Neutrosophic Sets and Systems, Vol. 35, 2020
University of New Mexico

On Neutrosophic Generalized Alpha Generalized Continuity

Qays Hatem Imran[1*], R. Dhavaseelan[2], Ali Hussein Mahmood Al-Obaidi[3], and Md. Hanif PAGE[4]

[1]Department of Mathematics, College of Education for Pure Science, Al-Muthanna University, Samawah, Iraq.
E-mail: qays.imran@mu.edu.iq
[2]Department of Mathematics, Sona College of Technology, Salem-636005, Tamil Nadu, India.
E-mail: dhavaseelan.r@gmail.com
[3]Department of Mathematics, College of Education for Pure Science, University of Babylon, Hillah, Iraq.
E-mail: aalobaidi@uobabylon.edu.iq
[4]Department of Mathematics, KLE Technological University, Hubballi-580031, Karnataka, India.
E-mail: mb_page@kletech.ac.in
* Correspondence: qays.imran@mu.edu.iq

Abstract: This article demonstrates a further class of neutrosophic closed sets named neutrosophic generalized αg-closed sets and discuss their essential characteristics in neutrosophic topological spaces. Moreover, we submit neutrosophic generalized αg-continuous functions with their elegant features.

Keywords: neutrosophic generalized αg-closed sets, neutrosophic generalized αg-continuous functions, and neutrosophic generalized αg-irresolute functions.

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1. Introduction

Smarandache [1,2] originally handed the theory of "neutrosophic set". Recently, Abdel-Basset et al. discussed a novel neutrosophic approach [3-8] in several fields, for a few names, information and communication technology. Salama et al. [9] gave the clue of neutrosophic topological space (or simply NTS). Arokiarani et al. [10] added the view of neutrosophic α-open subsets of neutrosophic topological spaces. Imran et al. [11] presented the idea of neutrosophic semi-α-open sets in neutrosophic topological spaces. Dhavaseelan et al. [12] presented the idea of neutrosophic α^m-continuity. Our aim is to introduce a new idea of neutrosophic generalized αg-closed sets and examine their vital merits in neutrosophic topological spaces. Additionally, we propose neutrosophic generalized αg-continuous functions by employing neutrosophic generalized αg-closed sets and emphasizing some of their primary characteristics.

2. Preliminaries

Everywhere of these following sections, we assume that NTSs $(\mathcal{U},\xi),(\mathcal{V},\varrho)$ and $(\mathcal{W},\mu)$ are briefly denoted as $\mathcal{U},\mathcal{V}$, and $\mathcal{W}$, respectively. Let $\mathcal{C}$ be a neutrosophic set in $\mathcal{U}$, and we are easily symbolized it by NS, then the complement of $\mathcal{C}$ is basically given by $\bar{\mathcal{C}}$. If $\mathcal{C}$ is a neutrosophic open set in $\mathcal{U}$ and shortly indicated by Ne-OS. Then, $\bar{\mathcal{C}}$ is termed a neutrosophic closed set in $\mathcal{U}$ and simply referred by Ne-CS. The neutrosophic closure and the neutrosophic interior of $\mathcal{C}$ are merely signified by Ne-$cl(\mathcal{C})$ and Ne-$int(\mathcal{C})$, correspondingly.

Definition 2.1 [10]: A NS $\mathcal{C}$ in a NTS $\mathcal{U}$ is named a neutrosophic α-open set and simply written as Ne-αOS if $\mathcal{C} \subseteq$Ne-int(Ne-cl(Ne-$int(\mathcal{C})$)). Besides, if Ne-cl(Ne-int(Ne-$cl(\mathcal{C})$)) $\subseteq \mathcal{C}$, then $\mathcal{C}$ is called a neutrosophic α-closed set, and we are shortly given it as Ne-αCS. The collection of all such these

Ne-αOSs (correspondently, Ne-αCSs) in $\mathcal{U}$ is referred to Ne-α$O(\mathcal{U})$ (correspondently, Ne-α$C(\mathcal{U})$). The intersection of all Ne-αCSs that contain $\mathcal{C}$ is called the neutrosophic α-closure of $\mathcal{C}$ in $\mathcal{U}$ and represented by Ne-$\alpha cl(\mathcal{C})$.

Definition 2.2 [13]: A NS $\mathcal{C}$ in NTS $\mathcal{U}$ is so-called a neutrosophic generalized closed set and denoted by Ne-gCS if for any Ne-OS $\mathcal{M}$ in $\mathcal{U}$ such that $\mathcal{C} \subseteq \mathcal{M}$, then Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$. Moreover, its complement is named a neutrosophic generalized open set and referred to Ne-gOS.

Definition 2.3 [14]: A NS $\mathcal{C}$ in NTS $\mathcal{U}$ is so-called a neutrosophic αg-closed set and indicated by Ne-αgCS if for any Ne-OS $\mathcal{M}$ in $\mathcal{U}$ such that $\mathcal{C} \subseteq \mathcal{M}$, then Ne-$\alpha cl(\mathcal{C}) \subseteq \mathcal{M}$. Furthermore, its complement is named a neutrosophic αg-open set and symbolized by Ne-αgOS.

Definition 2.4 [15]: A NS $\mathcal{C}$ in NTS $\mathcal{U}$ is so-called a neutrosophic gα-closed set and signified by Ne-gαCS if far any Ne-αOS $\mathcal{M}$ in $\mathcal{U}$ such that $\mathcal{C} \subseteq \mathcal{M}$, then Ne-$\alpha cl(\mathcal{C}) \subseteq \mathcal{M}$. Besides, its complement is named a neutrosophic gα-open set and briefly written as Ne-gαOS.

