

Chapter 4

Some New Results on Neutrosophic Soft Relations and Its Applications

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ABSTRACT

In neutrosophic soft relation, if only the parameters or alternatives are processed, the relations may not give the desired clear result. In this chapter, in order to overcome this problem, a cartesian product is defined on neutrosophic soft sets with a different approach. With this approach, both alternatives and parameters are processed. Then, the concept of neutrosophic soft relation is denoted by using the definition of Cartesian product. The important features of the presented structures are examined, and various examples are given. In addition, the basic method that can be used in decision-making problems is presented by using the concept of neutrosophic soft relation.

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1. INTRODUCTION

In 1965, Zadeh (Zadeh, 1965), introduced the idea of fuzzy set theory, which is used to address uncertainty in many real-world applications. Zadeh specified that there is a considerable amount of ambiguity in most real-life situations and physical problems that the classical set theory and its normal mathematical theories centered on such set theory did not give us the necessary knowledge and inferences. Later, the fuzzy set is generalized as the concept of the intuitionistic fuzzy set by Atanassov (Atanassov, 1986).

Molodtsov described soft set theory (Molodtsov, 1999) in 1999 as a new mathematical instrument for dealing with uncertainty, and how soft set theory is free of the parameterization inadequacy syndrome of fuzzy set theory and probability theory. In soft set theory, the challenge of determining the membership function, among other related issues, does not arise. As a result, the theory is highly straightforward and simple to use in practice. In line with this, Maji et al., presented a viewpoint on fuzzy soft sets and intuitionistic fuzzy soft sets (Maji et al., 2001a, 2001b). Soft sets and other set structures used in hybrid architectures are still being investigated extensively (Mehmood et al., 2022; Feng et al., 2010; Yolcu & Ozturk, 2021,2022; Yolcu et al., 2021a; Ozturk, 2016, 2018; Ozturk & Bayramov, 2017)

In 1999, Smarandache was established the concept of neutrosophic set (Smarandache, 1999). A membership function, an indeterminacy function, and a non membership function characterize a neutrosophic set. The functions are connected separately, with membership, indeterminacy, and non-membership functional values belonging to $[0,1]$. Later, Maji (Maji, 2013). proposed a combined notion called Neutrosophic soft set (NSS), which was later extended and generalized by (Bui et al., 2022; Tran et al., 2022; Yolcu et al., 2021b, 2023a, 2023b; Broumi, 2013; Broumi & Smarandache, 2013; Hussain & Shabir, 2015; Maji, 2015; Ozturk et al., 2021a, 2021b; Gunduz et al., 2019) and others. Presently, work on this NSS theory is progressing rapidly in different branches of Mathematics.

The use of fuzzy relations (Zadeh, 1965) arose from the realization that real-world items might be connected to each other to some extent. In the sense that they provide the degree to which two items are connected to each other, fuzzy relations can describe ambiguity. They cannot, however, model uncertainty. As a result, Bustince and Burillo (Bustince & Burillo, 1996) defined intuitionistic fuzzy relations, and Dinda and Samanta (Dinda & Samanta, 2012) defined intuitionistic fuzzy soft relations. This allows for the inclusion of uncertainty to some extent, but it does not manage indeterminacy of membership degree. As a result, Deli and Broumi (Deli & Broumi, 2015) launched neutrosophic soft connections. Many academics have recently explored fuzzy relations (Di Nola et al. 1988; Dutta & Chakraborty, 2015),

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