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On Almost π- Generalized Semi Continuous Mappings in Intuitionistic Fuzzy Topological Spaces

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Abstract

In this paper we have introduced intuitionistic fuzzy almost π- generalized semi continuous mappings and intuitionistic fuzzy almost contra π- generalized semi continuous mappings and some of their basic properties are studied.

Key words: Intuitionistic fuzzy topology, intuitionistic fuzzy π -generalized semi closed set, intuitionistic fuzzy almost π - generalized semi continuous mappings and intuitionistic fuzzy almost contra π- generalized semi continuous mappings, intuitionistic fuzzy $\pi T_{1/2}$ (IF$\pi T_{1/2}$) space and intuitionistic fuzzy $\pi gT_{1/2}$ (IF $\pi gT_{1/2}$) space

1. Introduction

The concept of intuitionistic fuzzy sets was introduced by Atanassov[1] and later Coker[4] introduced intuitionistic fuzzy topological spaces using the notion of intuitionistic fuzzy sets. In this paper we introduce intuitionistic fuzzy almost π- generalized semi continuous mappings, intuitionistic fuzzy almost contra π- generalized semi continuous mappings and studied some of their basic properties. We provide some characterizations of intuitionistic fuzzy almost π- generalized semi continuous mappings and intuitionistic fuzzy almost contra π- generalized semi continuous mappings.

2. Preliminaries

Definition 2.1:[1] An intuitionistic fuzzy set (IFS in short) A in X is an object having the form

$$A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X\}$$

where the functions $\mu_A(x)$: X $\to$ [0, 1] and $\nu_A(x)$: X $\to$ [0, 1] denote the degree of membership (namely $\mu_A(x)$) and the degree of non-membership (namely $\nu_A(x)$) of each element $x \in X$ to the set A, respectively, and $0 \leq \mu_A(x) + \nu_A(x) \leq 1$ for each $x \in X$. Denote by IFS(X), the set of all intuitionistic fuzzy sets in X.

Definition 2.2:[1] Let A and B be IFSs of the form

$A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X \}$ and $B = \{ \langle x, \mu_B(x), \nu_B(x) \rangle / x \in X \}$. Then

(a) $A \subseteq B$ if and only if $\mu_A(x) \leq \mu_B(x)$ and $\nu_A(x) \geq \nu_B(x)$ for all $x \in X$

(b) $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$

(c) $A^c = \{ \langle x, \nu_A(x), \mu_A(x) \rangle / x \in X \}$

(d) $A \cap B = \{ \langle x, \mu_A(x) \wedge \mu_B(x), \nu_A(x) \vee \nu_B(x) \rangle / x \in X \}$

(e) $A \cup B = \{ \langle x, \mu_A(x) \vee \mu_B(x), \nu_A(x) \wedge \nu_B(x) \rangle / x \in X \}$

For the sake of simplicity, we shall use the notation $A = \langle x, \mu_A, \nu_A \rangle$ instead of $A = \{ \langle x, \mu_A(x), \nu_A(x) \rangle / x \in X \}$. Also for the sake of simplicity, we shall use the notation $A = \{ \langle x, (\mu_A, \mu_B), (\nu_A, \nu_B) \rangle \}$ instead of

$A = \langle x, (A/\mu_A, B/\mu_B), (A/\nu_A, B/\nu_B) \rangle$.The intuitionistic fuzzy sets $0_\sim = \{ \langle x, 0, 1 \rangle / x \in X \}$ and $1_\sim = \{\langle x, 1, 0 \rangle / x \in X\}$ are respectively the empty set and the whole set of X.

Definition 2.3:[3] An intuitionistic fuzzy topology (IFT in short) on X is a family τ of IFSs in X satisfying the following axioms.

(i) $0_\sim, 1_\sim \in \tau$

(ii) $G_1 \cap G_2 \in \tau$ for any $G_1, G_2 \in \tau$

(iii) $\cup G_i \in \tau$ for any family $\{ G_i / i \in J \} \subseteq \tau$.

In this case the pair (X, τ) is called an intuitionistic fuzzy topological space (IFTS in short) and any IFS in τ is known as an intuitionistic fuzzy open set (IFOS in short) in X. The complement A^c of an IFOS A in IFTS (X, τ) is called an intuitionistic fuzzy closed set (IFCS in short) in X.

Definition 2.4:[3] Let (X, τ) be an IFTS and $A = \langle x, \mu_A, \nu_A \rangle$ be an IFS in X. Then the intuitionistic fuzzy interior and intuitionistic fuzzy closure are defined by

$\text{int}(A) = \cup \{ G / G$ is an IFOS in X and $G \subseteq A \}$,

$\text{cl}(A) = \cap \{ K / K$ is an IFCS in X and $A \subseteq K \}$.

