On $\alpha^{**}g$-Closed sets, $\alpha^{**}g$- Continuity and $\alpha^{**}g$- Homeomorphisms in Intuitionistic Fuzzy Topological Space

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Abstract: **In this paper, we introduce and study the notions of intuitionistic fuzzy α^{**}g-closed sets, intuitionistic fuzzy α^{**}g-continuity, intuitionistic fuzzy α^{**}g-open mapping, intuitionistic fuzzy α^{**}g-closed mapping, intuitionistic fuzzy α^{**}g-homeomorphisms and some of its properties in intuitionistic fuzzy topological spaces.**

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Key words: **Intuitionistic fuzzy α^{**}g-closed sets, intuitionistic fuzzy α^{**}g-continuity, intuitionistic fuzzy α^{**}g-open mapping, intuitionistic fuzzy α^{**}g-closed mapping and intuitionistic fuzzy α^{**}g-homeomorphisms.**

I. INTRODUCTION

The concept of fuzzy sets and fuzzy topology was introduced by Zadeh [14] and Chang [2] respectively and later Atanassov [1] generalized this idea to intuitionistic fuzzy sets using the notion of fuzzy sets. On the other hand Coker [3] introduced intuitionistic fuzzy topological spaces using the notion of intuitionistic fuzzy sets. In this paper, we introduce the concepts of intuitionistic fuzzy $\alpha^{**}g$-closed sets, intuitionistic fuzzy $\alpha^{**}g$-continuity, intuitionistic fuzzy $\alpha^{**}g$-open mapping, intuitionistic fuzzy $\alpha^{**}g$-closed mapping, intuitionistic $\alpha^{**}g$-homeomorphisms and study some of its properties in intuitionistic fuzzy topological spaces.

II.PRELIMINARIES

Definition 2.1:[1] An intuitionistic fuzzy set (IFS in short) A in X is an object having the form $A = \{< x, \mu_A(x), \gamma_A(x) >: x \in X\}$, where the functions $\mu_A: X \to [0,1]$ and $\gamma_A: X \to [0,1]$ denote the the degree of membership (namely $\mu_A(x)$) and the degree of non-membership (namely $\gamma_A(x)$) of each element $x \in X$ to the set A respectively and $0 \le \mu_A(x) + \gamma_A(x) \le 1$ for each $x \in X$. Denote by IFS(X), the set of all intuitionistic fuzzy sets in X.

Definition2.2:[1] Let A and B be intuitionistic fuzzy sets of the form $A = \{< x, \mu_A(x), \gamma_A(x) >: x \in X\}$ and $B = \{< x, \mu_B(x), \gamma_B(x) >: x \in X\}$. Then

1. $A \subseteq B$ if and only if $\mu_A(x) \le \mu_B(x)$ and $\gamma_A(x) \ge \gamma_B(x)$ for all $x \in X$.
2. $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
3. $A^c = \{< x, \gamma_A(x), \mu_A(x) >: x \in X\}$.
4. $A \cap B = \{< x, \mu_A(x) \wedge \mu_B(x), \gamma_A(x) \vee \gamma_B(x) > : x \in X\}$.
5. $A \cup B = \{< x, \mu_A(x) \vee \mu_B(x), \gamma_A(x) \wedge \gamma_B(x) > : x \in X\}$.

For the sake of simplicity, we shall use the notation $A =< x, \mu_A, \gamma_A >$ instead of $A = \{< x, \mu_A(x), \gamma_A(x) >: x \in X\}$. Also for the sake of simplicity, we shall use the notation $A =< x, (\mu_A, \mu_B), (\gamma_A, \gamma_B) >$ instead of $A =< x, (A/\mu_A, B/\mu_B), (A/\gamma_A, B/\gamma_B) >$.
The intuitionistic fuzzy sets $0_\sim = \{< x, 0, 1 >: x \in X\}$ and $1_\sim = \{< x, 1, 0 > : x \in X\}$ are respectively the empty and 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:

1. $0_\sim, 1_\sim \in \tau$,
2. $G_1 \cap G_2 \in \tau$, for any $G_1, G_2 \in \tau$,
3. $\cup G_i \in \tau$, 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 an 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 $A = < x, \mu_A, \gamma_A >$ be an IFS in X. Then

1. int(A) = $\cup \{G / G$ is an IFOS in X and $G \subseteq A\}$.
2. cl(A) = $\cap \{K / K$ is an IFCS in X and $A \subseteq K\}$.
3. cl(A^c) = $(\text{int}(A))^c$.
4. int(A^c) = $(\text{cl}(A))^c$.