Theorem 2.5 [10,13-15]: For any NTS $\mathcal{U}$, the next declarations valid and but not vice versa:
(i) for all Ne-OSs (correspondingly, Ne-CSs) are Ne-αOSs (correspondingly, Ne-αCSs).
(ii) for all Ne-OSs (correspondingly, Ne-CSs) are Ne-gOSs (correspondingly, Ne-gCSs).
(iii) for all Ne-gOSs (correspondingly, Ne-gCSs) are Ne-αgOSs (correspondingly, Ne-αgCSs).
(iv) for all Ne-αOS (correspondingly, Ne-αCSs) are Ne-gαOSs (correspondingly, Ne-gαCSs).
(v) for all Ne-gαOSs (correspondingly, Ne-gαCSs) are Ne-αgOSs (correspondingly, Ne-αgCSs).

Definition 2.6: Let $(\mathcal{U}, \xi)$ and $(\mathcal{V}, \varrho)$ be NTSs and $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{V}, \varrho)$ be a mapping, we have
(i) if for each Ne-OS (correspondingly, Ne-CS) $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-OS (correspondingly, Ne-CS) in $\mathcal{U}$, then η is known as neutrosophic continuous and denoted by Ne-continuous. [16]
(ii) if for each Ne-OS (correspondingly, Ne-CS) $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-αOS (correspondingly, Ne-αCS) in $\mathcal{U}$, then η is known as neutrosophic α-continuous and referred to Ne-α-continuous. [10]
(iii) if for each Ne-OS (correspondingly, Ne-CS) $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gOS (correspondingly, Ne-gCS) in $\mathcal{U}$, then $\eta$is known as neutrosophic g-continuous and signified by Ne-g-continuous. [17]

Remark 2.7 [17,10]: Let $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{V}, \varrho)$ be a map, the next declarations valid and but not vice versa:
(i) For all Ne-continuous functions are Ne-α-continuous.
(ii) For all Ne-continuous functions are Ne-g-continuous.

3. Neutrosophic Generalized αg-Closed Sets

The neutrosophic generalized **α**g-closed sets and their features are studied and discussed in this part of the paper.

Definition 3.1: Let $\mathcal{C}$ be a NS in $NTS\ \mathcal{U}$, then it called a neutrosophic generalized αg-closed set and denoted by Ne-gαgCS if for any Ne-αgOS $\mathcal{M}$ in $\mathcal{U}$ such that $\mathcal{C} \subseteq \mathcal{M}$, then Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$.We indicated the collection of all Ne-gαgCSs in $NTS\ \mathcal{U}$ by Ne-gαgC$(\mathcal{U})$.

Definition 3.2: Let $\mathcal{C}$ be a NS in $TS\ \mathcal{U}$, then its neutrosophic gαg-closure is the intersection of each Ne-gαgCS in $\mathcal{U}$ including $\mathcal{C}$, and we are shortly written it as Ne-gαg$cl(\mathcal{C})$. In other words, Ne-gαg$cl(\mathcal{C}) = \bigcap\{\mathcal{D}: \mathcal{C} \subseteq \mathcal{D}, \mathcal{D}$ is a Ne-gαgCS$\}$.

Theorem 3.3: The subsequent declarations are valid in any $TS\ \mathcal{U}$:

(i) for all Ne-CSs are Ne-gαgCSs.

(ii) for all Ne-gαgCSs are Ne-gCSs.

(iii) for all Ne-gαgCSs are Ne-αgCSs.

(iv) for all Ne-gαgCSs are Ne-gαCSs.

Proof:

(i) Suppose a Ne-CS $\mathcal{C}$ is in $TS\ \mathcal{U}$. For any Ne-αgOS $\mathcal{M}$, including $\mathcal{C}$, we have $\mathcal{M} \supseteq \mathcal{C}$ =Ne-$cl(\mathcal{C})$. Therefore, $\mathcal{C}$ stands a Ne-gαgCS.

(ii) Suppose Ne-gαgCS $\mathcal{C}$ is in $TS\ \mathcal{U}$. For any Ne-OS $\mathcal{M}$, including $\mathcal{C}$, we have theorem (2.5) states that $\mathcal{M}$ stands a Ne-αgOS in $\mathcal{U}$. Because a Ne-gαgCS $\mathcal{C}$ satisfying this fact Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$. As a result, $\mathcal{C}$ considers a Ne-gCS.

(iii) Assume Ne-gαgCS $\mathcal{C}$ is in $TS\ \mathcal{U}$. For any Ne-OS $\mathcal{M}$, including $\mathcal{C}$, we have theorem (2.5) states that $\mathcal{M}$ remains a Ne-αgOS in $\mathcal{U}$. Subsequently, Ne-gαgCS $\mathcal{C}$ satisfying this statement Ne-α$cl(\mathcal{C}) \subseteq$Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$. Therefore, $\mathcal{C}$ becomes a Ne-αgCS.

(iv) Assume Ne-gαgCS $\mathcal{C}$ is in $TS\ \mathcal{U}$. For any Ne-αOS $\mathcal{M}$ including $\mathcal{C}$, we have theorem (2.5) states that $\mathcal{M}$ remains a Ne-αgOS in $\mathcal{U}$. Subsequently, Ne-gαgCS $\mathcal{C}$ satisfying this statement Ne-α$cl(\mathcal{C}) \subseteq$Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$. Therefore, $\mathcal{C}$ considers a Ne-gαCS.

The opposite conditions for this previous theorem do not look accurate by the next obvious examples.

Example 3.4: Suppose $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$, such that we have the sets $\mathcal{A} = \langle u, (0.6,0.7), (0.1,0.1), (0.4,0.2)\rangle$ and $\mathcal{B} = \langle u, (0.1,0.2), (0.1,0.1), (0.8,0.8)\rangle$, so that $(\mathcal{U}, \xi)$ is a NTS. However, the $NS\ \mathcal{C} = \langle u, (0.2,0.2), (0.1,0.1), (0.6,0.7)\rangle$ is a Ne-gαgCS but not a Ne-CS.