Definition 2.5:[9] A subset of A of a space (X, τ) is called:

(i) regular open if $A = \text{int}(\text{cl}(A))$.

(ii) π open if A is the union of regular open sets.

Definition 2.6:[8] An IFS $A = \{ \langle x, \mu_A, \nu_A \rangle \}$ in an IFTS (X, τ) is said to be an

(i) *intuitionistic fuzzy semi open set* (IFSOS in short) if $A \subseteq \text{cl}(\text{int}(A))$,

(ii) *intuitionistic fuzzy α-open set* (IFαOS in short) if $A \subseteq \text{int}(\text{cl}(\text{int}(A)))$,

(iii) intuitionistic fuzzy regular open set (IFROS in short) if $A = \text{int}(\text{cl}(A))$.

The family of all IFOS (respectively IFSOS, IFαOS, IFROS) of an IFTS (X, τ) is denoted by IFO(X) (respectively IFSO(X), IFαO(X), IFRO(X)).

Definition 2.7:[8] An IFS $A = \langle x, \mu_A, \nu_A \rangle$ in an IFTS (X, τ) is said to be an

(i) *intuitionistic fuzzy semi closed set* (IFSCS in short) if $\text{int}(\text{cl}(A)) \subseteq A$,

(ii) *intuitionistic fuzzy α-closed set* (IFαCS in short) if $\text{cl}(\text{int}(\text{cl}(A)) \subseteq A$,

(iii) intuitionistic fuzzy regular closed set (IFRCS in short) if $A = \text{cl}(\text{int}(A))$.

The family of all IFCS (respectively IFSCS, IFαCS, IFRCS) of an IFTS (X, τ) is denoted by IFC(X) (respectively IFSC(X), IFαC(X), IFRC(X)).

Definition 2.8:[11] Let A be an IFS in an IFTS (X, τ). Then $\text{scl}(A) = \cap \{ K / K$ is an IFSCS in X and $A \subseteq K \}$.

Definition 2.9:[10] An IFS $A = \langle x, \mu_A, \nu_A \rangle$ in an IFTS (X, τ) is said to be an *intuitionistic fuzzy γ closed set* (IFγCS in short) if $\text{int}(\text{cl}(A)) \cap \text{cl}(\text{int}(A)) \subseteq A$.

Definition 2.10:[6] An IFS A of an IFTS (X, τ) is an

(i) intuitionistic fuzzy pre closed set (IFPCS in short) if cl(int(A)) $\subseteq$ A,

(ii) intuitionistic fuzzy pre open set (IFPOS in short) if A $\subseteq$ int(cl(A)).

Definition 2.11:[9] An IFS A in an IFTS (X, τ) is an

(i) intuitionistic fuzzy generalized closed set (IFGCS in short) if cl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFOS in X,

(ii) intuitionistic fuzzy regular generalized closed set (IFRGCS in short) if cl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFROS in X,

(iii) intuitionistic fuzzy generalized pre closed set (IFGPCS in short) if cl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFOS in X.

Definition 2.12:[12] An IFS A is said to be an intuitionistic fuzzy alpha generalized open set (IFαGOS in short) in X if the complement A^c is an IFαGCS in X.

The family of all IFαGCSs (IFαGOSs) of an IFTS (X, τ) is denoted by IFαGC(X) (IFαGO(X)).

Definition 2.13:[9] An IFS A in an IFTS (X, τ) is said to be an intuitionistic fuzzy π -generalized semi closed set (IFπGSCS in short) if scl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFπOS in (X, τ). An IFS A is said to be an intuitionistic fuzzy π - generalized semi open set (IFπGSOS in short) in X if the complement A^c is an IFπGSCS in X. The family of all IFπGSCSs of an IFTS (X, τ) is denoted by IFπGSC(X).

Result 2.14:[9] Every IFCS, IFGCS, IFRCS, IFαCS , IFαGCS IFGSCS is an IFπGSCS but the converses may not be true in general.

Definition 2.15:[6] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be intuitionistic fuzzy continuous (IF continuous in short) if $f^{-1}(B) \in$ IFO(X) for every B $\in$ σ.

Definition 2.16:[10] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be

(i)intuitionistic fuzzy semi continuous (IFS continuous in short) if $f^{-1}(B) \in$ IFSO(X) for every B $\in$ σ,

(ii)intuitionistic fuzzy α-continuous (IFα continuous in short) if $f^{-1}(B) \in$ IFαO(X) for every B $\in$ σ.

Definition 2.17:[10] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy γ-continuous (IFγ continuous in short) if $f^{-1}(B) \in$ IFγCS(X) for every IFCS B in Y.

