NEUTROSOPHIC TRIPLET PARTIAL b − NORMED SPACES

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CONGRESS PROCEEDINGS BOOK

ISBN 978-605-7811-04-2
ISPEC PUBLICATIONS-2019

PROCEEDINGS BOOK

MAS EUROPEAN INTERNATIONAL CONGRESS ON MATHEMATICS-ENGINEERING-NATURAL & MEDICAL SCIENCES-IV

July 12-14, 2019

Kiev, Ukraine

EDITORS

Dr. Murat ONAY

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ISPEC PUBLISHING

https://www.masjournal.co.uk/

E mail: mascongress@gmail.com

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Issued: 24.07.2019

ISBN - 978-605-7811-04-2

MAS
International Journal of
Mathematics, Engineering, Natural & Medical Sciences

CONGRESS IDENTIFICATION

CONGRESS TITLE

MAS EUROPEAN INTERNATIONAL CONGRESS
ON MATHEMATICS-ENGINEERING-NATURAL & MEDICAL SCIENCES-VI

DATE AND PLACE

July 12-14, 2019
Kiev, Ukraine

ORGANIZATION

MAS
International Journal of
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NEUTROSOPHIC TRIPLET PARTIAL b – NORMED SPACES

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ÖZET

Bu çalışmada, biz nötrosofik üçlü kısmi b – normlu uzayları tanımladık. Bu yapı için örnekler ve özellikler verdik. Ayrıca nötrosofik üçlü normlu uzayları [6] ve nötrosofik üçlü kısmi b – metrik uzayları [10] nötrosofik üçlü kısmi b – normlu uzaylarla karşılaştırdık. Bunun yanı sıra bu nötrosofik üçlü yapıların nötrosofik üçlü kısmi b – normlu uzaylardan farklı olduğunu gösterdik. Ek olarak nötrosofik üçlü kısmi b – normlu uzayların hangi durumlarda diğer nötrosofik üçlü yapıların özelliklerini sağladığını tartıştık. Bundan dolayı yeni bir teori olan nötrosofik üçlü yapılara nötrosofik üçlü kısmi b – normlu uzayları eklemiş olduk.
Anahtar Kelimeler: b - metrik uzaylar, nötrosofik üçlü kümeler, nötrosofik üçlü kısmi b - metrik uzaylar, nötrosofik üçlü kısmi b – normlu uzaylar

ABSTRACT

In this study, we defined neutrosophic triplet partial b - normed spaces. We gave examples and properties for this structure. Also, neutrosophic triplet normed spaces [6], and neutrosophic triplet partial b - metric spaces [9] are compared with neutrosophic triplet partial b - normed spaces. Furthermore, we show that neutrosophic triplet partial b - normed spaces are different from these neutrosophic triplet structures. In addition, we discussed in which special cases the neutrosophic partial b - normed spaces provide the properties of other neutrosophic triplet structures. Thus, we added neutrosophic triplet partial b - normed spaces to the neutrosophic triplet structures which are a new theory.
Key words: b - metric spaces, neutrosophic triplet sets, neutrosophic triplet partial b - metric spaces, neutrosophic triplet partial b – normed spaces

1. PRELIMINARIES

Smarandache introduced neutrosophy in 1980, which studies a lot of scientific fields. In neutrosophy, there are neutrosophic logic, set and probability in [1]. Neutrosophic logic is a generalization of a lot of logics such as fuzzy logic in [2] and intuitionistic fuzzy logic in [3]. Neutrosophic set is showed by (t, i, f) such that “t” is degree of membership, “i” is degree of indeterminacy and “f” is degree of non-membership. Also, a lot of researchers have studied neutrosophic sets. Furthermore, Smarandache and Ali obtained neutrosophic triplet in [4] and they introduced neutrosophic triplet groups in [4]. For every element “x” in neutrosophic triplet set A, there exist a neutral of “a” and an opposite of “a”. Also, neutral of “x” must different from the classical unitary element. Therefore, the neutrosophic triplet set is different from the classical set. Furthermore, a neutrosophic triplet “x” is showed by <x, neut(x), anti(x)>. Also, many researchers have introduced NT structures. Recently, Şahin and Kargın introduced neutrosophic triplet metric space and neutrosophic triplet normed space in [6]; Smarandache, Şahin and Kargın studied neutrosophic triplet G – modules in [7], Şahin and Kargın obtained neutrosophic triplet partial metric space in [8]; Şahin and Kargın obtained neutrosophic triplet b - metric space in [9]; Şahin and Kargın obtained neutrosophic triplet partial b - metric space in [10].
In this study, we obtained neutrosophic triplet partial b - normed space. In section 2; we gave

