

Neutrosophic πG Pre Continuous Mappings and Neutrosophic πG Pre Irresolute Mappings in Neutrosophic Topological Spaces

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ABSTRACT

The aim of this paper is to introduce a new class of function called Neutrosophic π Generalized Pre Continuous Mapping. Also, analyzed Neutrosophic π Generalized Pre Continuous Mapping with the existing continuous mapping in Neutrosophic Topological Spaces.

Keywords: Neutrosophic Topological Space, Neutrosophic open set, Neutrosophic closed set, Neutrosophic π Generalized Pre closed set, and Neutrosophic π Generalized Pre continuous mapping.

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I. Introduction

The concept of fuzzy sets, introduced by Zadeh [3] in 1965, allow each element to have a degree of membership. This concept was expanded by K. Atanassov [1] in 1986 with the introduction of Intuitionistic Fuzzy sets, which assign both a degree of membership and a degree of non-membership to each element. Florentin Samarandache [4] introduced Neutrosophic Sets as a further generalization, which adds more flexibility. Later, A. A. Salama and S. A. Albawi [5] extended the idea by developing Neutrosophic Topological Spaces.

In this paper we introduced Neutrosophic π Generalized Pre Continuous Mapping in Neutrosophic Topological Space.

II. Preliminaries

In this paper the Neutrosophic topological space is denoted by (X, τ_N) . Also the Neutrosophic interior, Neutrosophic closure of a Neutrosophic set A are denoted by $Nint(A)$ and $Ncl(A)$. The complement of a Neutrosophic set A is denoted by A^c and the empty and whole set is denoted by 0_N and 1_N respectively.

Definition 2.1 [10]:

Let X be a non-empty fixed set. A Neutrosophic set (NS) A is an object having the form $A = \{(x, \mu_A(x), \sigma_A(x), \nu_A(x)) : x \in X\}$ where $\mu_A(x), \sigma_A(x), \nu_A(x)$ represent the degree of membership, degree of indeterminacy and the degree of non-membership respectively of each element $x \in X$ to the set A .

A Neutrosophic set $A = \{(x, \mu_A(x), \sigma_A(x), \nu_A(x)) : x \in X\}$ can be identified as an ordered triple $\langle \mu_A, \sigma_A, \nu_A \rangle$.

Definition 2.2 [10]:

For any two Neutrosophic sets $A = \{(x, \mu_A(x), \sigma_A(x), \nu_A(x)) : x \in X\}$ and

$B = \{(x, \mu_B(x), \sigma_B(x), \nu_B(x)) : x \in X\}$ we may have,

1. $A \subseteq B \Leftrightarrow \mu_A(x) \leq \mu_B(x), \sigma_A(x) \leq \sigma_B(x), \nu_A(x) \geq \nu_B(x) \forall x \in X$
2. $A \cap B = \langle \mu_A(x) \wedge \mu_B(x), \sigma_A(x) \wedge \sigma_B(x), \nu_A(x) \vee \nu_B(x) \rangle$
3. $A \cup B = \langle \mu_A(x) \vee \mu_B(x), \sigma_A(x) \vee \sigma_B(x), \nu_A(x) \wedge \nu_B(x) \rangle$

Definition 2.3 [10]:

A Neutrosophic topology (NT) on a non-empty set X is a family τ_N of Neutrosophic subsets in X satisfies the following axioms:

- (NT1) $0_N, 1_N \in \tau_N$
- (NT2) $G_1 \cap G_2 \in \tau_N$ for any $G_1, G_2 \in \tau_N$
- (NT3) $\cup G_i \in \tau_N \forall \{G_i : i \in J\} \subseteq \tau_N$

In this case the pair (X, τ_N) is a Neutrosophic topological space (NTS) and any Neutrosophic set in τ_N is known as a Neutrosophic open set (NOS) in X . A Neutrosophic set A is a Neutrosophic Closed set (NCS) if and only if complement A^c is a Neutrosophic open set in X .