Definition 2.18:[11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy generalized continuous (IFG continuous in short) if $f^{-1}(B) \in$ IFGCS(X) for every IFCS B in Y.

Definition 2.19:[11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy α-generalized semi continuous (IFαGS continuous in short) if $f^{-1}(B) \in$ IFαGSCS(X) for every IFCS B in Y.

Definition 2.20:[11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy generalized semi continuous (IFGS continuous in short) if $f^{-1}(B) \in$ IFGSCS(X) for every IFCS B in Y.

Definition 2.21:[14] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be intuitionistic fuzzy almost continuous (IFA continuous in short) if $f^{-1}(B) \in$ IFC(X) for every IFRCS Bin Y.

Definition 2.22:[11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be intuitionistic fuzzy almost α-generalized continuous (IFAαG continuous in short) if $f^{-1}(B) \in$ IFαGC(X) for every IFRCS B in Y.

Definition 2.23:[2] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be intuitionistic fuzzy contra continuous (IF contra continuous in short) if $f^{-1}(B) \in$ IFC(X) for every IFOS B in Y.

Definition 2.24:[2] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be intuitionistic fuzzy contra α-continuous (IFCα continuous in short) if $f^{-1}(B) \in$ IFαC(X) for every IFOS B in Y.

Definition 2.25:[11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy contra pre-continuous (IFCP continuous in short) if $f^{-1}(B) \in$ IFPCS(X) for every IFOS B in Y.

Definition 2.26:[2] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy contra generalized continuous (IFCG continuous in short) if $f^{-1}(B) \in$ IFGCS(X) for every IFOS B in Y.

Definition 2.27:[12] An IFTS (X, τ) is said to be an intuitionistic fuzzy $\pi T_{1/2}$ (IF$\pi T_{1/2}$ in short) space if every IFπGSCS in X is an IFCS in X.

Definition 2.28: [12] An IFTS (X, τ) is said to be an intuitionistic fuzzy $\pi gT_{1/2}$ (IF $\pi gT_{1/2}$ in short) space if every IFπGSCS in X is an IFGCS in X.

Result 2.29:[9] (i) Every IFπOS is an IFOS in (X, τ),
(ii) Every IFπCS is an IFCS in (X, τ).

3. Intuitionistic fuzzy almost π- generalized semi continuous mappings

In this section we introduce intuitionistic fuzzy almost π- generalized semi continuous mapping and studied some of its properties.

Definition 3.1: A mapping f: (X, τ) → (Y,σ) is called an *intuitionistic fuzzy almost π- generalized semi continuous* (IFAπGS continuous in short) if $f^{-1}(B)$ is an IFπGSCS in (X, τ) for every IFRCS B of (Y, σ).

Example 3.2: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.2, 0.2), (0.6, 0.7) ⟩, G_2 = ⟨ y, (0.4, 0.2), (0.6, 0.7) ⟩. Then τ = { $0_\sim$, G_1, $1_\sim$ } and σ = { $0_\sim$, G_2, $1_\sim$ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping.

Theorem 3.3: Every IF continuous mapping is an IFAπGS continuous mapping but not conversely.

Proof: Assume that f : (X, τ) → (Y, σ) is an IF continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Since f is an IF continuous mapping, $f^{-1}(A)$ is an IFCS in X. Every IFCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.4: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.3, 0.2), (0.6, 0.7) ⟩, G_2 = ⟨ y, (0.4, 0.2), (0.5, 0.4) ⟩. Then τ = { $0_\sim$, G_1, $1_\sim$ } and σ = { $0_\sim$, G_2, $1_\sim$ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping. But f is not an IF continuous mapping since G_2^c = ⟨ y, (0.5, 0.4), (0.4, 0.2) ⟩ is an IFCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.5, 0.4), (0.4, 0.2) ⟩ is not an IFCS in X.

Theorem 3.5: Every IFS continuous mapping is an IFAπGS continuous mapping but not conversely.

Proof: Assume that f : (X, τ) → (Y, σ) is an IFS continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Then by hypothesis $f^{-1}(A)$ is an IFSCS in X. Every IFSCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.6: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.2, 0.3), (0.5, 0.7) ⟩, G_2 = ⟨ y, (0.6, 0.8), (0.1, 0.2) ⟩. Then τ = { $0_\sim$, G_1, $1_\sim$ } and σ = { $0_\sim$, G_2, $1_\sim$ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping. But f is not an IFS continuous mapping since G_2^c = ⟨ y, (0.1, 0.2), (0.6, 0.8) ⟩ is an IFCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.1, 0.2), (0.6, 0.8) ⟩ is not an IFSCS in X.

Theorem 3.7: Every IFα continuous mapping is an IFAπGS continuous mapping but not conversely.

