Neutrosophic Knowledge, Vol. 10, 2026
University of New Mexico

Article

Neutrosophic partial derivative with two variables by AH-Isometry

Ahmed Hatip[1], Taqi-Aldin Alkhatib [2,*]

[1] Department of Mathematics, Gaziantep University, Turkey , e-mail: Kollnaar5@gmail.com

[2] Department of Mathematics, Faculty of Science, Aleppo University, Syria , e-mail: taaaqimath@e-mail.com

* Correspondence: e-mail: taaaqimath@e-mail.com

Received: 02, 20, 2026; *Accepted:* 03, 25, 2026

Abstract:

This paper introduces a rigorous formulation of the neutrosophic partial derivative as a natural extension of the classical notion of partial differentiation. The principal difficulty in this context arises from the indeterminate nature of the neutrosophic component which lacks a fixed numerical value and therefore obstructs a direct analytical definition. To overcome this obstacle, we employ a one-dimensional isometric transformation that preserves distances while mapping the problem into a classical analytical framework. This transformation enables a simplified treatment within classical logic, after which the results are consistently transferred back to the neutrosophic setting. The proposed approach provides a coherent and mathematically sound methodology for defining and analyzing neutrosophic partial derivatives.

Keywords: Neutrosophic Partial derivative, isometric transformation, Neutrosophic logic.

1. Introduction

Neutrosophic logic, introduced by Florentin Smarandache, was proposed as a comprehensive mathematical framework for modeling uncertainty, indeterminacy, and inconsistency beyond the capabilities of classical and fuzzy logics [1]. Within this framework, Smarandache defined the standard form of neutrosophic real numbers and established the necessary conditions for the existence of division between two neutrosophic real numbers [2]. Subsequently, in 2013, he introduced the concepts of neutrosophic integration and mereo-integrals, together with neutrosophic analogues of classical notions such as limits, continuity, derivatives, and integrals [3].

Further developments in neutrosophic analysis include applications of neutrosophic triplet groups to physics [4], as well as numerous studies that significantly expanded the theoretical foundations and applications of neutrosophic mathematics [5]. Owing to the central role of calculus in mathematical analysis, Smarandache later presented the fundamentals of neutrosophic pre-calculus and neutrosophic calculus, focusing on the study of neutrosophic functions and their properties [6–7].

In a related direction, Ahmed Hatip introduced the concept of special neutrosophic functions, defining new classes of functions within neutrosophic logic. As particular cases, he proposed neutrosophic versions of the floor (greatest integer) function, the absolute value function, and the signum function [8]. Despite these advances, defining derivatives—especially partial derivatives—in the neutrosophic setting remains a challenging problem due to the inherent indeterminacy of the neutrosophic component.

Motivated by this challenge, the present work adopts a geometric perspective based on isometric transformations to establish a consistent definition of the neutrosophic partial derivative.**2.**

Preliminaries

2.1 Neutrosophic Real Number [2]

Suppose that u is a neutrosophic number, then it takes the following standard form: $u = u_1 + u_2 I$ where u_1, u_2 are real coefficients, and I represent indeterminacy, such $0.I = 0$ and $In = I$, for all positive integers n.

2.2 Definition [9]

Let $R(I) = \{a + bI \,; a, b \in R\}$ where $I^2 = I$ be the neutrosophic field of reals. The one-dimensional Isometry (AH-Isometry) is defined as follows:

$$T: R(I) \to R \times R$$
$$T(a + bI) = (a, a + b)$$

2.3 Remark [9]

T is an algebraic isomorphism between two rings, it has the following properties:

1) T is bijective.
2) T preserve addition and multiplication, i.e:
$$T[(a + bI) + (c + dI)] = T(a + bI) + T(c + dI)$$
$$T[(a + bI).(c + dI)] = T(a + bI).T(c + dI)$$
3) Since T is bijective, then it is invertible by:
$$T^{-1}: R \times R \to R(I) \quad , \qquad T^{-1}(a, b) = a + (b - a)I$$
4) T preserves distance, i.e.: The distance on $R(I)$ can be defined as follows:

Let $= a + bI$, $B = c + dI$ be two neutrosophic real numbers, then:

$\|\overrightarrow{AB}\| = |a - c| + I[|a + b - c - d| - |a - c|]$.

On the other hand, we have:

$T(\|\overrightarrow{AB}\|) = \|T(\overrightarrow{AB})\|$.