Result 2.5:[10] Let A be an IFS in (X, τ). Then

1. $\alpha cl(A) = A \cup cl(int(cl(A)))$
2. $\alpha int(A) = A \cap \text{int}(\text{cl}(\text{int}(A)))$

Definition 2.6:[4] An IFS $A = \{< x, \mu_A(x), \gamma_A(x) >: x \in X\}$ in an IFTS (X, τ) is said to be an

1. intuitionistic fuzzy regular open set (IFROS) if $A = int(cl(A))$.
2. intuitionistic fuzzy α- open set (IFαOS) if $A \subseteq int(cl(int(A)))$.

An IFS A is said to be an intuitionistic fuzzy regular closed set (IFRCS) and intuitionistic fuzzy α- closed set (IFαCS) if the complement of A is an IFROS and IFαOS respectively.

Definition 2.7: An IFS $A = \{< x, \mu_A(x), \gamma_A(x) >: x \in X\}$ in an IFTS (X, τ) is said to be an

1. intuitionistic fuzzy generalized closed set (IFGCS) [11] if $cl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS in X.
2. intuitionistic fuzzy α- generalized closed set (IFαGCS) [7] if $\alpha cl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS in X.
3. intuitionistic fuzzy regular generalized closed set (IFRGCS) [12] if $cl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFROS in X.

An IFS A is said to be an intuitionistic fuzzy generalized open set (briefly IFGOS), intuitionistic fuzzy α- generalized open set (IFαGOS) and intuitionistic fuzzy regular generalized open set (IFRGOS) if the complement of A is an IFGCS, IFαGCS and IFRGCS respectively.

Definition 2.8:[4] Let (X, τ) and (Y, σ) be two intuitionistic fuzzy topological spaces and let $f : X \to Y$ be a function. Then f is said to be an intuitionistic fuzzy continuous if the pre image of each intuitionistic fuzzy open set of Y is an intuitionistic fuzzy open set in X.

Definition 2.9:[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 α-continuous if $f^{-1}(B) \in$ IFαO(X) for every $B \in \sigma$.

Definition 2.10: Let (X, τ) and (Y, σ) be two intuitionistic fuzzy topological spaces and let $f : X \to Y$ be a function. Then f is said to be an

1. intuitionistic fuzzy g-continuous if pre image of every intuitionistic fuzzy closed set in Y is intuitionistic fuzzy g-closed in X.[6]
2. intuitionistic fuzzy αg-continuous if pre image of every intuitionistic fuzzy closed set in Y is intuitionistic fuzzy αg-closed in X.[8]

Definition 2.11:[13] Let $\alpha, \beta \in [0,1]$ with $\alpha + \beta \leq 1$. An intuitionistic fuzzy point (briefly IFP), written as $p_{(\alpha,\beta)}$, is defined to be an IFS of X given by

$$p_{(\alpha,\beta)}(x) = \begin{cases} (\alpha, \beta), & if\ x = p \\ (0,1) & otherwise. \end{cases}$$

We observe that an IFP $p_{(\alpha,\beta)}$ is said to belong to an IFS $A =< x, \mu_A(x), \gamma_A(x) >$, denoted by $p_{(\alpha,\beta)} \in A$ if $\alpha \leq \mu_A(x)$ and $\beta \geq \gamma_A(x)$.

Definition 2.12:[13] Two IFSs A and B are said to be q-coincident ($A_q B$ in short) if and only if there exists an element $x \in X$ such that $\mu_A(x) > \gamma_B(x)$ or $\gamma_A(x) < \mu_B(x)$.

Definition 2.13:[13] Two IFSs are said to be not q-coincident ($A_q^c B$ in short) if and only if $A \subseteq B^c$.

Definition 2.14:[4] Let (X, τ) and (Y, σ) be two intuitionistic fuzzy topological spaces and let $f : X \to Y$ be a function. Then f is said to be an

(i) intuitionistic fuzzy closed map if the image of each intuitionistic fuzzy closed set in X is an intuitionistic fuzzy closed set in Y.

(ii) intuitionistic fuzzy open map if the image of each intuitionistic fuzzy open set in X is an intuitionistic fuzzy open set in Y.

