



**EDITORIAL**

## **Introduction to the Special Issue on Advances in Neutrosophic and Plithogenic Sets for Engineering and Sciences: Theory, Models, and Applications**

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Recently, research on uncertainty modeling has been progressing rapidly, and many essential and breakthrough studies have already been done. There are various ways to handle these uncertainties, such as fuzzy and intuitionistic fuzzy sets. Although these concepts can take incomplete information in various real-world issues, they cannot address all types of uncertainty, such as indeterminate and inconsistent information. The neutrosophic theory founded by Florentin Smarandache in 1998 constitutes a further generalization of fuzzy set, intuitionistic fuzzy set, picture fuzzy set, Pythagorean fuzzy set, spherical fuzzy set, etc. Since then, this logic has been applied in various science and engineering domains.

Furthermore, the plithogenic set (as a generalization of crisp, fuzzy, Intuitionistic fuzzy, and neutrosophic sets) was introduced by Smarandache in 2017. The plithogenic set is a set whose elements are characterized by attribute values. This special considered new and recent developments in methodologies, techniques, and applications of Neutrosophic and plithogenic sets for various practical problems and demonstrated the challenging issues.

Twenty articles were chosen from a large number of submissions after a thorough peer-review procedure.

Six articles in the discipline of pure mathematics have been chosen. [Muhiuddin et al.](#) concentrated on ordered semigroups with neutrosophic  $\kappa$ -structures. They defined and examined the characteristics of neutrosophic  $\kappa$ -ideals and neutrosophic  $\kappa$ -interior ideals in ordered semigroups. [Mehmood et al.](#) developed a new notion of vague soft bi-topological space and its structural properties with a new definition. This method is based on vague soft open sets, which are generalized vague soft open sets. [In another paper](#), the authors suggested a new generalized neutrosophic soft  $* b$  open set in neutrosophic soft bi-topological structures (NSBTS). [Saber et al.](#) proposed single-valued neutrosophic regularity spaces as a new word for single-valued neutrosophic ideas in the ostak meaning. Moreover, they introduced the concept of  $r$ -single-valued neutrosophic  $\theta\mathcal{L}$ -cluster point and  $r$ -single-valued neutrosophic  $\gamma \mathcal{L}$ -cluster point,  $r$ - $\theta\mathcal{L}$ -closed, and  $\theta\mathcal{L}$ -closure operators and studied some of their properties. In the Neutrosophic set, [Basumatary et al.](#) investigated the origin, nature, and extent of neutrality. Based on the neutrosophic set, they are guided to execute their task in semi-continuous and virtually continuous mapping. On a Sheffer stroke BL-algebra, [Katican et al.](#) developed a neutrosophic N-subalgebra, an (ultra) neutrosophic N-filter, level sets of these neutrosophic N-structures, and their



characteristics. It is shown that the level set of neutrosophic N-subalgebras on the algebraic structure is its quasi-subalgebra and vice versa by establishing a quasi-subalgebra of a Sheffer stroke BL-algebra.

In the field of decision-making, eight papers have been selected. [Mahmood et al.](#) employed a multi-attribute decision-making (MADM) model with Dombi-normalized weighted Bonferroni mean operators with innovative multiple-valued complicated neutrosophic uncertain language sets. [Ajay et al.](#) explored the usefulness of the sine trigonometry operational laws (ST-OLs) by extending them to neutrosophic sets and operations. This study focuses on developing these ST-OLs into complicated neutrosophic sets. ST-OLs are used to prove several mathematical properties. Then, using an unsupervised criterion weighting methodology termed the Entropy-ST-OLs-CNDM method, they constructed a decision-making system based on these operators. [Zeng et al.](#) created the complex T-spherical dual hesitant linguistic set theory, combining three concepts: complex T-spherical fuzzy set, double hesitant fuzzy set, and uncertain linguistic set.

Furthermore, the offered operators check the competency and capabilities of the identified ways, which solves an issue with enterprise informatization level evaluation. An indeterminate fuzzy multiset was introduced by [Du et al.](#), in which any element in a universe set can be repeated several times with various and/or identical indeterminate membership values. The parameterized correlation coefficients of indeterminate fuzzy multisets were then reported based on the de-neutrosophication of indeterminate fuzzy multisets transformed into parameterized fuzzy multisets by a parameter. They also created fuzzy multisets with distinct choice risks for decision-makers (small, moderate, and big risks) to deal with multicriteria group decision-making problems in an indeterminate fuzzy multiset context. The neutrosophic parameterized hypersoft sets were conceptualized by [Rahman et al.](#) under the settings of fuzzy set, intuitionistic fuzzy set, and neutrosophic set, as well as some of their fundamental characteristics and set-theoretic operations. Then, using these ideas, they presented decision-making-based algorithms. The p-indeterminate cosine measure, p-indeterminate Dice measure, and p-indeterminate Jaccard measure of orthopair neutrosophic number set (ONNS) in vector space were proposed by [Zhao et al.](#). Then, by selecting different indeterminate degrees of the parameter p, a DM approach based on parameterized indeterminate vector similarity measures of ONNSs is devised to tackle indeterminate multiple attribute DM issues. [Zeng et al.](#) created a hybrid new model called the m-polar Diophantine neutrosophic N-soft set, which combines neutrosophic and soft sets. They also defined a novel choice-value function to show how the suggested set may be used in multi-attribute decision-making challenges. [Xu et al.](#) developed a new strategy for solving multi-attribute decision-making issues in a multi-valued neutrosophic environment based on TODIM and TOPSIS.

Two articles on the topic of optimization issues have been chosen. [Fallah et al.](#) used the neutrosophic programming approach to create a multi-objective sustainable biomass supply chain network. In this study, the Neutrosophic programming approach tries to maximize the overall expenses of the supply chain network, the quantity of greenhouse gas emissions, the number of prospective employees employed, and the duration of product movement through the supply chain network at the same time. [Ahmed et al.](#) devised a new approach for solving linear programming issues based on bipolar single-valued neutrosophic sets, employing the score function to convert bipolar single-valued neutrosophic difficulties into crisp linear programming problems.

Three articles on the topic of neutrosophic set applications have been chosen. When all observations are undermined, imprecise, or fuzzy, [Shafqat et al.](#) devised two control charts in an uncertain environment or neutrosophic statistical interval system. Neutrosophic double and triple exponentially weighted moving average (NDEWMA and NTEWMA) control charts are what they're called.

According to the simulation research and real-world implementations, the suggested NDEWMA and NTEWMA charts outperform the existing control charts in terms of monitoring the process of road traffic collisions and electric engineering data. Wang et al. used a neutrosophic number methodology to examine the indeterminate information on rock joint roughness. They proposed a method to capture the incomplete, uncertain, and inaccurate knowledge of the joint roughness coefficient (JRC) in uncertain situations. The JRC values for sandstone joint samples acquired from a rock landslide were then determined using the suggested approach. The efficiency of the neutrosophic number was confirmed by comparing the JRC findings obtained by the recommended method to experimental data. Duran et al. assessed the Five Facet Mindfulness Questionnaire in its neutrosophic version, developed from the short form of the Five Facet Mindfulness Questionnaire.

Finally, Hussain et al. introduced the quadripartitioned bipolar single-valued neutrosophic graph as a novel notion in graph theory. The quadripartitioned bipolar single-valued neutrosophic graph's Cartesian product, cross product, lexicographic product, strong product, and composition are examined. Finally, we hope that this special issue will contribute to the development of neutrosophical techniques and will benefit a wider audience of academics, practitioners, and students interested in relevant themes.

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