Poincare Journal of Analysis & Applications
Vol. 13, No. 1 (2026), 103-114

DOI: 10.46753/pjaa.2026.v013i01.007
Online Published on 05. 07. 2026

AXIOMATIC STUDY OF CONNECTEDNESS AND SEPARATION IN NEUTROSOPHIC TOPOLOGICAL SPACES

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Date of Receiving : 22. 02. 2026
Date of Acceptance : 20. 06. 2026

Abstract. An exhaustive analysis of neutrosophic topological structures is performed here, where classical topology is unified with neutrosophic ambiguity, expressed through the independent degrees of truth (T), indeterminacy (I), and non-membership (F). We explore fundamental properties including connectedness, countability axioms, and separation axioms, and extend the framework to superhyper-neutrosophic topology, which models complex relationships under uncertainty. Formal definitions, examples, theorems, and proofs are provided to rigorously establish the structure and behavior of these spaces. The results demonstrate that neutrosophic topologies generalize classical notions and offer a robust tool for modeling systems with incomplete or contradictory information, providing theoretical foundations for applications in decision-making, information processing, and network analysis.

1. Introduction

The field of topology has historically concentrated on spatial attributes that endure through continuous transformations, usually predicated on a dichotomous membership system. However, this binary perspective is often insufficient for describing real-world scenarios characterized by significant vagueness or data gaps. Addressing these limitations, the neutrosophic framework developed by Smarandache expands upon classical and fuzzy methodologies by evaluating every element through three independent parameters: truth-membership (T), indeterminacy (I), and falsity-membership (F). This tripartite model offers a sophisticated mechanism for encoding nuanced knowledge, making it possible to rigorously model systems that contain paradoxical or unreliable information

By merging neutrosophic logic with traditional topological principles, we construct neutrosophic topological environments where standard spatial attributes, such as open

2010 *Mathematics Subject Classification.* 54A05, 54D10.
Key words and phrases. Neutrosophic, Topology, Seperation axioms.
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