number Numbers Type

Defuzzyfication of fuzzy numbers using total Integral Ranking with hexagonal fuzzy number has a different consistency with fuzzy triangular number when viewed based on fuzzy number type. Therefore, the following consistency comparison of defuzzyfication based on hexagonal type is symmetrical, non symmetrical type 1 and non symmetrical type 2 with fuzzy triangular number showed in Table 1.

Table 1. The total integral rank value

Fuzzy number of type	Optimism index		
	$\alpha = 0$	$\alpha = 0.5$	$\alpha = 1$
Symetris $A_1 = (5, 7, 9)$ $A_2 = (3, 7, 9)$ $A_3 = (1, 3, 7, 9)$	$A_1 = 6$ $A_2 = 5$ $A_3 = 2.75$	$A_1 = 7$ $A_2 = 6.5$ $A_3 = 5.37$	$A_1 = 8$ $A_2 = 8$ $A_3 = 8$
Non symetris type 1 $A_1 = (5, 7, 9)$ $A_2 = (3, 7, 9)$ $A_3 = (1, 2, 5, 9)$	$A_1 = 6$ $A_2 = 5$ $A_3 = 1.87$	$A_1 = 7$ $A_2 = 6.5$ $A_3 = 8.93$	$A_1 = 8$ $A_2 = 8$ $A_3 = 16$
Non symetris type 2 $A_1 = (5, 7, 9)$ $A_2 = (3, 7, 9)$ $A_3 = (1, 5, 8, 9)$	$A_1 = 6$ $A_2 = 5$ $A_3 = 4.5$	$A_1 = 7$ $A_2 = 6.5$ $A_3 = 4.25$	$A_1 = 8$ $A_2 = 8$ $A_3 = 8$

From Table 1 it can be seen that hexagonal fuzzy number type of symmetrical and non symmetrical type 2 shows the same consistency of defuzzyfication with optimism index value that is

$$\alpha = 0$$

$\alpha = 0.5$ and $\alpha = 1$. This is in according with discussions previously made by Ebrahimnejad [3] who use fuzzy trapezoidal numbers. As for comparison of defuzzification consistency can be seen in Table 2. From the table shows that fuzzy hexagonal type of symmetrical and non-symmetrical type 2 can be used for defuzzification process in solving fuzzy transportation problems that shown in Table 2.

Table 2. Comparison of defuzzification consistency with total integral ranking

Fuzzy number of type	New Total Integral ranking (Eq.5)			Ebrahimnejad [3]		
	$\alpha = 0$	$\alpha = 0.5$	$\alpha = 1$	$\alpha = 0$	$\alpha = 0.5$	$\alpha = 1$
Symetris	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 = A_2 = A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$
Non symetris type 1	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 = A_2 = 1/2 A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$
Non symetris type 2	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 = A_2 = A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$	$A_1 > A_2 > A_3$

5. Fuzzy Transportation problem

On the transportation problem of optimization theory, parameters S_i, D_j, C_{ij} expressed in the form crisp number. However, if parameters S_i, D_j, C_{ij} and x_{ij} expressed in form of fuzzy numbers $\tilde{S}_i, \tilde{D}_j, \tilde{C}_{ij}$ and $\tilde{X}_{ij}$. Then the problem of crisp transportation becomes FTP which can be formulated as follows:

$$\min: \tilde{z} = \sum_{i=1}^m \sum_{j=1}^n \tilde{C}_{ij} \tilde{x}_{ij} \quad (6)$$

$$\text{subject to: } \sum_{j=1}^n \tilde{x}_{ij} \leq \tilde{S}_i, \quad i = 1, 2, \dots, m \quad (7)$$

$$\sum_{i=1}^m \tilde{x}_{ij} \leq \tilde{D}_j, \quad j = 1, 2, \dots, n \quad (8)$$

$$\tilde{x}_{ij} \geq 0, \quad \forall i, j.$$

where:

$$\tilde{X}_{ij} = (x_{1ij}, x_{2ij}, \dots, x_{pij}), \tilde{C}_{ij} = (c_{1ij}, c_{2ij}, \dots, c_{pij}), \tilde{S}_i = (s_{1i}, s_{2i}, \dots, s_{pi}), \tilde{D}_j = (d_{1j}, d_{2j}, \dots, d_{pj}), p = 1, 2, \dots, k$$