Example 3.5: Suppose $\mathcal{U} = \{p, q, r\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$, where such that we have the sets $\mathcal{A} = \langle u, (0.5,0.5,0.4), (0.7,0.5,0.5), (0.4,0.5,0.5)\rangle$ and $\mathcal{B} = \langle u, (0.3,0.4,0.4), (0.4,0.5,0.5), (0.3,0.4,0.6)\rangle$, so that $(\mathcal{U}, \xi)$ is a NTS. However, the $NS\ \mathcal{C} = \langle u, (0.4,0.6,0.5), (0.4,0.3,0.5), (0.5,0.6,0.4)\rangle$ is a Ne-gCS but not a Ne-gαgCS.

Example 3.6: Suppose $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$, where such that we have the sets $\mathcal{A} = \langle u, (0.5,0.6), (0.3,0.2), (0.4,0.1)\rangle$ and $\mathcal{B} = \langle u, (0.4,0.4), (0.4,0.3), (0.5,0.4)\rangle$, so that $(\mathcal{U}, \xi)$ is a NTS.

However, the $NS\ \mathcal{C} = \langle u, (0.5,0.4), (0.4,0.4), (0.4,0.5)\rangle$ is a Ne-αgCS and hence Ne-gαCS but not a Ne-gαgCS.

Definition 3.7: Let $\mathcal{C}$ be any NS in $TS\ \mathcal{U}$, then it is called a neutrosophic generalized αg-open set and referred to by Ne-gαgOS iff the set $\mathcal{U} - \mathcal{C}$ is a Ne-gαgCS. The collection of the whole Ne-gαgOSs in $NTS\ \mathcal{U}$ indicated by Ne-gαgO$(\mathcal{U})$.

Definition 3.8: The union of the whole Ne-gαgOSs in $NTS\ \mathcal{U}$ included in $NS\ \mathcal{C}$ is termed neutrosophic gαg-interior of $\mathcal{C}$ and symbolized by Ne-gαg$int(\mathcal{C})$. In symbolic form, we have this thing Ne-gαg$int(\mathcal{C}) = \cup\{\mathcal{D}: \mathcal{C} \supseteq \mathcal{D}, \mathcal{D}$ is a Ne-gαgOS$\}$.

Proposition 3.9: For any $NS\ \mathcal{M}$ in $TS\ \mathcal{U}$, the subsequent features stand:
(i) Ne-gαg$int(\mathcal{M}) = \mathcal{M}$ iff $\mathcal{M}$ is a Ne-gαgOS.
(ii) Ne-gαg$cl(\mathcal{M}) = \mathcal{M}$ iff $\mathcal{M}$ is a Ne-gαgCS.
(iii) Ne-gαg$int(\mathcal{M})$ is the biggest Ne-gαgOS included in $\mathcal{M}$.
(iv) Ne-gαg$cl(\mathcal{M})$ is the littlest Ne-gαgCS, including $\mathcal{M}$.
Proof: the features (i-iv) are understandable.

Proposition 3.10: For any $NS\ \mathcal{M}$ in $TS\ \mathcal{U}$, the subsequent features stand:
(i) Ne-gαg$int(\overline{\mathcal{M}}) = \overline{(\text{Ne} - \text{g}\alpha\text{g}cl(\mathcal{M}))}$,
(ii) Ne-gαg$cl(\overline{\mathcal{M}}) = \overline{(\text{Ne} - \text{g}\alpha\text{g}int(\mathcal{M}))}$.
Proof:
(i) The proof will be evident by symbolic definition, Ne-gαg$cl(\mathcal{M}) = \cap\{\mathcal{D}: \mathcal{M} \subseteq \mathcal{D}, \mathcal{D}$ is a Ne-gαgCS$\}$

$$\overline{(\text{Ne} - \text{g}\alpha\text{g}cl(\mathcal{M}))} = \cap\{\overline{D}: \overline{\mathcal{M}} \subseteq \overline{D}, \overline{D} \text{ is a Ne-g}\alpha\text{gCS}\}$$
$$= \cup\{\overline{\mathcal{D}}: \overline{\mathcal{M}} \subseteq \overline{\mathcal{D}}, \overline{\mathcal{D}} \text{ is a Ne-g}\alpha\text{gCS}\}$$
$$= \cup\{\mathcal{N}: \mathcal{M} \supseteq \mathcal{N}, \mathcal{N} \text{is a Ne-g}\alpha\text{gOS}\}$$
$$= \text{Ne-g}\alpha\text{g}int(\overline{\mathcal{M}}).$$

(ii) This feature has undeniable proof analogous to feature (i).

Theorem 3.11: For any Ne-OS $\mathcal{C}$ in $TS\ \mathcal{U}$, then this set is a Ne-gαgOS.
Proof: Suppose Ne-OS $\mathcal{C}$ in $TS\ \mathcal{U}$, so we obtain that $\bar{\mathcal{C}}$ is a Ne-CS. Therefore, $\bar{\mathcal{C}}$ is a Ne-gαgCS via the previous theorem (3.3), part (i). Consequently, $\mathcal{C}$ is a Ne-gαgOS.

Theorem 3.12: For any Ne-gαgOS $\mathcal{C}$ in $TS\ \mathcal{U}$, then this set is a Ne-gOS.
Proof: Suppose Ne-gαgOS $\mathcal{C}$ in $TS\ \mathcal{U}$, so we obtain that $\bar{\mathcal{C}}$ is a Ne-gαgCS. Therefore, $\bar{\mathcal{C}}$ is a Ne-gCS via the previous theorem (3.3), part (ii). Consequently, $\mathcal{C}$ is a Ne-gOS.