Definition 2.15:[5] 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-closed mapping (IFα-closed mapping in short) if $f(A)$ is an IFαCS in Y for every IFCS A in X.

Definition 2.16:[9] Let f be a bijection mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an

(i) intuitionistic fuzzy homeomorphism (IF homeomorphism in short) if f and f^{-1} are IF continuous mappings.

(ii) intuitionistic fuzzy α-homeomorphism (IFα-homeomorphism in short) if f and f^{-1} are IFα- continuous mappings.

III. INTUITIONISTIC FUZZY $\alpha^{**}g$- CLOSED SETS

In this section, we introduced the concept of intuitionistic fuzzy $\alpha^{**}g$-closed sets and studied some of its properties in intuitionistic fuzzy topological spaces.

Definition 3.1: An IFS Aof an IFTS (X, τ) is said to be intuitionistic fuzzy $\alpha^{**}g$-closed set (briefly IFα^{**}GCS) if $\alpha cl(A) \subseteq int(cl(U))$ whenever $A \subseteq U$ and U is IFOS in X.

Example 3.2: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.3, 0.6), (0.7, 0.4) >. Then the IFS S= < x, (0.2, 0.3), (0.8, 0.7) > is an IFα^{**}GCS in (X, τ).

Theorem 3.3: Every IFCS in (X, τ) is an IFα^{**}GCS, but not conversely.

Proof: Let $A \subseteq U$ and U is IFOS in (X, τ). Since $\alpha cl(A) \subseteq cl(A)$ and A is an IFCS, $\alpha cl(A) \subseteq cl(A) = A \subseteq U \subseteq int(cl(U))$. Therefore A is an IF$\alpha^{**}$GCS in X.

Example 3.4: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.3, 0.6), (0.7, 0.4) >. Then the IFS S= < x, (0.2, 0.3), (0.8, 0.7) > is an IFα^{**}GCS in (X, τ) but not an IFCS in X.

Theorem 3.5: Every IFαCS in (X, τ) is an IFα^{**}GCS, but not conversely.

Proof: Let $A \subseteq U$ and U is IFOS in (X, τ). By hypothesis $\alpha cl(A) = A$. Hence $\alpha cl(A) \subseteq U \subseteq int(cl(U))$. Therefore A is an IF$\alpha^{**}$GCS in X.

Example 3.6: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.3, 0.4), (0.7, 0.6) >. Then the IFS S= < x, (0.2, 0.6), (0.2, 0.3) > is an IFα^{**}GCS in (X, τ) but not an IFαCS in X.

Theorem 3.7: Every IFRCS in (X, τ) is an IFα^{**}GCS, but not conversely.

Proof: Let A be an IFRCS in (X, τ). By definition, $A = cl(int(A))$. This implies $cl(A) = cl(int(A))$. Therefore $cl(A) = A$. That is A is an IFCS in X. By Theorem 3.3, A is an IFα^{**}GCS in X.

Example 3.8: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.3, 0.4), (0.7, 0.6) >. Then the IFS S= < x, (0.2, 0.6), (0.2, 0.3) > is an IFα^{**}GCS in (X, τ) but not an IFRCS in X.

Theorem 3.9: Every IFGCS in (X, τ) is an IFα^{**}GCS, but not conversely.

Proof: Let $A \subseteq U$ and U is IFOS in (X, τ). Since $cl(A) \subseteq U$ and $\alpha cl(A) \subseteq cl(A)$ we have, $\alpha cl(A) \subseteq cl(A) \subseteq U \subseteq int(cl(U))$. Therefore A is an IF$\alpha^{**}$GCS in X.

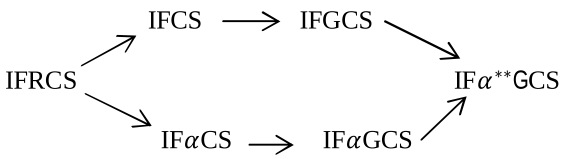
Example 3.10: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.3, 0.6), (0.7, 0.4) >. Then the IFS S= < x, (0.2, 0.3), (0.8, 0.7) > is an IFα^{**}GCS in (X, τ) but not an IFGCS in X.

Theorem 3.11: Every IFαGCS in (X, τ) is an IFα^{**}GCS, but not conversely.

Proof: Let $A \subseteq U$ and U is IFOS in (X, τ). Since A is an IFαGCS, we have $\alpha cl(A) \subseteq U \subseteq int(cl(U))$. That is $\alpha cl(A) \subseteq int(cl(U))$. Therefore A is an IF$\alpha^{**}$GCS in X.