It will be given about the existence of Fuzzy Transportation Algorithm. Given a FTP at (6) - (8) denoted by FTP 1. Next, fuzzy transportation problem is denoted by FTP 2 as follows:

$$\min: \tilde{z} = \sum_{i=1}^m \sum_{j=1}^n I_T^a(\tilde{C}_{ij}) \tilde{x}_{ij},$$

$$\text{subject to: } \sum_{j=1}^n \tilde{x}_{ij} \leq \tilde{S}_i, \quad i = 1, 2, \dots, m$$

$$\sum_{i=1}^m \tilde{x}_{ij} \leq \tilde{D}_j, \quad j = 1, 2, \dots, n$$

$$\tilde{x}_{ij} \geq 0, \quad \forall i, j.$$

Existence of Fuzzy Transportation Algorithm can be shown by the following two theorems.

Theorem 1. If $(\tilde{x}_{11}^*, \tilde{x}_{12}^*, \dots, \tilde{x}_{ij}^*, \dots, \tilde{x}_{mn}^*)$ is a visible solution of FTP 2 and $\lambda_{ij} = X_{ij} - (v_i + w_j) \geq 0, \forall i, j$ then $(\tilde{x}_{11}^*, \tilde{x}_{12}^*, \dots, \tilde{x}_{ij}^*, \dots, \tilde{x}_{mn}^*)$ is optimal solution of FTP 2 with $X_{ij} = I_T^a(\tilde{C}_{ij})$, v_i and w_j is real number

Theorem 4 explains that any FTP 2 compatible solution with $\lambda_{ij} \geq 0, \forall i, j$ is optimal solution of FTP 2. This theorem ensures that determination of optimal criteria in Step 6 in Fuzzy Transportation Algorithm is correct. Furthermore, the optimal solution obtained in Step 6 is an optimal solution of FTP 1 that can be assured by following theorem.

Theorem 2. If $(\tilde{x}_{11}^*, \tilde{x}_{12}^*, \dots, \tilde{x}_{ij}^*, \dots, \tilde{x}_{mn}^*)$ is optimal solution of FTP 2 then $(\tilde{x}_{11}^*, \tilde{x}_{12}^*, \dots, \tilde{x}_{ij}^*, \dots, \tilde{x}_{mn}^*)$ is optimal solution of FTP 1.

FTP 2 is more easily resolved than FTP 1 because FTP 2 is a transportation problem with cost transport shaped crisp transportation. Therefore, in Fuzzy Transportation Algorithm to determine

optimal solution of FTP 1, first FTP 1 is changed to FTP 2, then FTP 2 is determined the optimal solution. By using Theorem 5 it is found that optimal solution of FTP 2 is optimal solution from FTP

6. Numerical Example

A motorcycle company has three factories S_1, S_2, S_3 which every week doing production activity with capacity of factory respectively that is $(40,50,60,70)$, $(80,90,60,70)$ and $(80,100,120,140)$ motorcycle unit. The company supplies motorcycle to showrooms located three destinations D_1, D_2, D_3 which has successively supply i.e $(30,40,50,60)$, $(90,95,100,105)$ and $(55,65,75,85)$ motorcycle unit. Transportation costs per motor unit are presented in Table 3. Determine minimum transportation costs of motor shipment from factory to showroom.

Table 3. Full fuzzy transportation

Company	Destination			s_i
	D1	D2	D3	
S1	(6,8,14,16)	(8,9,10,11)	(5,7,11,13)	(40,50,60,70)
S2	(1,3,7,9)	(2,4,12,14)	(7,9,1,13)	(80,90,60,70)
S3	(16,18,22,24)	(6,7,8,9)	(6,7,8,9)	(80,100,120,140)
d_j	(30,40,50,60)	(90,95,100,105)	(55,65,75,85)	

Solution: Supply quantity $\sum_{i=1}^4 \tilde{S}_i = (175,200,225,250)$ and demand quantity $\sum_{j=1}^4 \tilde{D}_j = (200,240,280,320)$.

So $\sum_{i=1}^m \tilde{S}_i \neq \sum_{j=1}^n \tilde{D}_j$. Therefore, added demand of fictitious $\tilde{D}_4 = (25,40,55,70)$.

Next step, defuzzification using the total integral ranking of formula (Eq.5) and obtained in Table 4.

