









# Defuzzification of Intuitionistic Z-Numbers for Fuzzy Multi Criteria Decision Making

Nik Muhammad Farhan Hakim Nik Badrul Alam<sup>1,2</sup> ,  
Ku Muhammad Naim Ku Khalif<sup>1</sup>  , Nor Izzati Jaini<sup>1</sup> ,  
Ahmad Syafadhli Abu Bakar<sup>3</sup> , and Lazim Abdullah<sup>4</sup> 

<sup>1</sup> Centre for Mathematical Sciences, Universiti Malaysia Pahang, Gambang, Malaysia  
kunaim@ump.edu.my

<sup>2</sup> Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Pahang,  
Bandar Tun Abdul Razak Jengka, Pahang, Malaysia

<sup>3</sup> Mathematics Division, Centre for Foundation Studies in Science, University of Malaya,  
Kuala Lumpur, Malaysia

<sup>4</sup> Management Science Research Group, Faculty of Ocean Engineering Technology and  
Informatics, Universiti Malaysia Terengganu, Kuala Nerus, 21030 Kuala Terengganu,  
Terengganu, Malaysia

**Abstract.** Z-numbers and intuitionistic fuzzy numbers are both important as they consider the reliability of the judgement, membership and non-membership functions of the numbers. The combination of these two numbers produce intuitionistic Z-numbers which need to be defuzzified before aggregation of multiple experts' opinions could be done in the decision making problems. This paper presents the generalised intuitionistic Z-numbers and proposes a centroid-based defuzzification of such numbers, namely intuitive multiple centroid. The proposed defuzzification is used in the decision making model and applied to the supplier selection problem. The ranking of supplier alternatives is evaluated using the ranking function based on centroid. In the present paper, the ranking is improved since the intuitionistic fuzzy numbers (IFN) are integrated within the evaluations which were initially in form of Z-numbers, considering their membership and non-membership grades. The ranking of the proposed model gives almost similar ranking to the existing model, with simplified but detailed defuzzification method.

**Keywords:** Intuitionistic Z-numbers · Defuzzification · Intuitive multiple centroid · Ranking function · Aggregation

## 1 Introduction

With the basis of uncertainty, Zadeh [1] introduced the knowledge of fuzzy set by considering the value in the interval  $[0, 1]$  for its membership value instead of crisp numbers. This concept was further extended by Dubois and Prade [2] by defining a fuzzy number (FN), which is a fuzzy subset of real number whereby its maximum membership values are surrounding the average value [2]. Some commonly used shapes of FNs are trapezoidal and triangular FNs.