Lemma 3.13: For any Ne-gαgOS $\mathcal{C}$ in $TS\ \mathcal{U}$, then this set is Ne-αgOS (correspondingly, Ne-gαOS).
Proof: The proof of this lemma is similar to one of the previous theorem.

Proposition 3.14: For any two Ne-gαgCSs $\mathcal{C}$ and $\mathcal{D}$ in $TS\ \mathcal{U}$, then the set $\mathcal{C} \cup \mathcal{D}$ is a Ne-gαgCS.

Proof: Suppose any two Ne-gαgCSs $\mathcal{C}$ and $\mathcal{D}$ in $NTS\ \mathcal{U}$ and $\mathcal{M}$ is a Ne-αgOS, including $\mathcal{C}$ and $\mathcal{D}$. In other words, we have $\mathcal{C}\cup\mathcal{D} \subseteq \mathcal{M}$. So, $\mathcal{C},\mathcal{D} \subseteq \mathcal{M}$. Because $\mathcal{C}$ and $\mathcal{D}$ are Ne-gαgCSs, we get that Ne-$cl(\mathcal{C})$, Ne-$cl(\mathcal{D}) \subseteq \mathcal{M}$. Therefore, Ne-$cl(\mathcal{C}\cup\mathcal{D})$ = Ne-$cl(\mathcal{C})\cup$Ne-$cl(\mathcal{D}) \subseteq \mathcal{M}$. Then Ne-$cl(\mathcal{C}\cup\mathcal{D}) \subseteq \mathcal{M}$. Thus, $\mathcal{C}\cup\mathcal{D}$ stands a Ne-gαgCS.

Proposition 3.15: For any two Ne-gαgOSs $\mathcal{C}$ and $\mathcal{D}$ in $TS\ \mathcal{U}$, then the set $\mathcal{C}\cap\mathcal{D}$ is a Ne-gαgOS.

Proof: Suppose any two Ne-gαgOSs $\mathcal{C}$ and $\mathcal{D}$ in $TS\ \mathcal{U}$. Subsequently, we have that $\bar{\mathcal{C}}$ and $\bar{\mathcal{D}}$ are Ne-gαgCSs. So, we reach to this fact $\bar{\mathcal{C}}\cup\bar{\mathcal{D}}$ is a Ne-gαgCS by proposition (3.14). Because $\bar{\mathcal{C}}\cup\bar{\mathcal{D}} = \overline{(\mathcal{C}\cap\mathcal{D})}$, we obtain to our final result $\mathcal{C}\cap\mathcal{D}$ is a Ne-gαgOS.

Proposition 3.16: Let Ne-gαgCS $\mathcal{C}$ be in $TS\ \mathcal{U}$, then Ne-$cl(\mathcal{C}) - \mathcal{C}$ does not include non-empty Ne-CS in $\mathcal{U}$.

Proof: Assume we have Ne-gαgCS $\mathcal{C}$ and Ne-CS $\mathcal{F}$ in $NTS\ \mathcal{U}$ so as $\mathcal{F} \subseteq$ Ne-$cl(\mathcal{C}) - \mathcal{C}$. Because $\mathcal{C}$ stands a Ne-gαgCS, this gives us the fact Ne-$cl(\mathcal{C}) \subseteq \bar{\mathcal{F}}$. The latter means $\mathcal{F} \subseteq \overline{\text{Ne} - cl(\mathcal{C})}$. Subsequently, we arrive to $\mathcal{F} \subseteq$ Ne-$cl(\mathcal{C})\cap(\overline{\text{Ne} - cl(\mathcal{C})}) = 0_N$. Therefore, $\mathcal{F} = 0_N$ and so, we reach to our final result Ne-$cl(\mathcal{C}) - \mathcal{C}$ does not include non-empty Ne-CS.

Proposition 3.17: Let Ne-gαgCS $\mathcal{C}$ be in $NTS\ \mathcal{U}$ iff Ne-$cl(\mathcal{C}) - \mathcal{C}$ does not include non-empty Ne-αgCS in $\mathcal{U}$.

Proof: Assume we have Ne-gαgCS $\mathcal{C}$ and Ne-αgCS $\mathcal{G}$ in $NTS\ \mathcal{U}$ so as $\mathcal{G} \subseteq$ Ne-$cl(\mathcal{C}) - \mathcal{C}$. Because $\mathcal{C}$ considers a Ne-gαgCS, this gives us the fact Ne-$cl(\mathcal{C}) \subseteq \bar{\mathcal{G}}$. The latter means $\mathcal{G} \subseteq \overline{\text{Ne} - cl(\mathcal{C})}$. Subsequently, we arrive to $\mathcal{G} \subseteq$ Ne-$cl(\mathcal{C})\cap(\overline{\text{Ne} - cl(\mathcal{C})}) = 0_N$. Therefore, $\mathcal{G}$ is empty.

On The Other Hand, let us assume that Ne-$cl(\mathcal{C}) - \mathcal{C}$ does not include non-empty Ne-αgCS in $\mathcal{U}$. Suppose $\mathcal{M}$ is Ne-αgOS so as $\mathcal{C} \subseteq \mathcal{M}$. If we have this truth Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$ but then we get this fact Ne-$cl(\mathcal{C})\cap(\bar{\mathcal{M}})$ is non-empty. Meanwhile, we know that Ne-$cl(\mathcal{C})$ is Ne-CS and at the same time, we have $\bar{\mathcal{M}}$ is Ne-αgCS, so Ne-$cl(\mathcal{C})\cap(\bar{\mathcal{M}})$ is non-empty Ne-αgCS included Ne-$cl(\mathcal{C}) - \mathcal{C}$. This leads us to a contradiction. Consequently Ne-$cl(\mathcal{C}) \nsubseteq \mathcal{M}$. Therefore, $\mathcal{C}$ considers a Ne-gαgCS.