Here the empty set (0_N) and the whole set (1_N) may be defined as follows:

- 1. $0_N = \{\langle x, (0,0,1) \rangle : x \in X\}$
- 2. $1_N = \{\langle x, (1,1,0) \rangle : x \in X\}$

Definition 2.4 [10]:

Let (X, τ_N) be a NTS and $A = \{\langle x, \mu_A(x), \sigma_A(x), \nu_A(x) \rangle : x \in X\}$ be a NS in X . Then the Neutrosophic interior and the Neutrosophic closure of A are defined by

$$Nint(A) = \cup \{G : G \text{ is an NOS in } X \text{ and } G \subseteq A\}$$

$$Ncl(A) = \cap \{K : K \text{ is an NCS in } X \text{ and } A \subseteq K\}$$

Definition 2.5 [10]:

An NS $A = \{\langle x, \mu_A, \sigma_A, \nu_A \rangle\}$ is an NTS (X, τ_N) is said to be an

- 1. Neutrosophic semi closed set ($NSCS$ in short) if $Nint(Ncl(A)) \subseteq A$.
- 2. Neutrosophic pre closed set ($NPCS$ in short) if $Ncl(Nint(A)) \subseteq A$.
- 3. Neutrosophic α -closed set ($N\alpha CS$ in short) if $Ncl(Nint(Ncl(A))) \subseteq A$
- 4. Neutrosophic semi pre closed set ($NSPCS$ in short) if $Nint(Ncl(Nint(A))) \subseteq A$
- 5. Neutrosophic regular closed set ($NRCS$ in short) if $A = Ncl(Nint(A))$
- 6. Neutrosophic generalized closed set ($NGCS$ in short) if $Ncl(A) \subseteq U$ whenever $A \subseteq U$ and U is an NOS in X .
- 7. Neutrosophic generalized semi closed set ($NGSCS$ in short) if $Nscl(A) \subseteq U$ whenever $A \subseteq U$ and U is an NOS in X .
- 8. Neutrosophic π open if A is the union of Neutrosophic regular open sets.

Definition 2.6 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Continuous mapping if $f^{-1}(A)$ is Neutrosophic Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.7 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Pre Continuous mapping if $f^{-1}(A)$ is Neutrosophic Pre Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.8 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic α Continuous mapping if $f^{-1}(A)$ is Neutrosophic α Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.9 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Semi Continuous mapping if $f^{-1}(A)$ is Neutrosophic Semi Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.10 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Semi Pre Continuous mapping if $f^{-1}(A)$ is Neutrosophic Semi Pre Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.11 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Regular Continuous mapping if $f^{-1}(A)$ is Neutrosophic Regular Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.12 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Generalized Semi Continuous mapping if $f^{-1}(A)$ is Neutrosophic Generalized Semi Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.13 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Generalized Pre Continuous mapping if $f^{-1}(A)$ is Neutrosophic Generalized Pre Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.14 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Generalized Semi Pre Continuous mapping if $f^{-1}(A)$ is Neutrosophic Generalized Semi Pre Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.15 [12]:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is said to be Neutrosophic Generalized α Continuous mapping if $f^{-1}(A)$ is Neutrosophic Generalized α Closed in (X, τ_N) for every Neutrosophic closed set A of (Y, κ_N) .

Definition 2.16 [7]:

An $NTS (X, \tau_N)$ is said to be an

1. Neutrosophic $\pi PaT_{\frac{1}{2}}$ space ($N\pi P aT_{\frac{1}{2}}$ in short) if every $N\pi GPCS$ in (X, τ_N) is an NCS in (X, τ_N) .
2. Neutrosophic $\pi PbT_{\frac{1}{2}}$ space ($N\pi P bT_{\frac{1}{2}}$ in short) if every $N\pi GPCS$ in (X, τ_N) is an $NGCS$ in (X, τ_N) .