Example 3.12: Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.2, 0.4), (0.8, 0.3) >. Then the IFS S= < x, (0.1, 0.4), (0.8, 0.6) > is an IFα^{**}GCS in (X, τ) but not an IFαGCS in X.

Remark 3.13: From the above theorems, we have the following diagram. None of the implications are reversible.



Theorem 3.14: Let A and B are two IFα^{**}GCSs in an IFTS (X, τ), then $A \cup B$ is IFα^{**}GCS in (X, τ).
Proof: Let U be an IFOS in X, such that $A \cup B \subseteq U$. Since A and B are IFα^{**}GCSs we have $\alpha cl(A) \subseteq int(cl(U))$ and $\alpha cl(B) \subseteq int(cl(U))$. Therefore $\alpha cl(A) \cup \alpha cl(B) \subseteq \alpha cl(A \cup B) \subseteq int(cl(U))$. Hence $A \cup B$ is an IFα^{**}GCS in (X, τ).

*Theorem 3.15***:** If A is an IFα^{**}GCS and $A \subseteq B \subseteq \alpha cl(A)$ then B is an IFα^{**}GCS.
Proof: Let U be an IFOS such that $B \subseteq U$. Since A is an IFα^{**}GCS, we have $\alpha cl(A) \subseteq int(cl(U))$. By hypothesis $B \subseteq \alpha cl(A)$ then $\alpha cl(B) \subseteq \alpha cl(A)$. This implies $\alpha cl(B) \subseteq int(cl(U))$. Hence B is an IF$\alpha^{**}$GCS.

Theorem 3.16: If A is an IFGCS such that $A \subseteq B \subseteq cl(A)$, where B is an IFS in an IFTS (X, τ), then B is an IFα^{**}GCS in (X, τ).
Proof: Let U be an IFOS in (X, τ) such that $B \subseteq U$. Then $A \subseteq U$. Since A is an IFGCS and $\alpha cl(A) \subseteq cl(A)$, we have $\alpha cl(A) \subseteq cl(A) \subseteq U$. Now $\alpha cl(B) \subseteq cl(B) \subseteq cl(A) \subseteq U \subseteq int(cl(U))$. Hence B is an IF$\alpha^{**}$GCS in (X, τ).

Definition 3.17: An IFS A of an IFTS (X, τ) is called an intuitionistic fuzzy $\alpha^{**}g$ open set (IFα^{**}GOS in short) if and only if A^c is an IFα^{**}GCS in (X, τ).

Theorem 3.18: For any IFTS (X, τ), we have the following:

(i) Every IFOS is an IFα^{**}GOS
(ii) Every IFαOS is an IFα^{**}GOS
(iii) Every IFROS is an IFα^{**}GOS
(iv) Every IFGOS is an IFα^{**}GOS
(v) Every IFαGOS is an IFα^{**}GOS

Proof: Obvious.
Remark 3.19: Converse of the above theorem need not be hold as shown in the following example.

Let X = {a, b} and $\tau = \{0_\sim, A, 1_\sim\}$ be an IFTS on X, where A= < x, (0.5, 0.6), (0.5, 0.4) >. Then the IFS S= < x, (0.6, 0.5), (0.4, 0.5) > is an IFα^{**}GOS in (X,τ) but not an IFOS, IFαOS, IFROS, IFGOS, IFαGOS in (X,τ).

Theorem 3.20: If A is an IFα^{**}GOS and $\alpha int(A) \subseteq B \subseteq A$, then B is an IF$\alpha^{**}$GOS.

Proof: If $\alpha int(A) \subseteq B \subseteq A$, then $A^c \subseteq B^c \subseteq (\alpha int(A))^c = \alpha cl(A^c)$. Since A^c is an IFα^{**}GCS, then by Theorem 3.15, B^c is an IFα^{**}GCS. Therefore B is an IFα^{**}GOS.

IV. INTUITIONISTIC FUZZY $\alpha^{**}g$- CONTINUITY

In this section we introduced the concept of intuitionistic fuzzy $\alpha^{**}g$ -continuous mapping and studied some of its properties.

Definition 4.1: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy $\alpha^{**}g$ -continuous (briefly IFα^{**}G-continuous) if inverse image of every intuitionistic fuzzy closed set of Y is an intuitionistic fuzzy $\alpha^{**}g$ -closed set in X.