Theorem 3.18: Let Ne-αgOS and Ne-gαgCS $\mathcal{C}$ be in $TS\ \mathcal{U}$, then $\mathcal{C}$ considers a Ne-CS in $\mathcal{U}$.

Proof: Assume we have Ne-αgOS and Ne-gαgCS $\mathcal{C}$ is in $TS\ \mathcal{U}$, so we get that Ne-$cl(\mathcal{C}) \subseteq \mathcal{C}$ and subsequently, we reach to $\mathcal{C} \subseteq$ Ne-$cl(\mathcal{C})$. Consequently, Ne-$cl(\mathcal{C}) = \mathcal{C}$. Therefore, $\mathcal{C}$ stands a Ne-CS.

Theorem 3.19: Let Ne-gαgCS $\mathcal{C}$ be in $NTS\ \mathcal{U}$ so as $\mathcal{C} \subseteq \mathcal{D} \subseteq$ Ne-cl$(\mathcal{C})$, but then again $\mathcal{D}$ considers a Ne-gαgCS in $\mathcal{U}$.

Proof: Assume we have Ne-gαgCS $\mathcal{C}$ and Ne-αgOS $\mathcal{M}$ are in $NTS\ \mathcal{U}$ so as $\mathcal{D} \subseteq \mathcal{M}$. Later, $\mathcal{C} \subseteq \mathcal{M}$. Subsequently, $\mathcal{C}$ stands a Ne-gαgCS; this fact pursues Ne-$cl(\mathcal{C}) \subseteq \mathcal{M}$. So, $\mathcal{D} \subseteq$ Ne-$cl(\mathcal{C})$ infers Ne-$cl(\mathcal{D}) \subseteq$ Ne-$cl($Ne-$cl(\mathcal{C}))$ = Ne-$cl(\mathcal{C})$. Consequently, Ne-$cl(\mathcal{D}) \subseteq \mathcal{M}$. Therefore, $\mathcal{D}$ exists a Ne-gαgCS.

Theorem 3.20: Let Ne-gαgOS $\mathcal{C}$ be in $NTS\ \mathcal{U}$ so as Ne-$int(\mathcal{C}) \subseteq \mathcal{D} \subseteq \mathcal{C}$, but then again $\mathcal{D}$ considers a Ne-gαgOS in $\mathcal{U}$.

Proof: Assume we have Ne-gαgOS $\mathcal{C}$ is in $NTS\ \mathcal{U}$ so as Ne-$int(\mathcal{C}) \subseteq \mathcal{D} \subseteq \mathcal{C}$. After that, $\mathcal{U} - \mathcal{C}$ stands a Ne-gαgCS as well as $\bar{\mathcal{C}} \subseteq \bar{\mathcal{D}} \subseteq$ Ne-$cl(\bar{\mathcal{C}})$. But then again, we depend on theorem (3.19) to get $\mathcal{U} - \mathcal{D}$ is a Ne-gαgCS. Therefore, $\mathcal{D}$ exists a Ne-gαgOS.

Theorem 3.21: A $NS\ \mathcal{C}$ is Ne-gαgOS iff $\mathcal{P} \subseteq$ Ne-$int(\mathcal{C})$ so as $\mathcal{P} \subseteq \mathcal{C}$ and $\mathcal{P}$ considers a Ne-gαgCS.
Proof: Assume we have that Ne-gαgCS $\mathcal{P}$ satisfying $\mathcal{P} \subseteq \mathcal{C}$ and $\mathcal{P} \subseteq$ Ne-$int(\mathcal{C})$. Afterward, $\overline{\mathcal{C}} \subseteq \bar{\mathcal{P}}$ and we have by lemma (3.13), $\bar{\mathcal{P}}$ remains a Ne-αgOS. Accordingly, Ne-$cl(\overline{\mathcal{C}}) = \overline{\text{Ne} - int(\mathcal{C})} \subseteq \bar{\mathcal{P}}$. Subsequently, $\bar{\mathcal{C}}$ stands a Ne-gαgCS. Therefore, $\mathcal{C}$ stands a Ne-gαgOS.
On the contrary, we assume Ne-gαgOS $\mathcal{C}$ and Ne-gαgCS $\mathcal{P}$ is so as $\mathcal{P} \subseteq \mathcal{C}$. Subsequently, $\bar{\mathcal{C}} \subseteq \bar{\mathcal{P}}$. While $\bar{\mathcal{C}}$ exists a Ne-gαgCS and $\bar{\mathcal{P}}$ remains a Ne-αgOS, we reach to that Ne-$cl(\overline{\mathcal{C}}) \subseteq \bar{\mathcal{P}}$. Therefore, $\mathcal{P} \subseteq$ Ne-$int(\mathcal{C})$.

Remark 3.22: The next illustration demonstrates the relative among the distinct kinds of Ne-CS:

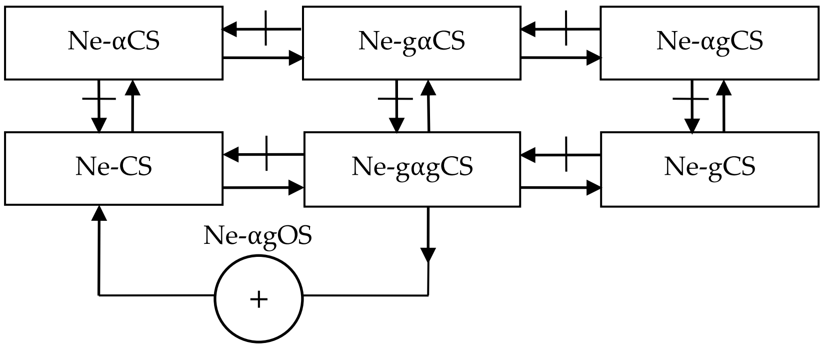

Fig. 3.1

4. Neutrosophic Generalized αg-Continuous Functions

In this part of this paper, the neutrosophic generalized **α**g-continuous functions are performed and examined their fundamental features.