Definition 2.17 [10]:

An $NFS A$ is said to be an Neutrosophic π Generalized Pre Closed Set ($N\pi GPCS$ in short) if $pcl(A) \subseteq U$ whenever $A \subseteq U$ and U is an $N\pi OS$ in (X, τ_N) . The family of all $N\pi GPCS$ of an $NTS(X, \tau_N)$ is denoted by $N\pi GPCS(X)$.

III. NEUTROSOPHIC πG PRE CONTINUOUS MAPPING

In this section, we introduce Neutrosophic πG Pre continuous mapping and investigate some of its properties.

Definition 3.1:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is called Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping if $f^{-1}(A)$ is $N\pi G$ Pre closed set in (X, τ_N) for every $NCS A$ of (Y, κ_N)

Example 3.2:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.5, 0.4, 0.4), (0.6, 0.4, 0.5) \rangle$ and $K = \langle Y, (0.4, .3, 0.7), (0.4, 0.3, 0.7) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$ respectively. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.7, 0.7, 0.4), (0.7, 0.7, 0.4) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.7, 0.7, 0.4), (0.7, 0.7, 0.4) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping.

Theorem 3.3:

Every Neutrosophic continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be an Neutrosophic Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic Continuous Mapping, $f^{-1}(A)$ is an Neutrosophic Closed Set in (X, τ_N) . Since every Neutrosophic Closed Set is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.4:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.2, 0.3, 0.5), (0.3, 0.4, 0.6) \rangle$ and $K = \langle Y, (0.4, 0.4, 0.3), (0.5, 0.5, 0.3) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.3, 0.6, 0.4), (0.3, 0.5, 0.5) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.3, 0.6, 0.4), (0.3, 0.5, 0.5) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic continuous mapping.

Theorem 3.5:

Every Neutrosophic α continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be an Neutrosophic α Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic α Continuous Mapping, $f^{-1}(A)$ is an $N\alpha CS$ in (X, τ_N) . Since every $N\alpha CS$ is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.6:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.3, 0.5, 0.6), (0.4, 0.4, 0.6) \rangle$ and $K = \langle Y, (0.5, 0.5, 0.4), (0.4, 0.5, 0.6) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.4, 0.5, 0.5), (0.6, 0.5, 0.4) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.4, 0.5, 0.5), (0.6, 0.5, 0.4) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic α continuous mapping.

Theorem 3.7:

Every Neutrosophic Generalized continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be an Neutrosophic Generalized Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic Generalized Continuous Mapping, $f^{-1}(A)$ is an $NGCS$ in (X, τ_N) . Since every $NGCS$ is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.8:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.3, 0.6, 0.6), (0.4, 0.6, 0.5) \rangle$ and $K = \langle Y, (0.8, 0.7, 0.2), (0.6, 0.7, 0.3) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.2, 0.3, 0.8), (0.3, 0.3, 0.6) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.2, 0.3, 0.8), (0.3, 0.3, 0.6) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic Generalized continuous mapping.

Theorem 3.9:

Every Neutrosophic Regular continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be a Neutrosophic Regular Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic Regular Continuous Mapping, $f^{-1}(A)$ is an $NRCS$ in (X, τ_N) . Since every $NRCS$ is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.10:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.2, 0.4, 0.6), (0.3, 0.7, 0.5) \rangle$ and $K = \langle Y, (0.3, 0.7, 0.2), (0.5, 0.8, 0.3) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.2, 0.3, 0.3), (0.3, 0.2, 0.5) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.2, 0.3, 0.3), (0.3, 0.2, 0.5) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic Regular continuous mapping.

Theorem 3.11:

Every Neutrosophic Pre continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be a Neutrosophic Pre Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic Pre Continuous Mapping, $f^{-1}(A)$ is an $NPCS$ in (X, τ_N) . Since every $NPCS$ is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.12:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.3, 0.4, 0.5), (0.7, 0.6, 0.8) \rangle$ and $K = \langle Y, (0.3, 0.3, 0.7), (0.4, 0.2, 0.8) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.7, 0.7, 0.3), (0.8, 0.8, 0.4) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.7, 0.7, 0.3), (0.8, 0.8, 0.4) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic Pre continuous mapping.