definitions of neutrosophic triplet set in [4], neutrosophic triplet b - metric space in [9], neutrosophic triplet field in [5], neutrosophic triplet vector space and neutrosophic triplet normed space in [6]. In section 3, we defined neutrosophic triplet partial b – normed space and we gave properties for this structure. Also, we showed relationship between neutrosophic triplet partial b – metric space and neutrosophic triplet partial b- normed space. Furthermore, we defined neutrosophic triplet partial b – Banach space. In section 5, we gave conclusions.

2. INTRODUCTION

Definition 2.1 [4]: Let # be a binary operation. A neutrosophic triplet set (X, #) is a set such that for x ∈ X,

i) There exists neutral of "x" such that x#neut(x) = neut(x)#x = x,

ii) There exists anti of "x" such that x#anti(x) = anti(x)#x = neut(x).

Also, a neutrosophic triplet "x" is showed with (x, neut(x), anti(x)).

Furthermore, neut(x) must different from classical neutral element.

Definition 2.2: [10] A neutrosophic triplet partial b - metric on a neutrosophic triplet set (N, *) is a function d_{pb}:NxN→ ℝ such for every n, m, s ∈ N,
i) n * m ∈ N
ii) $d_{pb}(n, m) \geq 0$
iii) If $d_{pb}(n, m) = 0$, then n = m,
iv) $d_{pb}(n, m) = d_{pb}(n, m)$
v) If there exists at least an element s ∈ N for n, m ∈ N pair such that
$d_{pb}(n, m) \leq d_{pb}(n, m*neut(s))$, then $d_{pb}(n, m*neut(s)) \leq b(d_{pb}(n, s)+ d_{pb}(s, n)+ d_{pb}(s, s))$
Where, $b \in \mathbb{R}^+$ and $b \geq 1$.

Definition 2.3. [5] Let (NTF,*,#) be a neutrosophic triplet set together with two binary operations * and #. Then (NTF,*, #) is called neutrosophic triplet field if the following conditions hold.
1. (NTF,*) is a commutative neutrosophic triplet group with respect to *.
2. (NTF, #) is a neutrosophic triplet group with respect to #.
3. a#(b*c)= (a#b)*(a#c) and (b*c)#a = (b#a)*(c#a) for all a,b,c ∈ NTF.

Definition 2.4. [6] Let $(NTF,*_1, \#_1)$ be a neutrosophic triplet field and let $(NTV,*_2, \#_2)$ be a neutrosophic triplet set together with binary operations "$*_2$ " and "$\#_2$". Then $(NTV,*_2, \#_2)$ is called a neutrosophic triplet vector space if the following conditions hold. For all u, v ∈ NTV and for all k∈ NTF; such that $u*_2v$ ∈ NTV and u $\#_2$k ∈ NTV;
1) $(u*_2v) *_2t= u*_2 (v*_2t)$; u, v, t ∈ NTV;
2) $u*_2v = v*_2u$; u, v ∈ NTV;
3) $(v*_2u) \#_2k= (v\#_2k) *_2(u\#_2k)$; k ∈ NTF and u, v ∈ NTV;
4) $(k*_1t) \#_2u= (k\#_2v) *_1(u\#_2v)$; k, t ∈ NTF and u ∈ NTV;
5) $(k\#_1t) \#_2u= k\#_1(t\#_2u)$; k, t ∈ NTF and u ∈ NTV;
6) there exists at least an element k ∈ NTF for every element u such that
$u\#_2$ neut(k)= neut(k) $\#_2$ u = u; u ∈ NTV.