Definition 4.1: Let $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{V}, \varrho)$ be a map so as $\mathcal{U}$ and $\mathcal{V}$ are NTSs, then:
(i) η is named a neutrosophic αg-continuous and signified by Ne-αg-continuous if for every Ne-OS (correspondingly, Ne-CS) $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-αgOS (correspondingly, Ne-αgCS) in $\mathcal{U}$.
(ii) η is named a neutrosophic gα-continuous and signified by Ne-gα-continuous if for every Ne-OS (correspondingly, Ne-CS) $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gαOS (correspondingly, Ne-gαCS) in $\mathcal{U}$.

Theorem 4.2: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. So, we have the following:
(i) all Ne-g-continuous functions are Ne-αg-continuous.
(ii) all Ne-α-continuous functions are Ne-gα-continuous.
(iii) all Ne-gα-continuous functions are Ne-αg-continuous.
Proof:
(i) Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-g-continuous function η defined on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. By definition of Ne-g-continuous, $\eta^{-1}(\mathcal{K})$ remains a Ne-gCS in $\mathcal{U}$. So, we have $\eta^{-1}(\mathcal{K})$ is a Ne-αgCS in $\mathcal{U}$ because of theorem (2.5) part (iii). As a result, η stands a Ne-αg-continuous.

(ii) Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-α-continuous function η defined on $NTS\ \mathcal{U}$ and valued in $NTS\ \mathcal{V}$. By definition of Ne-α-continuous, $\eta^{-1}(\mathcal{K})$ remains a Ne-αCS in $\mathcal{U}$. So, we have $\eta^{-1}(\mathcal{K})$ is a Ne-gαCS in $\mathcal{U}$ because of theorem (2.5) part (iv). As a result, η stands a Ne-gα-continuous.
(iii) Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-gα-continuous function η defined on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. So, we have $\eta^{-1}(\mathcal{K})$ is a Ne-gαCS and then $\eta^{-1}(\mathcal{K})$ is a Ne-αgCS in $\mathcal{U}$ because of theorem (2.5) part (v). Therefore, η stands a Ne-αg-continuous.
The reverse of the beyond proposition does not become valid as shown in the next examples.

Example 4.3: (i) Assume $\mathcal{U} = \{p, q\}$ and $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{B}, \mathcal{C}, 1_N\}$, where $\mathcal{A} = \langle u, (0.6,0.7), (0.4,0.3), (0.5,0.2)\rangle$, $\mathcal{B} = \langle u, (0.5,0.5), (0.5,0.4), (0.6,0.5)\rangle$ and $\mathcal{C} = \langle u, (0.5,0.5), (0.6,0.4), (0.7,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = q$ and $\eta(q) = p$. Then η is Ne- α g- continuous. But $\bar{\mathcal{C}} = \langle u, (0.7,0.5), (0.6,0.4), (0.5,0.5)\rangle$ is a Ne-CS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\bar{\mathcal{C}})$ is not a Ne-gCS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-g-continuous.
(ii) Let $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{B}, \mathcal{C}, 1_N\}$, where $\mathcal{A} = \langle u, (0.6,0.7), (0.4,0.3), (0.5,0.2)\rangle$, $\mathcal{B} = \langle u, (0.5,0.5), (0.5,0.4), (0.6,0.5)\rangle$ and $\mathcal{C} = \langle u, (0.5,0.5), (0.5,0.5), (0.4,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = p$ and $\eta(q) = q$. Then η is Ne-g α - continuous . But $\bar{\mathcal{C}} = \langle u, (0.4,0.5), (0.5,0.5), (0.5,0.5)\rangle$ is a Ne-CS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\bar{\mathcal{C}})$ is not a Ne-αCS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-α-continuous.
(iii) Let $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{B}, \mathcal{C}, 1_N\}$, where $\mathcal{A} = \langle u, (0.6,0.7), (0.4,0.3), (0.5,0.2)\rangle$, $\mathcal{B} = \langle u, (0.5,0.5), (0.5,0.4), (0.6,0.5)\rangle$ and $\mathcal{C} = \langle u, (0.5,0.5), (0.6,0.4), (0.7,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = q$ and $\eta(q) = p$. Then η is Ne- α g- continuous . But $\bar{\mathcal{C}} = \langle u, (0.5,0.5), (0.5,0.5), (0.6,0.4)\rangle$ is a Ne-CS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\bar{\mathcal{C}})$ is not a Ne-$g\alpha$CS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-gα-continuous.

Definition 4.4: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. Then, we named η as neutrosophic generalized αg-continuous and shortly wrote it as Ne-gαg-continuous if for each Ne-CS $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$.

Theorem 4.5: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. Afterward, η remains a Ne-gαg-continuous function iff for each Ne-OS $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgOS in $\mathcal{U}$.
Proof: Let Ne-OS $\mathcal{K}$ and Ne-CS $\bar{\mathcal{K}}$ are in $\mathcal{V}$. Therefore, $\eta^{-1}(\bar{\mathcal{K}}) = \overline{(\eta^{-1}(\mathcal{K}))}$ remains a Ne-gαgCS in $\mathcal{U}$. Consequently, $\eta^{-1}(\mathcal{K})$ exists a Ne-gαgOS in $\mathcal{U}$. The reverse proof is evident.

Proposition 4.6: For all Ne-gαg-continuous functions are Ne-αg-continuous.
Proof: Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-gαg-continuous function η defined on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. By definition of Ne-gαg-continuous function, $\eta^{-1}(\mathcal{K})$ stands a Ne-gαgCS in $\mathcal{U}$. So, we have $\eta^{-1}(\mathcal{K})$ remains a Ne-αgCS in $\mathcal{U}$ because of theorem (3.3) part (iii). As a result, η exists a Ne-αg-continuous.