Theorem 3.13:

Every Neutrosophic α Generalized continuous mapping is Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping but not conversely.

Proof:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ be an Neutrosophic α Generalized Continuous Mapping. Let A be an NCS in (Y, κ_N) . Since f is Neutrosophic α Generalized Continuous Mapping, $f^{-1}(A)$ is an $NaGCS$ in (X, τ_N) . Since every $NaGCS$ is an $N\pi GPCS$, $f^{-1}(A)$ is an $N\pi GPCS$ in (X, τ_N) . Hence f is an $N\pi G$ Pre continuous mapping.

Example 3.14:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.4, 0.3, 0.4), (0.3, 0.6, 0.4) \rangle$ and $K = \langle Y, (0.8, 0.7, 0.3), (0.4, 0.5, 0.2) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.3, 0.3, 0.8), (0.2, 0.5, 0.4) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.3, 0.3, 0.8), (0.2, 0.5, 0.4) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic α Generalized continuous mapping.

Proposition 3.15:

Neutrosophic Semi continuous mapping and Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping are independent

Example 3.16:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G_1 = \langle X, (0.2, 0.2, 0.8), (0.3, 0.4, 0.5) \rangle$, $G_2 = \langle X, (0.4, 0.6, 0.4), (0.3, 0.5, 0.4) \rangle$ and $K = \langle Y, (0.4, 0.7, 0.3), (0.4, 0.6, 0.3) \rangle$. Then $\tau_N = \{0_N, G_1, G_2, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$ respectively. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.3, 0.3, 0.4), (0.3, 0.4, 0.4) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.3, 0.3, 0.4), (0.3, 0.4, 0.4) \rangle$ is a Neutrosophic Semi Closed Set in (X, τ_N) . Hence f is Neutrosophic Semi continuous mapping. But not $N\pi G$ Pre continuous mapping.

Example 3.17:

Let $X = \{a, b\}, Y = \{u, v\}$ and $G = \langle X, (0.3, 0.4, 0.6), (0.6, 0.4, 0.3) \rangle$ and $K = \langle Y, (0.2, 0.4, 0.6), (0.3, 0.4, 0.3) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N), f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.6, 0.6, 0.2), (0.3, 0.6, 0.3) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.6, 0.6, 0.2), (0.3, 0.6, 0.3) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic Semi continuous mapping.

Proposition 3.18:

Neutrosophic Generalized Semi continuous mapping and Neutrosophic π Generalized Pre Continuous ($N\pi G$ Pre continuous for short) Mapping are independent

Example 3.19:

Let $X = \{a, b\}$, $Y = \{u, v\}$ and $G_1 = \langle X, (0.3, 0.4, 0.8), (0.3, 0.5, 0.6) \rangle$, $G_2 = \langle X, (0.5, 0.6, 0.5), (0.3, 0.5, 0.4) \rangle$ and $K = \langle Y, (0.6, 0.6, 0.4), (0.6, 0.5, 0.3) \rangle$. Then $\tau_N = \{0_N, G_1, G_2, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$, $f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.4, 0.4, 0.6), (0.3, 0.5, 0.6) \rangle$ is a Neutrosophic Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.4, 0.4, 0.6), (0.3, 0.5, 0.6) \rangle$ is Neutrosophic Generalized Semi Closed set in (X, τ_N) . Hence f is Neutrosophic Generalized Semi continuous mapping. But not a $N\pi G$ Pre continuous mapping.

Example 3.20:

Let $X = \{a, b\}$, $Y = \{u, v\}$ and $G = \langle X, (0.7, 0.5, 0.1), (0.6, 0.5, 0.2) \rangle$ and $K = \langle Y, (0.6, 0.5, 0.6), (0.5, 0.5, 0.4) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$, $f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.6, 0.5, 0.6), (0.4, 0.5, 0.5) \rangle$ is a Neutrosophic Closed Set in (Y, σ) . Then $f^{-1}(K^c) = \langle X, (0.6, 0.5, 0.6), (0.4, 0.5, 0.5) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre continuous mapping. But not a Neutrosophic Generalized Semi continuous mapping.