This implies that distance is preserved up to isometry. i.e. $\|T(AB)\| = T(\|AB\|)$

2.4 Definition [10]

Let $: R(I) \to R(I)$; $f = f(X)$ and $X = x_1 + x_2 I \in R(I)$ the f is called a neutrosophic real function with one neutrosophic variable.

A neutrosophic real function $f(X)$ written as follows:

$$f(X) = f(x_1 + x_2 I) = f(x_1) + I[f(x_1 + x_2) - f(x_1)]$$

2.5 Theorem [11]

Any neutrosophic real function into two classical real functions, i.e., to the classical Euclidean plane $R \times R$.

Proof: Let $f(X) = f(x_1 + x_2 I) = f(x_1) + I[f(x_1 + x_2) - f(x_1)]$ a neutrosophic real function.

Now, using the one-dimensional AH-isometry, we have:

$$\begin{cases} f_1 = f(x_1) \\ f_2 = f(x_1 + x_2) \end{cases}$$

The functions (x_1) , $f(x_1 + x_2)$ are real functions.

2.6 Definition:

Let $(X, Y): R(I) \times R(I) \to R(I) \times R(I)$; $X = x_1 + x_2I$, $Y = y_1 + y_2I \in R(I)$ the f is called a neutrosophic real function with two neutrosophic variable, and we can written as follows:

$$f(X, Y) = f(x_1 + x_2I, y_1 + y_2I) = f(x_1, y_1) + I[f(x_1 + x_2, y_1 + y_2) - f(x_1, y_1)]$$

3. Neutrosophic Partial derivative:

In this section we define Neutrosophic Partial derivative with two neutrosophic variable.

3.1 Definition:

Let $\boldsymbol{f(X, Y) = f(x_1 + x_2I, y_1 + y_2I) = f(x_1, y_1) + I[f(x_1 + x_2, y_1 + y_2) - f(x_1, y_1)]}$ a neutrosophic function on $\boldsymbol{R(I) \times R(I)}$, then we define a neutrosophic partial derivative with two neutrosophic variable $\boldsymbol{f(X, Y)}$ as follows:

$$\boldsymbol{\frac{\partial f}{\partial X} = f_X = \lim_{\Delta X \to 0} \frac{f(X + \Delta X, Y) - f(X, Y)}{\Delta X}} \qquad (1)$$

Where $X = x_1 + x_2I$, $Y = y_1 + y_2I \in R(I)$, then:

$$\frac{\partial f}{\partial X} = f_X = \lim_{\Delta x_1 \to 0} \frac{f(x_1 + \Delta x_1, y_1) - f(x_1, y_1)}{\Delta x_1} +$$

$$I\left[\lim_{\Delta(x_1+x_2)\to 0} \frac{f\big(x_1 + x_2 + \Delta(x_1 + x_2), (y_1 + y_2)\big) - f(x_1 + x_2, y_1 + y_2)}{\Delta(x_1 + x_2)} - \lim_{\Delta x_1 \to 0} \frac{f(x_1 + \Delta x_1, y_1) - f(x_1, y_1)}{\Delta x_1}\right] \qquad (2)$$

Take AH-Isometry for (2), we have:

$$\begin{cases} \frac{\partial f}{\partial x_1} = f_{x_1} = \lim_{\Delta x_1 \to 0} \frac{f(x_1+\Delta x_1, y_1) - f(x_1, y_1)}{\Delta x_1} \\ \frac{\partial f}{\partial(x_1+x_2)} = f_{(x_1+x_2)} = \lim_{\Delta(x_1+x_2)\to 0} \frac{f\big(x_1+x_2+\Delta(x_1+x_2),(y_1+y_2)\big) - f(x_1+x_2, y_1+y_2)}{\Delta(x_1+x_2)} \end{cases}$$

$\frac{\partial f}{\partial x_1}$, $\frac{\partial f}{\partial(x_1+x_2)}$ are two partial derivative classical.