Proposition 4.7: For all Ne-gαg-continuous functions are Ne-gα-continuous.

Proof: Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-gαg-continuous function η defined on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. By definition of Ne-gαg-continuous function, $\eta^{-1}(\mathcal{K})$ stands a Ne-gαgCS in $\mathcal{U}$. So, we have $\eta^{-1}(\mathcal{K})$ remains a Ne-gαCS in $\mathcal{U}$ because of theorem (3.3) part (iv). As a result, η exists a Ne-gα-continuous.

The reverse of the beyond proposition does not become valid as shown in the next examples.

Example 4.8: Let $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{C}, 1_N\}$, where $\mathcal{A} = \langle u, (0.5,0.6), (0.3,0.2), (0.4,0.1)\rangle$, $\mathcal{B} = \langle u, (0.4,0.4), (0.4,0.3), (0.5,0.4)\rangle$ and $\mathcal{C} = \langle u, (0.5,0.4), (0.4,0.4), (0.4,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = q$ and $\eta(q) = p$. Then η is Ne-αg-continuous. But $\mathcal{C} = \langle u, (0.4,0.5), (0.4,0.4), (0.5,0.4)\rangle$ is a Ne-CS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\bar{\mathcal{C}})$ is a Ne-αgCS but not a Ne-gαgCS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-gαg-continuous.

Example 4.9: Let $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{C}, 1_N\}$, where $\mathcal{A} = \langle u, (0.5,0.6), (0.3,0.2), (0.4,0.1)\rangle$, $\mathcal{B} = \langle u, (0.4,0.4), (0.4,0.3), (0.5,0.4)\rangle$ and $\mathcal{C} = \langle u, (0.5,0.4), (0.4,0.4), (0.4,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = q$ and $\eta(q) = p$. Then η is Ne-gα-continuous. But $\mathcal{C} = \langle u, (0.4,0.5), (0.4,0.4), (0.5,0.4)\rangle$ is a Ne-CS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\bar{\mathcal{C}})$ is a Ne-gαCS but not a Ne-gαgCS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-gαg-continuous.

Definition 4.10: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. Then, we named η as neutrosophic generalized αg-irresolute and shortly wrote it as Ne-gαg-irresolute if for each Ne-gαgCS $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$.

Theorem 4.11: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. Afterward, η remains a Ne-gαg-irresolute function iff for each Ne-gαgOS $\mathcal{K}$ in $\mathcal{V}$, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgOS in $\mathcal{U}$.

Proof: Let Ne-gαgOS $\mathcal{K}$ and Ne-gαgCS $\bar{\mathcal{K}}$ are in $\mathcal{V}$. Therefore, $\eta^{-1}(\bar{\mathcal{K}}) = \overline{(\eta^{-1}(\mathcal{K}))}$ remains a Ne-gαgCS in $\mathcal{U}$. Consequently, $\eta^{-1}(\mathcal{K})$ exists a Ne-gαgOS in $\mathcal{U}$. The reverse proof is evident.

Proposition 4.12: For all Ne-gαg-irresolute functions are Ne-gαg-continuous.

Proof: Let Ne-CS $\mathcal{K}$ be in $NTS\ \mathcal{V}$ and Ne-gαg-irresolute function η defined on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$. So, we have $\mathcal{K}$ stands a Ne-gαgCS in $\mathcal{V}$ by theorem (3.3) part (i). By definition of Ne-gαg-irresolute function, $\eta^{-1}(\mathcal{K})$ stands a Ne-gαgCS in $\mathcal{U}$. As a result, η exists a Ne-gαg-continuous.

The subsequent example explains that the inverse of the overhead proposition does not work.

Example 4.13: Suppose $\mathcal{U} = \{p, q\}$ and let $\xi = \{0_N, \mathcal{B}, 1_N\}$ and $\varrho = \{0_N, \mathcal{A}, \mathcal{B}, 1_N\}$, where $\mathcal{A} = \langle u, (0.6,0.7), (0.4,0.3), (0.5,0.2)\rangle$ and $\mathcal{B} = \langle u, (0.5,0.5), (0.5,0.4), (0.6,0.5)\rangle$ are the neutrosophic sets, then $(\mathcal{U}, \xi)$ and $(\mathcal{U}, \varrho)$ are NTSs. Define $\eta: (\mathcal{U}, \xi) \longrightarrow (\mathcal{U}, \varrho)$ as a $\eta(p) = q$ and $\eta(q) = p$. Then η is Ne-gαg-continuous. But $\mathcal{C} = \langle u, (0.5,0.5), (0.6,0.4), (0.5,0.7)\rangle$ is a Ne-gαgCS in $(\mathcal{U}, \varrho)$, $\eta^{-1}(\mathcal{C})$ is not a Ne-gαgCS in $(\mathcal{U}, \xi)$. Thus η is not a Ne-gαg-irresolute.

Definition 4.14: We called a $NTS\ \mathcal{U}$ with a neutrosophic $T_{\frac{1}{2}}$-space if for each Ne-gCS in $\mathcal{U}$ is a Ne-CS and we denoted it by Ne-$T_{\frac{1}{2}}$-space.

Definition 4.15: We called a $NTS\ \mathcal{U}$ with a neutrosophic $T_{g\alpha g}$-space if for each Ne-gαgCS in $\mathcal{U}$ is a Ne-CS and we denoted by Ne-$T_{g\alpha g}$-space.

Proposition 4.16: Every Ne-$T_{\frac{1}{2}}$-space stands a Ne-$T_{g\alpha g}$-space.