Proof: Let f: (X, τ) → (Y,σ) be an IFα continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Then by hypothesis $f^{-1}(A)$ is an IFαCS in X. Every IFαCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.8: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.4, 0.2), (0.6, 0.7) ⟩, G_2 = ⟨ y, (0.8, 0.8), (0.2, 0.2) ⟩ and G_3 = ⟨x, (0.4, 0.4), (0.5, 0.6) ⟩. Then τ = {$0_\sim$, G_1, G_2, $1_\sim$} and σ = { $0_\sim$, G_3, $1_\sim$} are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is IFAπGS continuous mapping but not an IFα continuous mapping The IFS G_3^c = ⟨ y, (0.5, 0.6), (0.4, 0.4) ⟩ is IFRCS in Y but $f^{-1}(G_3^c)$ = ⟨ x, (0.5, 0.6), (0.4, 0.4) ⟩ is not an IFαCS in X.

Theorem 3.9: Every IFαG continuous mapping is an IFAπGS continuous but not conversely.

Proof: Let f: (X, τ) → (Y,σ) be an IFαG continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Then by hypothesis $f^{-1}(A)$ is an IFαGCS in X. Since every IFαGCS is an IFGSCS and every IFGSCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.10: Let X = {a, b}, Y = {u, v} and G_1 = ⟨ x, (0.7, 0.6), (0.3, 0.4) ⟩, G_2 = ⟨ y, (0.3, 0.4), (0.4, 0.2) ⟩. Then τ = {$0_\sim$, G_1, $1_\sim$} and σ = {$0_\sim$, G_2, $1_\sim$} are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping but not an IFαG continuous mapping since G_2^c = ⟨ y, (0.4, 0.2), (0.3, 0.4) ⟩ is an IFCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.4, 0.2), (0.3, 0.4) ⟩ is not an IFαGCS in X.

Theorem 3.11: Every IFG continuous mapping is an IFAπGS continuous but not conversely.

Proof: Assume that f : (X, τ) → (Y,σ) is an IFG continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Then by hypothesis $f^{-1}(A)$ is an IFGCS in X. Since every IFGCS is an IFπGSCS, f is an IFAπGS continuous mapping.

Example 3.12: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.7, 0.6), (0.3, 0.4) ⟩, G_2 = ⟨ y, (0.3, 0.4), (0.4, 0.2) ⟩. Then τ = { 0~, G_1, 1~ } and σ = { 0~, G_2, 1~ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping. But f is not an IFG continuous mapping since G_2^c = ⟨ y, (0.4, 0.2), (0.3, 0.4) ⟩ is an IFCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.4, 0.2), (0.3, 0.4) ⟩ is not an IFGCS in X.

Theorem 3.13: Every IFGS continuous mapping is an IFAπGS continuous but not conversely.

Proof: Assume that f : (X, τ) → (Y,σ) is an IFGS continuous mapping. Let A be an IFRCS in Y. This implies A is an IFCS in Y. Then by hypothesis $f^{-1}(A)$ is an IFGSCS in X. Since every IFGSCS is an IFπGSCS, f is an IFAπGS continuous mapping.

Example 3.14: Let X = {a, b}, Y = {u, v} and G_1 = ⟨ x, (0.5, 0.6), (0.2, 0.2) ⟩, G_2 = ⟨ y, (0.6, 0.6), (0.3, 0.2) ⟩. Then τ = {0~, G_1, 1~} and σ = { 0~, G_2, 1~} are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping but f is not an IFGSC continuous mapping since G_2^c = ⟨ y, (0.3, 0.2), (0.6, 0.6) ⟩ is an IFCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.3, 0.2), (0.6, 0.6) ⟩ is not an IFGSCS in X.

Theorem 3.15: Every IFA continuous mapping is an IFAπGS continuous mapping but not conversely.

Proof: Let f: (X, τ) → (Y, σ) be an IFA continuous mapping. Let A be an IFRCS in Y. Since f is IFA continuous mapping, $f^{-1}(A)$ is an IFCS in X. Since every IFCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.16: Let X = {a, b}, Y = {u, v} and G_1 = ⟨ x, (0.3, 0.2), (0.6, 0.7) ⟩, G_2 = ⟨ y, (0.4, 0.2), (0.5, 0.4) ⟩. Then τ = {0~, G_1, 1~} and σ = { 0~, G_2, 1~} are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping but f is not an IFA continuous mapping since G_2^c = ⟨ y, (0.5, 0.4), (0.4, 0.2) ⟩ is an IFRCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.5, 0.4), (0.4, 0.2) ⟩ is not an IFCS in X.

Theorem 3.17: Every IFAαG continuous mapping is an IFAπGS continuous but not conversely.

