





## Ranking Z-numbers Using the Optimal Clustering Method

Saeed jafari, PhD Student<sup>1</sup>  | Mojtaba Najafi, Associate Professor<sup>2\*</sup>  | Naghi Moadabi Pirkolachahi, Assistant Professor<sup>3</sup>  | Najmeh Cheraghi Shirazi, Assistant Professor<sup>4</sup> 

<sup>1</sup>Department of Electrical Engineering, Bushehr Branch, Islamic Azad University, Bushehr Branch, Iran, saeed0jafari@gmail.com

<sup>2</sup> Department of Electrical Engineering, Bushehr Branch, Islamic Azad University, Bushehr Branch, Iran, mojtaba.najafi@iau.ac.ir

<sup>3</sup> Department of Electrical Engineering, Bushehr Branch, Islamic Azad University, Bushehr Branch, Iran, n.moaddabi@rayavin.com

<sup>4</sup> Department of Electrical Engineering, Bushehr Branch, Islamic Azad University, Bushehr Branch, Iran, na.cheraghi@iau.ac.ir

Corresponding Author:  
Mojtaba Najafi, Associate Professor of Electrical Engineering, Bushehr Branch, Islamic Azad University, Bushehr, Iran, mojtaba.najafi@iau.ac.ir

**Received:** 6 June 2023

**Revised:** 22 August 2023

**Accepted:** 9 September 2023

### Abstract

The use of new concepts in modeling uncertainties by natural language words has gained attention in recent years. The concept of Z number is one of these concepts that was proposed by Dr. Zadeh in 2011. The purpose of Z-number is to model inaccurate natural language sentences by a pair of fuzzy numbers (A,B), the first component of which indicates the possibility of occurrence and the second component indicates the probability of occurrence of the first number. Today, one of the important challenges of Z-number among researchers is the formation of the structure of the first component and the second component, if the researchers use inappropriate strategies in forming these components, this factor will cause the final results to be miscalculated. This weakness is more evident in group decision-making with a high volume of information. In order to solve this problem, the authors of this paper suggest optimal clustering of collected data. The proposed solution causes the first and second components of Z number to be formed in a purposeful manner. In order to validate the proposed method, the results of the proposed method are compared with the fuzzy method.

**Keywords:** Possibilitive-probability, Unsupervised clustering, Z-number, CZ number, Fuzzy.

### Highlights

- Using the unsupervised learning method in the optimal selection of expert opinions.
- Effectiveness of the proposed method in choosing the optimal opinions of experts in the conditions of large and complex data sets of expert opinions.
- Determining the optimal points in order to determine the points that make up the intervals of the Z-number.
- The use of any method or algorithm for unsupervised clustering of points forming the Z-number.

**Citation:** [in Persian].