Proof: Let $\mathcal{C}$ be a Ne-gαgCS in Ne-$T_{\frac{1}{2}}$-space $\mathcal{U}$. By theorem (3.3) part (ii), we obtain $\mathcal{C}$ is a Ne-gCS. By definition of Ne-$T_{\frac{1}{2}}$-space, we reach to that $\mathcal{C}$ is a Ne-CS in $\mathcal{U}$. Therefore, $\mathcal{U}$ endures a Ne-$T_{g\alpha g}$-space.

Theorem 4.17: Let η_1 be a Ne-gαg-continuous function on $NTS\ \mathcal{U}$ and valued in $NTS\ \mathcal{V}$ and let η_2 be a Ne-g-continuous function on $NTS\ \mathcal{V}$ and valued in $TS\ \mathcal{W}$. If $\mathcal{V}$ is a Ne-$T_{\frac{1}{2}}$-space, then $\eta_2 \circ \eta_1$ is a Ne-gαg-continuous function.

Proof: Assume Ne-CS $\mathcal{K}$ is in $\mathcal{W}$. Meanwhile, we have a Ne-g-continuous function η_2 defined on a Ne-$T_{\frac{1}{2}}$-space $\mathcal{V}$, then ${\eta_2}^{-1}(\mathcal{K})$ stands a Ne-CS in $\mathcal{V}$. Subsequently, we also see a Ne-gαg-continuous function η_1 defined on $\mathcal{U}$, then ${\eta_1}^{-1}({\eta_2}^{-1}(\mathcal{K}))$ stands a Ne-gαgCS in $\mathcal{U}$. Therefore, $\eta_2 \circ \eta_1$ stands a Ne-gαg-continuous.

Theorem 4.18: Let η be a function on $NTS\ \mathcal{U}$ and valued in $TS\ \mathcal{V}$, we have the following results:

(i) If $NTS\ \mathcal{U}$ stands a Ne-$T_{\frac{1}{2}}$-space then the function η becomes a Ne-g-continuous iff it considers a a Ne-gαg-continuous.

(ii) If $NTS\ \mathcal{U}$ stands a Ne-$T_{g\alpha g}$-space then the function η becomes a Ne-continuous iff it considers a Ne-gαg-continuous.

Proof:

(i) Let Ne-CS $\mathcal{K}$ be in $\mathcal{V}$ and η be a Ne-g-continuous function. By definition of Ne-g-continuous, $\eta^{-1}(\mathcal{K})$ is a Ne-gCS in $\mathcal{U}$. Besides, the definition of Ne-$T_{\frac{1}{2}}$-space states $\eta^{-1}(\mathcal{K})$ is a Ne-CS. So, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$ by theorem (3.3) part (i). Therefore, η is a Ne-gαg-continuous.

On the contrary, let Ne-CS $\mathcal{K}$ be in $\mathcal{V}$ and let η be a Ne-gαg-continuous. By definition of Ne-gαg-continuous, $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$. Besides, we have $\eta^{-1}(\mathcal{K})$ is a Ne-gCS in $\mathcal{U}$ by theorem (3.3) part (ii). Therefore, η is a Ne-g-continuous.

(ii) Let Ne-CS $\mathcal{K}$ be in $\mathcal{V}$ and let η be a Ne-continuous. By definition of Ne-continuous, $\eta^{-1}(\mathcal{K})$ is a Ne-CS in $\mathcal{U}$. So, we have $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$ by theorem (3.3) part (i). Therefore, η is a Ne-gαg-continuous.
On the contrary, let Ne-CS $\mathcal{K}$ be in $\mathcal{V}$ and let η be a Ne-gαg-continuous. Besides, we have $\eta^{-1}(\mathcal{K})$ is a Ne-gαgCS in $\mathcal{U}$. Furthermore, the definition of Ne-$T_{g\alpha g}$-space gives $\eta^{-1}(\mathcal{K})$ is a Ne-CS in $\mathcal{U}$. Therefore, η is a Ne-continuous.

Remark 4.19: The subsequent illustration indicates the relative among the various kinds of Ne-continuous functions:

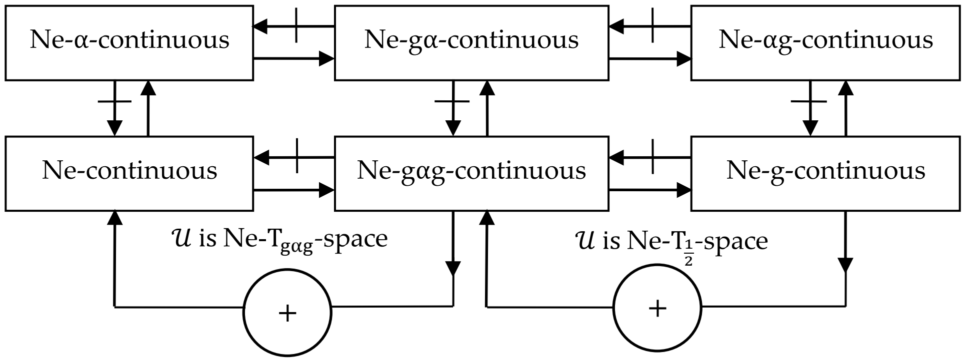

Fig. 4.1

5. Conclusion

The class of Ne-gαgCS described employing Ne-αgCS structures a neutrosophic topology and deceptions between the classes of Ne-CS and Ne-gCS. We as well illustration Ne-gαg-continuous functions by applying Ne-gαgCS. The Ne-gαgCS know how to be developed to establish another neutrosophic homeomorphism.

Funding: This work does not obtain any external grant.

Acknowledgments: The authors are highly grateful to the Referees for their constructive suggestions.

Conflicts of Interest: The authors declare no conflict of interest.

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Received: Apr 25, 2020. Accepted: July 5 2020