Table 4. Fuzzy transportation of defuzzification

Company	Destination			
	D1	D2	D3	D4
S1	8	6	7	0
S2	5	6	8	0
S3	13	5	5	0

Then using fuzzy transportation algorithm from Sudhagar and Ganesan [2] with least cost method, obtained table visible solution shown in Table 6. Because $\lambda_{ij} \geq 0, \forall i, j$. Then Table 5 shows the visible solution of it, then it determines value of fuzzy objective and compares the fuzzy objective value with the form of trapezoidal fuzzy number presented in Table 7. So $Z = (875,1280,2195,2820), I_T^{0.5}(Z) = 1865$

Table 5. Visible solution of fuzzy transportation

Company	Destination			
	D1	D2	D3	D4
S1	(15,20,25,30)	(0,0,0,0)	(0,0,0,0)	(25,30,35,40)
S2	(15,20,25,30)	(35,40,45,50)	(30,30,30,30)	(0,0,0,0)
S3	(0,0,0,0)	(55,55,55,55)	(25,35,45,55)	(0,0,0,0)

Table 6. Comparison of total integral ranking value fuzzy number

Fuzzy number	$I_T^{0.5}(Z)$	Rank
Trapezoidal (Eq.4)	179	2
Hexagonal (Eq.5)	1865	1

Based on Table 6 it can be seen that use of fuzzy numbers obtained from conversion of trapezoidal fuzzy numbers to hexagonal fuzzy numbers gives different optimum values on the total integral ranking value with optimism index $\alpha = 0.5$. Furthermore, given the problem of crisp transport shown in Table 8 with the optimal value that is $Z = 2315$

Table 7. Comparison of optimal value of crisp transportation and fuzzy transportation

Transportation	Fuzzy number	Optimal Value
Fuzzy	Trapezoidal (Eq.4)	(875,1280,2195,2820)=1792
	Hexagonal (Eq.5)	(875,1280,2195,2820)=1865
Crisp	-	2315

Table 8. Balance of craps transportation

Company	Destination				s_i
	D1	D2	D3	D4	
S1	14	10	11	0	60
S2	7	12	11	0	60
S3	22	8	8	0	120
d_j	50	100	75	15	

Based on Table 8 it is seen that transportation problem with the total integral ranking value by using hexagonal fuzzy number (Eq. 5) has optimal value which is closer than optimal value of crisp transportation problem compared to the total integral ranking value by using trapezoidal fuzzy number (Eq. 4). Thus, the total integral ranking value using the hexagonal fuzzy number has an optimal value better than the total integral ranking value using trapezoidal fuzzy number.

7. Conclusion

This paper provides the latest form of fuzzy membership function derived from conversion of trapezoidal fuzzy numbers to fuzzy hexagonal numbers that can be used for defuzzification using the total integral ranking method. In addition, in the case example a symmetric fuzzy number is generated which results in an optimal solution different from the total integral ranking value using trapezoidal fuzzy numbers. Result of the total integral ranking that uses hexagonal fuzzy number has an optimal value better than the total integral ranking value using trapezoidal fuzzy number.

Reference

- [1] A Kaur and A Kumar 2011 *Applied Mathematical Modelling* **35** 5652
- [2] C Sudhagar and K Ganesan 2012 *Optimisasi Engineering* **17** 965
- [3] A Ebrahimnejad 2013 *International Journal of Systems Science* **46** 2048
- [4] A Gupta and A Kumar 2012 *Applied Mathematical Modelling* **36** 1421
- [5] P Pandian and G Natarajan 2010 *Applied Mathematical Sciences* **4** 79
- [6] A Hatami-Marbini and M Tavana 2011 *International Journal of Mathematics in Operational Research* **3** 44
- [7] A Chakraborty and M Chakraborty 2010 *Journal of Transportation Systems Engineering and Information Technology* **10** 53
- [8] H. Basirzadeh 2011 *Applied Mathematical Sciences* **5** 1549
- [9] S. Saati, A Hatami-Marbini, M Tavana and E Hajiahkondi 2012 *International Journal of Fuzzy System Applications* **2** 1
- [10] A Kumar, J Kaur and P Singh 2011 *Applied Mathematical Modelling* **35** 817
- [11] D Dinagar, Stephen and J R Kannan 2014 *International Journal of Fuzzy Mathematics and Systems* **4** 193

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