Now we take invertible AH-Isometry, we have a neutrosophic partial derivative:

$$\frac{\partial f}{\partial X} = f_X = T^{-1}\left[\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial(x_1 + x_2)}\right] = \lim_{\Delta x_1 \to 0} \frac{f(x_1 + \Delta x_1, y_1) - f(x_1, y_1)}{\Delta x_1} +$$

$$I\left[\lim_{\Delta(x_1+x_2)\to 0} \frac{f\big(x_1 + x_2 + \Delta(x_1 + x_2), (y_1 + y_2)\big) - f(x_1 + x_2, y_1 + y_2)}{\Delta(x_1 + x_2)} - \lim_{\Delta x_1 \to 0} \frac{f(x_1 + \Delta x_1, y_1) - f(x_1, y_1)}{\Delta x_1}\right] = \lim_{\Delta X \to 0} \frac{f(X + \Delta X, Y) - f(X, Y)}{\Delta X}$$

3.2 Definition:

Let $\boldsymbol{f(X, Y) = f(x_1 + x_2I, y_1 + y_2I) = f(x_1, y_1) + I[f(x_1 + x_2, y_1 + y_2) - f(x_1, y_1)]}$ a neutrosophic function on $\boldsymbol{R(I) \times R(I)}$, then we define a neutrosophic partial derivative with two neutrosophic variable $\boldsymbol{f(X, Y)}$ as follows:

$$\boldsymbol{\frac{\partial f}{\partial Y} = f_Y = \lim_{\Delta Y \to 0} \frac{f(X, Y + \Delta Y) - f(X, Y)}{\Delta Y}} \qquad (3)$$

Where $X = x_1 + x_2I$, $Y = y_1 + y_2I \in R(I)$, then:

$$\frac{\partial f}{\partial Y} = f_Y = \lim_{\Delta y_1 \to 0} \frac{f(x_1, y_1 + \Delta y_1) - f(x_1, y_1)}{\Delta y_1} +$$

$$I\begin{bmatrix}\lim_{\Delta(y_1+y_2)\to 0}\frac{f\big(x_1+x_2,y_1+y_2+\Delta(y_1+y_2)\big)-f(x_1+x_2,y_1+y_2)}{\Delta(y_1+y_2)}-\\ \lim_{\Delta y_1\to 0}\frac{f(x_1,y_1+\Delta y_1)-f(x_1,y_1)}{\Delta y_1}\end{bmatrix} \qquad (4)$$

Take AH-Isometry for (4), we have:

$$\begin{cases}\frac{\partial f}{\partial y_1}=f_{y_1}=\lim_{\Delta y_1\to 0}\frac{f(x_1,y_1+\Delta y_1)-f(x_1,y_1)}{\Delta y_1}\\ \frac{\partial f}{\partial(y_1+y_2)}=f_{(y_1+y_2)}=\lim_{\Delta(y_1+y_2)\to 0}\frac{f\big(x_1+x_2,y_1+y_2+\Delta(y_1+y_2)\big)-f(x_1+x_2,y_1+y_2)}{\Delta(y_1+y_2)}\end{cases}$$

$\frac{\partial f}{\partial y_1}$, $\frac{\partial f}{\partial(y_1+y_2)}$ are two partial derivative classical.

Now we take invertible AH-Isometry, we have a neutrosophic partial derivative:

$$\frac{\partial f}{\partial Y}=f_Y=T^{-1}\left[\frac{\partial f}{\partial y_1},\frac{\partial f}{\partial(y_1+y_2)}\right]$$

$$=\lim_{\Delta y_1\to 0}\frac{f(x_1,y_1+\Delta y_1)-f(x_1,y_1)}{\Delta y_1}+I\begin{bmatrix}\lim_{\Delta(y_1+y_2)\to 0}\frac{f\big(x_1+x_2,y_1+y_2+\Delta(y_1+y_2)\big)-f(x_1+x_2,y_1+y_2)}{\Delta(y_1+y_2)}-\\ \lim_{\Delta y_1\to 0}\frac{f(x_1,y_1+\Delta y_1)-f(x_1,y_1)}{\Delta y_1}\end{bmatrix}$$

$$=\lim_{\Delta Y\to 0}\frac{f(X,Y+\Delta Y)-f(X,Y)}{\Delta Y}$$

3.3 Remark:

Let $\boldsymbol{f(X,Y)=f(x_1+x_2I,y_1+y_2I)=f(x_1,y_1)+I[f(x_1+x_2,y_1+y_2)-f(x_1,y_1)]}$ a neutrosophic function on $\boldsymbol{R(I)\times R(I)}$, then a neutrosophic partial derivative with two neutrosophic variables $\boldsymbol{f(X,Y)}$:

1) $\frac{\partial}{\partial X}\left(\frac{\partial f}{\partial X}\right)=\frac{\partial^2 f}{\partial X^2}=f_{XX}=\lim_{\Delta X\to 0}\frac{f_X(X+\Delta X,Y)-f_X(X,Y)}{\Delta X}=\lim_{\Delta x_1\to 0}\frac{f_{x_1}(x_1+\Delta x_1,y_1)-f_{x_1}(x_1,y_1)}{\Delta x_1}+$

$$I\begin{bmatrix}\lim_{\Delta(x_1+x_2)\to 0}\frac{f_{(x_1+x_2)}\big(x_1+x_2+\Delta(x_1+x_2),(y_1+y_2)\big)-f_{(x_1+x_2)}(x_1+x_2,y_1+y_2)}{\Delta(x_1+x_2)}-\\ \lim_{\Delta x_1\to 0}\frac{f_{x_1}(x_1+\Delta x_1,y_1)-f_{x_1}(x_1,y_1)}{\Delta x_1}\end{bmatrix} \qquad (5)$$

2) $\frac{\partial f}{\partial Y}\left(\frac{\partial f}{\partial Y}\right)=\frac{\partial^2 f}{\partial Y^2}=f_{YY}=\lim_{\Delta Y\to 0}\frac{f_Y(X,Y+\Delta Y)-f_Y(X,Y)}{\Delta Y}=\lim_{\Delta y_1\to 0}\frac{f_{y_1}(x_1,y_1+\Delta y_1)-f_{y_1}(x_1,y_1)}{\Delta y_1}+$

$$I\begin{bmatrix}\lim_{\Delta(y_1+y_2)\to 0}\frac{f_{(y_1+y_2)}\big(x_1+x_2,y_1+y_2+\Delta(y_1+y_2)\big)-f_{(y_1+y_2)}(x_1+x_2,y_1+y_2)}{\Delta(y_1+y_2)}-\\ \lim_{\Delta y_1\to 0}\frac{f_{y_1}(x_1,y_1+\Delta y_1)-f_{y_1}(x_1,y_1)}{\Delta y_1}\end{bmatrix} \qquad (6)$$

3) $\frac{\partial}{\partial X}\left(\frac{\partial f}{\partial Y}\right)=\frac{\partial^2 f}{\partial X\partial Y}=f_{YX}=\lim_{\Delta X\to 0}\frac{f_Y(X+\Delta X,Y)-f_Y(X,Y)}{\Delta X}=\lim_{\Delta x_1\to 0}\frac{f_{y_1}(x_1+\Delta x_1,y_1)-f_{y_1}(x_1,y_1)}{\Delta x_1}+$

$$I\begin{bmatrix}\lim_{\Delta(x_1+x_2)\to 0}\frac{f_{(y_1+y_2)}\big(x_1+x_2+\Delta(x_1+x_2),(y_1+y_2)\big)-f_{(y_1+y_2)}(x_1+x_2,y_1+y_2)}{\Delta(x_1+x_2)}-\\ \lim_{\Delta x_1\to 0}\frac{f_{y_1}(x_1+\Delta x_1,y_1)-f_{y_1}(x_1,y_1)}{\Delta x_1}\end{bmatrix} \tag{7}$$

4) $\frac{\partial}{\partial Y}\left(\frac{\partial f}{\partial X}\right)=\frac{\partial^2 f}{\partial Y\partial X}=f_{XY}=\lim_{\Delta Y\to 0}\frac{f_X(X,Y+\Delta Y)-f_X(X,Y)}{\Delta Y}=\lim_{\Delta y_1\to 0}\frac{f_{x_1}(x_1,y_1+\Delta y_1)-f_{x_1}(x_1,y_1)}{\Delta y_1}+$

$$I\begin{bmatrix}\lim_{\Delta(y_1+y_2)\to 0}\frac{f_{(x_1+x_2)}\big(x_1+x_2,y_1+y_2+\Delta(y_1+y_2)\big)-f_{(x_1+x_2)}(x_1+x_2,y_1+y_2)}{\Delta(y_1+y_2)}-\\ \lim_{\Delta y_1\to 0}\frac{f_{x_1}(x_1,y_1+\Delta y_1)-f_{x_1}(x_1,y_1)}{\Delta y_1}\end{bmatrix} \tag{8}$$