Example 4.2: Let X= {a, b} , Y={u, v} and A= < x, (0.3, 0.6), (0.7, 0.4) >, B = < y, (0.4,0.5), (0.6,0.3) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies 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 IFα^{**}G-continuous mapping.

Theorem 4.3: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-continuous if and only if the inverse image of every IFOS of Y is an IFα^{**}GOS in X.

Proof: It is obvious, because $f^{-1}(B^c) = (f^{-1}(B))^c$ for every IFS B of Y.

Theorem 4.4: Every intuitionistic fuzzy continuous mapping is IFα^{**}G- continuous, but converse may not be true.

Proof: Let $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy continuous mapping. Let A be an IFCS in Y. Since f is an intuitionistic fuzzy continuous mapping, $f^{-1}(A)$ is an IFCS in X. Since every IFCS is an IFα^{**}GCS, $f^{-1}(A)$ is an IFα^{**}GCS in X. Hence f is an IFα^{**}G-continuous mapping.

Example 4.5: Let X= {a, b} , Y={u, v} and A= < x, (0.3, 0.6), (0.7, 0.4) >, B = < y, (0.4,0.5), (0.6,0.3) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = u and f(b) = v.The intuitionistic fuzzy set S = < y, (0.6, 0.3), (0.4, 0.5) > is IFCS in Y. Then $f^{-1}(S)$ is IFα^{**}GCS in X but not IFCS in X. Therefore, f is an IFα^{**}G-continuous mapping but not an intuitionistic fuzzy continuous mapping.

Theorem 4.6: Every intuitionistic fuzzy g-continuous mapping is IFα^{**}G-continuous, but converse may not be true.

Proof: Let $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy g-continuous mapping. Let A be an IFCS in Y. Since f is an intuitionistic fuzzy g-continuous mapping, $f^{-1}(A)$ is an IFGCS in X. Since every IFGCS is an IFα^{**}GCS, $f^{-1}(A)$ is an IFα^{**}GCS in X. Hence f is an IFα^{**}G-continuous mapping.

Example 4.7: Let X= {a, b} , Y={u, v} and A= < x, (0.4, 0.6), (0.5, 0.2) >, B = < y, (0.9, 0.3), (0.1, 0.4) >. Then $= \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = u and f(b) = v.The intuitionistic fuzzy set S = < y, (0.1, 0.4), (0.9, 0.3) > is IFCS in Y. Then $f^{-1}(S)$ is IFα^{**}GCS in X but not IFGCS in X. Therefore f is an IFα^{**}G-continuous mapping but not an intuitionistic fuzzy g-continuous mapping.

Theorem 4.8: Every intuitionistic fuzzy α-continuous mapping is IFα^{**}G-continuous, but converse may not be true.

Proof: Let $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy α-continuous mapping. Let A be an IFCS in Y. Since f is an intuitionistic fuzzy α-continuous mapping, $f^{-1}(A)$ is an IFαCS in X. Since every IFαCS is an IFα^{**}GCS, $f^{-1}(A)$ is an IFα^{**}GCS in X. Hence f is an IFα^{**}G-continuous mapping.

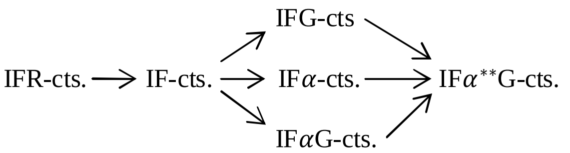
Example 4.9: Let X= {a, b} , Y={u, v} and A= < x, (0.3, 0.6), (0.7, 0.4) >, B = < y, (0.4,0.5), (0.6,0.3) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = u and f(b) = v.The intuitionistic fuzzy set S = < y, (0.6, 0.3), (0.4, 0.5) > is IFCS in Y. Then $f^{-1}(S)$ is IFα^{**}GCS in X but not IF αCS in X. Therefore, f is an IFα^{**}G-continuous mapping but not an intuitionistic fuzzy α-continuous mapping.

Theorem 4.10: Every intuitionistic fuzzy αg-continuous mapping is IF$\alpha^{**}g$-continuous, but converse may not be true.