Proof: Let f: (X, τ) → (Y,σ) be an IFAαG continuous mapping. Let A be an IFRCS in Y. Since f is IFA continuous mapping, Then by hypothesis $f^{-1}(A)$ is an IFαGCS in X. Since every IFαGCS is an IFGSCS and every IFGSCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Example 3.18: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, (0.8, 0.9), (0, 0.1) ⟩,G_2 = ⟨ y, (0, 0.3), (0.7, 0.7) ⟩. Then τ = { 0~, G_1, 1~ } and σ = { 0~, G_2, 1~ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping. But f is not an IFAαG continuous mapping since G_2^c = ⟨ y, (0.7, 0.7), (0, 0.3) ⟩ is an IFRCS in Y but $f^{-1}(G_2^c)$ = ⟨ x, (0.7, 0.7), (0, 0.3) ⟩ is not an IFαGCS in X.

Theorem 3.19: Let f: (X, τ) → (Y, σ) be a mapping from an IFTS X into an IFTS Y. Then the following conditions are equivalent if X is an IF$\pi T_{1/2}$ space.

(i) f is an IFAπGS continuous mapping.

(ii) If B is an IFROS in Y then $f^{-1}(B)$ is an IFπGSOS in X.

(iii) $f^{-1}(B) \subseteq int(cl(f^{-1}(B))$ for every IFROS B in Y.

Proof: **(i) ⇒ (ii):** obviously.

(ii) ⇒ (iii): Let B be any IFROS in Y. Then by hypothesis $f^{-1}(B)$ is an IFπGSOS in X. Since X is an IF$\pi T_{1/2}$ space, $f^{-1}(B)$ is an IFOS in X (Result 2.29). Therefore $f^{-1}(B) = int(f^{-1}(B)) \subseteq int(cl(f^{-1}(B)))$.

(iii) ⇒ (i): Let B be an IFRCS in Y. Then its complement B^c is an IFROS in Y. By hypothesis $f^{-1}(B^c) \subseteq int(cl(f^{-1}(B^c)))$. Hence $f^{-1}(B^c)$ is an IFπOS in X. Since every IFπOS is an IFπGSOS, $f^{-1}(B^c)$ is an IFπGSOS in X. Therefore $f^{-1}(B)$ is an IFπGSCS in X. Hence f is an IFAπGS continuous mapping.

Theorem 3.20: Let f: (X, τ) → (Y, σ) be a mapping. Then the following conditions are equivalent if X is an IF$\pi T_{1/2}$ space.

(i) f is an IFAπGS continuous mapping.

(ii) $int(cl(f^{-1}(A))) \subseteq f^{-1}(A)$ for every IFRCS A in Y.

Proof: **(i) ⇒ (ii):** Let A be an IFRCS in Y. By hypothesis, $f^{-1}(A)$ is an IFπGSCS in X. Since X is an IF$\pi T_{1/2}$, $f^{-1}(A)$ is an IFCS in X (Result 2.29).Therefore $cl(f^{-1}(A) = f^{-1}(A)$. Now $int(cl(f^{-1}(A))) \subseteq cl(f^{-1}(A)) \subseteq f^{-1}(A)$.

(ii) ⇒ (i): Let A be an IFRCS in Y. By hypothesis $int(cl(f^{-1}(A))) \subseteq f^{-1}(A)$. This implies $f^{-1}(A)$ is an IFπCS in X and hence $f^{-1}(A)$ is an IFπGSCS in X. Therefore f is an IFAπGS continuous mapping.

Theorem 3.21: Let f : (X, τ) → (Y, σ) be an IFπGS continuous mapping and g : (Y, σ) → (Z, δ) is IFA continuous, then g o f : (X, τ) → (Z, δ) is an IFAπGS continuous mapping.

Proof: Let A be an IFRCS in Z. Then $g^{-1}(A)$ is an IFCS in Y. Since f is an IFπGS continuous mapping, $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence g o f is an IFAπGS continuous mapping.

4. Intuitionistic fuzzy almost contra π- generalized semi continuous mappings

In this section we introduce intuitionistic fuzzy almost contra π- generalized semi continuous mappings and studied some of its properties.

Definition 4.1: A mapping f: (X, τ) → (Y,σ) is called an *intuitionistic fuzzy almost contra* π- generalized semi continuous mappings (IFACπGS continuous in short) if $f^{-1}(B)$ is an IFπGSCS in (X, τ) for every IFROS B of (Y, σ).

Example 4.2: Let X = {a, b}, Y = {u, v} and G_1 = ⟨ x, (0.2, 0.2), (0.6, 0.7) ⟩, G_2 = ⟨ y, (0.4, 0.2), (0.6, 0.7) ⟩. Then τ = {$0_\sim$, G_1, $1_\sim$} and σ = { $0_\sim$, G_2, $1_\sim$} are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFACπGS continuous mapping.