4. Example:

Find $\boldsymbol{f_X}$ a Neutrosophic partial derivative using by definition:

$$\boldsymbol{f(X,Y)=XY^2+X^2Y}$$

Sol: let $\boldsymbol{X=x_1+x_2I}$, $\boldsymbol{Y=y_1+y_2I}\in \boldsymbol{R(I)}$, then:

$$f(X,Y)=x_1{y_1}^2+{x_1}^2y_1+I\begin{bmatrix}(x_1+x_2)(y_1+y_2)^2+(x_1+x_2)^2(y_1+y_2)-\\ (x_1{y_1}^2+{x_1}^2y_1)\end{bmatrix} \tag{9}$$

Now take AH-Isometry for (9), we have:

$$\begin{cases}f(x_1,y_1)=x_1{y_1}^2+{x_1}^2y_1 & (10)\\ f(x_1+x_2,y_1+y_2)=(x_1+x_2)(y_1+y_2)^2+(x_1+x_2)^2(y_1+y_2) & (11)\end{cases}$$

By using definition 3.1 on (10):

$$\frac{\partial f}{\partial x_1}=f_{x_1}=\lim_{\Delta x_1\to 0}\frac{f(x_1+\Delta x_1,y_1)-f(x_1,y_1)}{\Delta x_1}$$

$$f(x_1+\Delta x_1,y_1)-f(x_1,y_1)=(x_1+\Delta x_1){y_1}^2+(x_1+\Delta x_1)^2y_1-x_1{y_1}^2-{x_1}^2y_1$$

$$=x_1{y_1}^2+\Delta x_1{y_1}^2+{x_1}^2y_1+2x_1\Delta x_1y_1++(\Delta x_1)^2y_1-x_1{y_1}^2-{x_1}^2y_1$$

$$=\Delta x_1{y_1}^2+2x_1\Delta x_1y_1+(\Delta x_1)^2y_1=\Delta x_1({y_1}^2+2x_1y_1+\Delta x_1y_1)\quad\Longrightarrow$$

$$\frac{\partial f}{\partial x_1}=f_{x_1}=\lim_{\Delta x_1\to 0}\frac{\Delta x_1({y_1}^2+2x_1y_1+\Delta x_1y_1)}{\Delta x_1}=\lim_{\Delta x_1\to 0}({y_1}^2+2x_1y_1+\Delta x_1y_1)={y_1}^2+2x_1y_1$$

By using definition 3.1 on (11):

$$\frac{\partial f}{\partial(x_1+x_2)}=f_{(x_1+x_2)}=\lim_{\Delta(x_1+x_2)\to 0}\frac{f\big(x_1+x_2+\Delta(x_1+x_2),(y_1+y_2)\big)-f(x_1+x_2,y_1+y_2)}{\Delta(x_1+x_2)}$$

$$f\big(x_1+x_2+\Delta(x_1+x_2),(y_1+y_2)\big)-f(x_1+x_2,y_1+y_2)$$

$$=\big(x_1+x_2+\Delta(x_1+x_2)\big)(y_1+y_2)^2+\big(x_1+x_2+\Delta(x_1+x_2)\big)^2(y_1+y_2)-(x_1+x_2)(y_1+y_2)^2$$

$$-(x_1+x_2)^2(y_1+y_2)$$

$$= (x_1 + x_2)(y_1 + y_2)^2 + \Delta(x_1 + x_2)(y_1 + y_2)^2 + (x_1 + x_2)^2(y_1 + y_2) +$$

$$2(x_1 + x_2)\Delta(x_1 + x_2)(y_1 + y_2) + \left(\Delta(x_1 + x_2)\right)^2(y_1 + y_2) - (x_1 + x_2)(y_1 + y_2)^2 - (x_1 + x_2)^2(y_1 + y_2)$$

$$= \Delta(x_1 + x_2)(y_1 + y_2)^2 + 2(x_1 + x_2)\Delta(x_1 + x_2)(y_1 + y_2) + \left(\Delta(x_1 + x_2)\right)^2(y_1 + y_2)$$

$$= \Delta(x_1 + x_2)[(y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2) + \Delta(x_1 + x_2)(y_1 + y_2)] \quad \Rightarrow$$

$$\frac{\partial f}{\partial(x_1 + x_2)} = f_{(x_1+x_2)}$$

$$= \lim_{\Delta(x_1+x_2)\to 0} \frac{\Delta(x_1 + x_2)[(y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2) + \Delta(x_1 + x_2)(y_1 + y_2)]}{\Delta(x_1 + x_2)}$$

$$= \lim_{\Delta(x_1+x_2)\to 0} [(y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2) + \Delta(x_1 + x_2)(y_1 + y_2)] \quad \Rightarrow$$

$$\frac{\partial f}{\partial(x_1 + x_2)} = f_{(x_1+x_2)} = (y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2)$$