Definition 2.5: [6] Let $(NTV,*_2, \#_2)$ be a neutrosophic triplet vector space on $(NTF,*_1, \#_1)$ neutrosophic triplet filed. If the function $\|.\| : NTV \rightarrow \mathbb{R}^+ \cup \{0\}$ is satisfied the following

properties, then the function $\|.\|$ is a neutrosophic triplet norm.
Where,

f, f: NTF X NTV $\rightarrow \mathbb{R}^+ \cup \{0\}$ is a function such that
$f(\alpha, x) = f(\alpha, anti(x))$ and if $x = neut(x)$, then $f(\alpha, x) = 0$.

a) $\|x\| \geq 0$
b) If $x = neut(x)$, then $\|x\| = 0$
c) $\|\alpha \#_2 x\| = f(\alpha, x).\|x\|$
d) $\|anti(x)\| = \|x\|$
e) If there exists at least an element $k \in N$ for $x, y \in$ NTV pair such that $\|x *_2 y\| \leq \|x *_2 y *_2 neut(k)\|$, then $\|x *_2 y *_2 neut(k)\| \leq \|x\| + \|y\|$.

Also, $((NTV, *_2, \#_2), \|.\|)$ is called a neutrosophic triplet normed space.

3. NEUTROSOPHIC TRIPLET PARTIAL b – NORMED SPACES

Definition 3.1: Let $(NTV, *_2, \#_2)$ be a neutrosophic triplet vector space on $(NTF, *_1, \#_1)$ neutrosophic triplet filed. If the function $\|.\|_{pb} : NTV \rightarrow \mathbb{R}^+ \cup \{0\}$ is satisfied the following properties, then the function $\|.\|_{pb}$ is a neutrosophic triplet partial b - norm.
Where,

f: NTF X NTV $\rightarrow \mathbb{R}^+ \cup \{0\}$ is a function such that
$f(\alpha, x) = f(\alpha, anti(x))$ and if $x = neut(x)$, then $f(\alpha, x) = 1$.

a) $\|x\|_{pb} \geq 0$
b) If $\|x\|_{pb} = 0$, then $x = neut(x)$
c) $\|\alpha \#_2 x\|_{pb} = f(\alpha, x).\|x\|_{pb}$
d) $\|anti(x)\|_{pb} = \|x\|_{pb}$
e) If there exists at least an element $k \in N$ for $x, y \in$ NTV pair such that $\|x *_2 y\|_{pb} \leq \|x *_2 y *_2 neut(k)\|_{pb}$, then $\|x *_2 y *_2 neut(k)\|_{pb} \leq b(\|x\|_{pb} + \|y\|_{pb} + \|neut(k)\|_{pb})$. Where, $b \in \mathbb{R}^+$ and $b \geq 1$.

Also, $((NTV, *_2, \#_2), \|.\|_{pb})$ is called a neutrosophic triplet b - normed space.

Example 3.2: Let X = {a, b} and P(X) = {∅, {a}, {b}, {a, b}} be power set of X.
(P(X), *, ∩) is a neutrosophic triplet set and neutrosophic triplet vector space. Where,
A, B ∈ P(X) ,

$$A*B = \begin{cases} B\backslash A, & if \ \ s(A)<s(B) \wedge B \supset A \wedge A' = B \\ A\backslash B, & if \ \ s(A)>s(B) \wedge A \supset B \wedge B' = A \\ (A\backslash B)', & if \ \ s(A)>s(B) \wedge A \supset B \wedge B' \neq A \\ (B\backslash A)', & if \ \ s(A)<s(B) \wedge B \supset A \wedge A' \neq B \\ X, & if \ \ s(A)=s(B) \wedge A \neq B \\ \emptyset, & A=B \end{cases}$$

Also, f: P(X) X P(X) $\rightarrow \mathbb{R}^+ \cup \{0\}$ is a function such that

$f(A, B) = (s(A \cap B)) + k)/(s(B) + k)$
Thus, $\|.\|_{pb}: P(X) \rightarrow \mathbb{R}^+ \cup \{0\}$, $\|A\|_{pb} = s(A) + k$ is a neutrosophic triplet b – normed space with b = 1.1. Where, s(A) is number of elements of A and $k \in \mathbb{R}^+$ and $k \geq 1$.