Theorem 4.3: Every IF contra continuous mapping is an IFACπGS continuous mapping but not conversely.

Proof: Let f: (X, τ) → (Y, σ) be an IF contra continuous mapping. Let A be an IFROS in Y. This implies A is an IFOS in Y. Since f is IF contra continuous mapping, $f^{-1}(A)$ is an IFCS in X. Since every IFCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFACπGS continuous mapping.

Example 4.4: Let X = {a, b}, Y = {u, v} and $G_1 = \langle$ x, (0.3, 0.2), (0.6, 0.7) $\rangle$, $G_2 = \langle$ y, (0.4, 0.2), (0.5, 0.4) $\rangle$. Then $\tau = \{0_\sim, G_1, 1_\sim\}$ and $\sigma = \{0_\sim, G_2, 1_\sim\}$ are IFTs on X and Y respectively. Define a mapping f: $(X, \tau) \to (Y, \sigma)$ by f(a) = u and f(b) = v. Then f is an IFACπGS continuous mapping but not an IF contra continuous mapping since $G_2 = \langle$ y, (0.4, 0.2), (0.5, 0.4) $\rangle$ is an IFOS in Y but $f^{-1}(G_2) = \langle$ x, (0.4, 0.2), (0.5, 0.4) $\rangle$ is not an IFCS in X.

Theorem 4.5: Every IFCGS continuous mapping is an IFACπGS continuous but not conversely.

Proof: Assume that f : $(X, \tau) \to (Y,\sigma)$ is an IFCGS continuous mapping. Let A be an IFROS in Y. This implies A is an IFOS in Y. Since f is IFCGS continuous mapping, $f^{-1}(A)$ is an IFGSCS in X. Since every IFGSCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFACπGS continuous mapping.

Example 4.6: Let X = {a, b}, Y = {u, v} and $G_1 = \langle$ x, (0.5, 0.6), (0.2, 0.2) $\rangle$, $G_2 = \langle$ y, (0.3, 0.2),(0.6, 0.6) $\rangle$. Then $\tau = \{0_\sim, G_1, 1_\sim\}$ and $\sigma = \{0_\sim, G_2, 1_\sim\}$ are IFTs on X and Y respectively. Define a mapping f: $(X, \tau) \to (Y, \sigma)$ by f(a) = u and f(b) = v. Then f is an IFAπGS continuous mapping but f is not an IFGSC continuous mapping since $G_2 = \langle$ y, (0.3, 0.2), (0.6, 0.6) $\rangle$ is an IFOS in Y but $f^{-1}(G_2) = \langle$ x, (0.3, 0.2), (0.6, 0.6) $\rangle$ is not an IFGSCS in X.

Theorem 4.7: Every IFCα continuous mapping is an IFACπGS continuous mapping but not conversely.

Proof: Let f: $(X, \tau) \to (Y,\sigma)$ be an IFCα continuous mapping. Let A be an IFROS in Y. This implies A is IFOS in Y. Then by hypothesis $f^{-1}(A)$ is an IFαCS in X. Since every IFαCS is an IFπGSCS, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFACπGS continuous mapping.

Example 4.8: Let X = { a, b }, Y = { u, v } and $G_1 = \langle$ x, (0.4, 0.2), (0.6, 0.7) $\rangle$, $G_2 = \langle$ x, (0.8, 0.8), (0.2, 0.2) $\rangle$ and $G_3 = \langle$y, (0.4, 0.4), (0.5, 0.6) $\rangle$. Then $\tau = \{0_\sim, G_1, G_2, 1_\sim\}$ and $\sigma = \{0_\sim, G_3, 1_\sim\}$ are IFTs on X and Y respectively. Define a mapping f: $(X, \tau) \to (Y, \sigma)$ by f(a) = u and f(b) = v. Then f is IFACπGS continuous mapping but not an IFCα continuous mapping since $G_3 = \langle$ y, (0.4, 0.4), (0.5, 0.6) $\rangle$ is an IFROS in Y but $f^{-1}(G_3) = \langle$ x, (0.4, 0.4), (0.5, 0.6) $\rangle$ not IFαCS in X.

Remark 4.9: IFCP continuous mapping and IFACπGS continuous mapping are independent to each other.