Now, take invertible AH-Isometry, we have a neutrosophic partial derivative:

$$\frac{\partial f}{\partial X} = f_X = T^{-1}\left[\frac{\partial f}{\partial x_1}, \frac{\partial f}{\partial(x_1 + x_2)}\right] = T^{-1}[{y_1}^2 + 2x_1y_1, (y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2)]$$

$$= {y_1}^2 + 2x_1y_1 + I\begin{bmatrix}(y_1 + y_2)^2 + 2(x_1 + x_2)(y_1 + y_2) - \\ ({y_1}^2 + 2x_1y_1)\end{bmatrix} = Y^2 + 2XY$$

5. Conclusion:

In this paper, we employed a one-dimensional AH-isometry to investigate the algebraic direct image of the classical partial derivative. By analyzing this image within the transformed classical framework, we were able to construct a well-defined notion of the neutrosophic partial derivative.

The results demonstrate that geometric transformations, particularly isometric transformations, are not merely auxiliary techniques but can serve as fundamental methodological tools in neutrosophic analysis. This approach lays a solid foundation for further developments in neutrosophic pre-calculus and neutrosophic calculus, and it opens new avenues for addressing complex analytical problems involving uncertainty and indeterminacy.

References

[1] Smarandache, F., "A Unifying Field in Logics: Neutrosophic Logic", Preface by Charles Le, American Research Press, Rehoboth, 1999, 2000. Second edition of the Proceedings of the First International Conference on Neutrosophy, Neutrosophic Logic, Neutrosophic Set, Neutrosophic Probability and Statistics, University of New Mexico, Gallup, 2001.

[2] Smarandache F. Neutrosophic Precalculus and Neutrosophic calculus, University of New Mexico, 705 Gurley Ave. Gallup,NM 87301, USA, 2015.

[3] Smarandache F. Neutrosophic Measure and Neutrosophic Integral , In Neutrosophic Sets and Systems, 3 – 7, Vol. 1, 2013.

[4] M. Abdel-Basset; G. Gunasekaran Mohamed; G. Abdullah. C. Victor, "A Novel Intelligent Medical Decision Support Model Based on soft Computing and Iot" IEEE Internet of Things Journal, Vol. 7, (2019).

[5] Sankari, H., and Abobala, M., "Neutrosophic Linear Diophantine Equations With two Variables", Neutrosophic Sets and Systems, Vol. 38, pp. 22-30, 2020.

[6] F. Smarandache, Neutrosophic Precalculus and Neutrosophic Calculus, Brussels: EuropaNova, 2015.

[7] F. Smarandache, Introduction To Neutrosophic Measure, Neutrosophic Integral, And Neutrosophic Probability, Craiova-Ohio: Sitech - Education , 2013.

[8] A. Hatip, "The Special Neutrosophic Functions," International Journal of Neutrosophic Science (IJNS), p. 13, 12 May 2020.

[9] M. Abobala and A. Hatip, ''An Algebraic Approach to Neutrosophic Euclidean Geometry'' Neutrosohic sets and systems, Vol. 43, pp. 114 123,2021.

[10] Salama, A, Aswad, M. and Dallah, R, ''A Study of Derivative and Integration a Neutrosophic Functions'', Journal of Neutrosophic and Fuzzy Systems, Vol. 05,No. 02, pp.33-37, 2023.

[11] Zeina, M. B., and Abobala, M., ''A Study of Neutrosophic Real Analysis by Using the one-Dimensional Geometric AH-Isometry'', Galoitica Journal of Mathematical Structures And Applications, Vol. 03,2023.

[12] Şahin, M., Olgun, N., Kargın, A., & Uluçay, V. (2018). Isomorphism theorems for soft G-modules. Afrika Matematika, 29(7), 1237-1244.

[13] Yetkin, E., & Olgun, N. (2011). Direct product of fuzzy groups and fuzzy rings. In Int. Math. Forum (Vol. 6, No. 21, pp. 1005-1015).

[14] Olgun, N., & Çelik, M. (2019). Neutrosophic triplet R-module. Neutrosophic Triplet Research, 1, 35-42.