IV. NEUTROSOPHIC πG PRE IRRESOLUTE MAPPING

In this section, we introduce Neutrosophic πG Pre irresolute mapping and investigate some of its properties.

DEFINITION 4.1:

A mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is called Neutrosophic π Generalized Pre irresolute ($N\pi G$ Pre irresolute for short) Mapping if $f^{-1}(A)$ is $N\pi GPCS$ in (X, τ_N) for every $N\pi GPCS$ A of (Y, κ_N) .

EXAMPLE 4.2:

Let $X = \{a, b\}$, $Y = \{u, v\}$ and $G = \langle X, (0.2, 0.5, 0.2), (0.2, 0.5, 0.3) \rangle$ and $K = \langle Y, (0.1, 0.5, 0.4), (0.2, 0.5, 0.7) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$, $f(a) = u$ and $f(b) = v$. $K^c = \langle Y, (0.4, 0.5, 0.1), (0.7, 0.5, 0.2) \rangle$ is a Neutrosophic πGP Closed Set in (Y, κ_N) . Then $f^{-1}(K^c) = \langle X, (0.4, 0.5, 0.1), (0.7, 0.5, 0.2) \rangle$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is $N\pi G$ Pre irresolute mapping.

THEOREM 4.3:

If $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is a $N\pi GP$ Pre irresolute mapping then f is a $N\pi G$ Pre continuous mapping but not conversely.

Proof:

Let f is a $N\pi G$ Pre irresolute mapping, Let A be any NCS in (Y, κ_N) . Then A is $N\pi GPCS$ in (Y, κ_N) . $f^{-1}(A)$ is a $N\pi GPCS$ in (X, τ_N) . Hence f is a $N\pi G$ Pre continuous mapping.

EXAMPLE 4.4:

Let $X = \{a, b\}$, $Y = \{u, v\}$ and $G = \langle X, (0.4, 0.3, 0.4), (0.5, 0.4, 0.5) \rangle$ and $K = \langle Y, (0.6, 0.3, 0.2), (0.5, 0.4, 0.6) \rangle$. Then $\tau_N = \{0_N, G, 1_N\}$ and $\kappa_N = \{0_N, K, 1_N\}$ respectively. Define a mapping $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$, $f(a) = u$ and $f(b) = v$. Then f is a $N\pi G$ Pre continuous mapping since for a closed set $K^c = \langle Y, (0.2, 0.7, 0.6), (0.6, 0.6, 0.5) \rangle$ in (Y, κ_N) , its inverse image $f^{-1}(K^c) = \langle X, (0.2, 0.7, 0.6), (0.6, 0.6, 0.5) \rangle$ is $N\pi GPCS$ in (X, τ_N) . But f is not Neutrosophic πG Pre irresolute mapping. For the Neutrosophic set $A = \langle Y, (0.4, 0.3, 0.4), (0.5, 0.4, 0.5) \rangle$ is $N\pi GPCS$ in (Y, κ_N) but $f^{-1}(A)$ is not a $N\pi GPCS$ in (X, τ_N) .

THEOREM 4.5:

Let $f: (X, \tau_N) \rightarrow (Y, \kappa_N)$ is a $N\pi G$ Pre irresolute mapping. If (X, τ_N) is a $N\pi P aT_{\frac{1}{2}}$ space. Then f is a Neutrosophic continuous mapping.

Proof:

Let f is a $N\pi G$ Pre irresolute mapping. Let A be any Neutrosophic Closed Set in (Y, κ_N) . Since f is irresolute $f^{-1}(A)$ is $N\pi GP$ Closed Set in (X, τ_N) . Since (X, τ_N) is $N\pi P aT_{\frac{1}{2}}$ space. $f^{-1}(A)$ is Neutrosophic Closed set in (X, τ_N) . Hence f is Neutrosophic Continuous mapping.

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