Example 4.10: Let X = { a, b }, Y = { u, v } and $G_1 = \langle$ x, (0.4, 0.2), (0.6, 0.7) $\rangle$, $G_2 = \langle$ y, (0.4, 0.2), (0.6, 0.7) $\rangle$. Then $\tau = \{0_\sim, G_1, 1_\sim\}$ and $\sigma = \{0_\sim, G_2, 1_\sim\}$ are IFTs on X and Y respectively. Define a mapping f: $(X, \tau) \to (Y, \sigma)$ by f(a) = u and f(b) = v. Then f is IFACπGS continuous mapping but not an IFCP continuous mapping since $G_2 = \langle$ y, (0.4, 0.2), (0.6, 0.7) $\rangle$ is an IFOS in Y but $f^{-1}(G_2) = \langle$ x, (0.4, 0.2), (0.6, 0.7) $\rangle$ is not an IFPCS in X.

Example 4.11: Let X = { a, b }, Y = { u, v } and $G_1 = \langle$ x, (0.2, 0.4), (0.5, 0.4) $\rangle$, $G_2 = \langle$ x, (0.1, 0.3), (0.3, 0.4) $\rangle$, $G_3 = \langle$ x, (0.1, 0.3), (0.5, 0.4) $\rangle$, $G_4 = \langle$ x, (0.2, 0.4), (0.3, 0.4) $\rangle$, $G_5 = \langle$ x, (0.4, 0.4), (0.3, 0.4) $\rangle$, $G_6 = \langle$ y, (0, 0.3), (0.5, 0.4) $\rangle$. Then $\tau = \{0_\sim, G_1, G_2, G_3, G_4, G_5, 1_\sim\}$ and $\sigma = \{0_\sim, G_6, 1_\sim\}$ are IFTs on X and Y respectively. Define a mapping f: $(X, \tau) \to (Y, \sigma)$ by f(a) = u and f(b) = v. Then f is IFP continuous mapping but not an IFACπGS continuous mapping since $G_6 = \langle$ y, (0, 0.3), (0.5, 0.4) $\rangle$ is an IFROS in Y but $f^{-1}(G_6) = \langle$ x, (0.0, 0.3), (0.5, 0.4) $\rangle$ is not an IFπGSCS in X.

Theorem 4.12: If a bijection mapping f: X → Y is IFACπGS continuous then the inverse image of each IFRCS in Y is an IFπGSOS in X.

Proof: Let A be an IFRCS in Y. This implies A^c is IFROS in Y. Since f is IFACπGS continuous, $f^{-1}(A^c)$ is IFπGSCS in X. Since $f^{-1}(A^c) = (f^{-1}(A))^c$, $f^{-1}(A)$ is an IFπGSOS in X.

Theorem 4.13: Let f: (X, τ) → (Y, σ) be an IFACπGS continuous mapping, then f is an IFACGS continuous mapping if X is an IFπg$T_{1/2}$space.

Proof: Let A be an IFROS in Y. Then $f^{-1}(A)$ is an IFπGSCS in X, by hypothesis. Since X is an IFπg$T_{1/2}$space, $f^{-1}(A)$ is an IFGSCS in X. Hence f is an IFACGS continuous mapping.

Theorem 4.14: Let f : (X, τ) → (Y, σ) be an IFπGS continuous mapping and g : (Y, σ) → (Z, δ) is IFA continuous, then g o f : (X, τ) → (Z, δ) is an IFACπGS continuous.

Proof: Let A be an IFROS in Z. Then $g^{-1}(A)$ is an IFCS in Y, by hypothesis. Since f is an IFπGS continuous mapping, $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence g o f is an IFACπGS continuous mapping.

4. CONCLUSION

In this paper we have introduced intuitionistic fuzzy almost π-generalized semi continuous mappings and studied some of its basic properties. Also we have studied the relationship between intuitionistic fuzzy generalized semi continuous mappings and some of the intuitionistic fuzzy continuous mappings already exist.

REFERENCES

Atanassov, K. (1986), "Intuitionistic fuzzy sets", *Fuzzy Sets and Systems*, 20, pp. 87-96.

Biljana Krsteska, and Erdal Ekici ,(2007), "Intuitionistic fuzzy contra strong pre continuity", *Faculty of Sciences and Mathematics* 21:2, pp. 273-284.

Chang, C. (1968), "Fuzzy topological spaces", *J. Math. Anal. Appl*., 24, pp. 182-190.

Coker, D. (1997), "An introduction to fuzzy topological space", *Fuzzy sets and systems*, 88, pp. 81-89.

El-Shafhi, M.E. and Zhakari, A. (2007), "Semi generalized continuous mappings in fuzzy topological spaces", *J. Egypt. Math. Soc*. 15 (1), pp. 57-67.

Gurcay, H., Coker, D. and Haydar, A. (1997), "On fuzzy continuity in intuitionistic fuzzy topological spaces", *jour. of fuzzy math*., 5, pp. 365-378.

Hanafy, I.M. (2009), "Intuitionistic fuzzy γ continuity", *Canad. Math Bull*. XX, pp. 1-11.