Corollary 3.3: From Definition 2.5 and Definition 3.1, neutrosophic triplet partial b –normed space is generally different from neutrosophic triplet normed space since for triangle inequality.

Property 3.4: Let $((NTV, *_2, \#_2), \|.\|_{pb})$ be a neutrosophic triplet partial b - normed space on $(NTF, *_1, \#_1)$ neutrosophic triplet field. Then, the function d_{pb}: NTV x NTV→ $\mathbb{R}$ defined by $d_{pb}(x, y) = \|x *_2 anti(y)\|_{pb}$ provides neutrosophic triplet partial b - metric space conditions.

Corollary 3.5: From Property 3.4, every neutrosophic triplet partial b - normed space is a neutrosophic triplet partial b – metric space.

Definition 3.6: Let $((NTV, *_2, \#_2), \|.\|_{pb})$ be a neutrosophic triplet partial b - normed space on $(NTF, *_1, \#_1)$ neutrosophic triplet field. d_{pb}: NTV x NTV→ $\mathbb{R}$ neutrosophic triplet partial b - metric define by $d_b(x, y) = \| x *_2 anti(y)\|_b$ is called the neutrosophic triplet partial b - metric space reduced by neutrosophic triplet partial b – normed space $((NTV, *_2, \#_2), \|.\|_{pb})$.

Definition 3.7: Let $((NTV, *_2, \#_2), \|.\|_{pb})$ be a neutrosophic triplet partial b - normed space on $(NTF, *_1, \#_1)$ neutrosophic triplet field, $\{x_n\}$ be a sequence in this space and d_{pb} a neutrosophic triplet partial b - metric reduced by $((NTV, *_2, \#_2), \|.\|_{pb})$. $\{x_n\}$ sequence converges to x, if for every $\varepsilon>0$ there exists $M\in \mathbb{N}$ such that for all $n \geq M$ we have $d_{pb}(x, \{x_n\}) = \|x *_2 anti(x_n\}\)\|_{pb} < \varepsilon$.
It is showed that $\lim_{n\to\infty} x_n = x$ or $x_n \to x$

Definition 3.8: Let $((NTV, *_2, \#_2), \|.\|_{pb})$ be a neutrosophic triplet partial b - normed space on $(NTF, *_1, \#_1)$ neutrosophic triplet field, $\{x_n\}$ be a sequence in this space and d_{pb} be a neutrosophic triplet partial b - metric reduced by $((NTV, *_2, \#_2), \|.\|_{pb})$. $\{x_n\}$ is a Cauchy sequence, if for every $\varepsilon>0$ there exists $M\in \mathbb{N}$ such that for all n, $m \geq M$ we have $d_{pb}(x, \{x_n\}) = \|x *_2 anti(x_n\}\)\|_{pb} < \varepsilon$.

Definition 3.9: Let $((NTV, *_2, \#_2), \|.\|_{pb})$ be a neutrosophic triplet partial b - normed space on $(NTF, *_1, \#_1)$ neutrosophic triplet field, $\{x_n\}$ be a sequence in this space and d_{pb} be a neutrosophic triplet partial b - metric reduced by $((NTV, *_2, \#_2), \|.\|_{pb})$. If each $\{x_n\}$ Cauchy sequence in this space is convergent, then $((NTV, *_2, \#_2), \|.\|_{pb})$ is called neutrosophic triplet partial b - Banach space.

4. CONCLUSION

In this chapter, we obtained neutrosophic triplet partial b – normed space. We also show that neutrosophic triplet partial b – normed space is different from the neutrosophic triplet normed space. Thus, we have added a new structure to neutrosophic structures and we gave rise to a new field or research called neutrosophic triplet partial b – normed space. Also, thanks to neutrosophic triplet partial b – normed space researcher can obtain new structure and properties. For example, neutrosophic triplet partial b – inner product space and neutrosophic triplet partial b – Hilbert space

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