Joung Kon Jeon, Young Bae Jun, and Jin Han Park, (2005), "Intuitionistic fuzzy alpha continuity and intuitionistic fuzzy pre continuity", *International Journal of Mathematics and Mathematical Sciences*, 19, pp. 3091-3101.

Maragathavalli, S. and Ramesh, K. (2012), "Intuitionistic fuzzy π- generalized semi closed sets *Advances in Theoretical and Applied Sciences"*, 1, pp. 33-42.

Santhi, R. and Sakthivel, K. (2009), "Intuitionistic fuzzy contra alpha generalized continuous mappings" , *Jour. Tri. Math. Soci*., 11, pp. 73-82.

Santhi, R. and Sakthivel, K. (2010), "Intuitionistic fuzzy almost alpha generalized continuous mappings", *Advances in Fuzzy Mathematics*, 5, pp. 209-219.

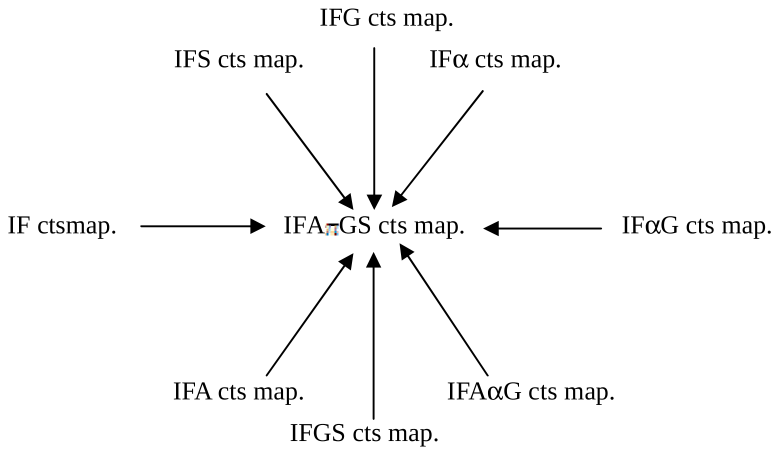
Maragathavalli, S. and Ramesh, K. (2012), “Intuitionistic fuzzy π- generalized semi continuous mappings”, International Journal of Computer Applications, 7, pp. 30-34.

Thakur, S.S. and Rekha Chaturvedi, (2006), “Regular generalized closed sets in intuitionistic fuzzy topological spaces”, *Universitatea Din Bacau, Studii Si Cercetari Stiintifice, Seria: Matematica*, 16, pp. 257-272.

Young Bae Jun, Jung Ok Kang and Seok Zun Song, (2005), “Intuitionistic fuzzy irresolute and continuous mapping”, *Far East J. Math. Sci*., 17, pp. 201-216.

Figure -1

The relations between various types of intuitionistic fuzzy continuity are given in the following diagram. In this diagram ‘cts map.’ means continuous mapping.



In this diagram by “A ⟶ B” we mean A implies B but not conversely.

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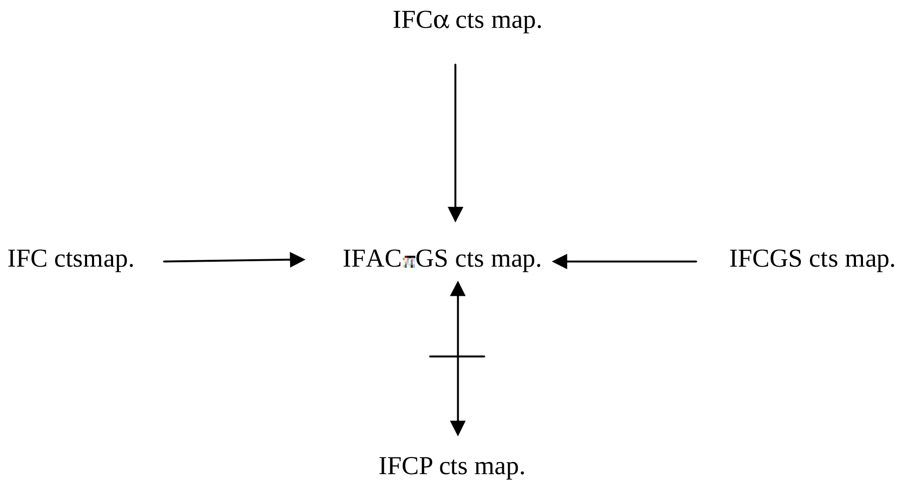
Figure -2

The relations between various types of intuitionistic fuzzy contra continuity are given in the following diagram. In this diagram ‘cts map.’ means continuous mapping.



In this diagram by “A → B” we mean A implies B but not conversely and

“A ←|→ B” means A and B are independent of each other.