Proof: Let $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy αg-continuous mapping. Let A be an IFCS in Y. Since f is an intuitionistic fuzzy αg-continuous mapping, $f^{-1}(A)$ is an IFαGCS in X. Since every IFαGCS is an IFα^{**}GCS, $f^{-1}(A)$ is an IFα^{**}GCS in X. Hence f is an IFα^{**}G-continuous mapping.

Example 4.11: Let X= {a, b} , Y={u, v} and A= < x, (0.4, 0.6), (0.5, 0.2) >, B = < y, (0.9,0.3), (0.1,0.4) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = u and f(b) = v.The intuitionistic fuzzy set S = < y, (0.1, 0.4), (0.9, 0.3) > is IFCS in Y. Then $f^{-1}(S)$ is IFα^{**}GCS in X but not IFαGCS in X. Therefore f is an IFα^{**}G-continuous mapping but not an intuitionistic fuzzy αg-continuous mapping.

The relation between various types of intuitionistic fuzzy continuity are given in the following diagram. In this diagram 'cts.' means continuous.



Theorem 4.12: If $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-continuous then for each IFP $p_{(\alpha,\beta)}$ of X and each IFOS B of Y such that $f(p_{(\alpha,\beta)}) \subseteq B$ there exists an intuitionistic fuzzy $\alpha^{**}g$-open set A of X such that $p_{(\alpha,\beta)} \subseteq A$ and $f(A) \subseteq B$.
Proof: Let $p_{(\alpha,\beta)}$ be an IFP of X and B be an IFOS of Y such that $f(p_{(\alpha,\beta)}) \subseteq B$. Put $A = f^{-1}(B)$. Then by hypothesis A is an intuitionistic fuzzy $\alpha^{**}g$-open set of X such that $p_{(\alpha,\beta)} \subseteq A$ and $f(A) = f(f^{-1}(B)) \subseteq B$.
Theorem 4.13: If $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-continuous then for each IFP $p_{(\alpha,\beta)}$ of X and each IFOS B of Y such that $f(p_{(\alpha,\beta)})_q B$ there exists an intuitionistic fuzzy $\alpha^{**}g$-open set A of X such that $p_{(\alpha,\beta)_q} A$ and $f(A) \subseteq B$.
Proof: Let $p_{(\alpha,\beta)}$ be an IFP of X and B be an IFOS of Y such that $f(p_{(\alpha,\beta)})_q B$. Put $A = f^{-1}(B)$. Then by hypothesis A is an intuitionistic fuzzy $\alpha^{**}g$-open set of X such that $p_{(\alpha,\beta)_q} A$ and $f(A) = f(f^{-1}(B)) \subseteq B$.
Definition 4.14: Let (X,τ) be an IFTS and A be an IFS in X. Then $\alpha^{**}g$- interior and $\alpha^{**}g$-closure of A are defined as

$$\alpha^{**}gcl(A) = \cap\{K: K \text{ is an IF}\alpha^{**}\text{GCS in X and } A \subseteq K\}$$
$$\alpha^{**}gint(A) = \cup\{G: G \text{ is an IF}\alpha^{**}\text{GOS in X and } G \subseteq A\}$$

If A is IF$\alpha^{**}GCS$, then $\alpha^{**}gcl(A) = A$.
Theorem 4.15: If $f:(X,\tau) \to (Y,\sigma)$ is IFα^{**}G - continuous and $g:(Y,\sigma) \to (Z,\mu)$ in intuitionistic fuzzy continuous, then $g \circ f:(X,\tau) \to (Z,\mu)$ is IFα^{**}G- continuous
Proof: Let A be an IFCS in Z. Then $g^{-1}(A)$ is an IFCS in Y because g is intuitionistic fuzzy continuous. Therefore, $(g \circ f)^{-1}(A) = f^{-1}(g^{-1}(A))$ is an IFα^{**}GCS in X. Hence $g \circ f$ is IFα^{**}G- continuous.
Definition 4.16: An IFTS (X,τ) is said to be an intuitionistic fuzzy $\alpha^{**}g - T_{1/2}$ space if every IFα^{**}GCS in X is IFCS in X.
Theorem 4.17: If $f:(X,\tau) \to (Y,\sigma)$ is IFα^{**}G- continuous and $g:(Y,\sigma) \to (Z,\mu)$ is intuitionistic fuzzy g-continuous and (Y,σ) is intuitionistic fuzzy $(\alpha^{**}g - T_{1/2})$ space then $g \circ f:(X,\tau) \to (Z,\mu)$ is an IFα^{**}G- continuous.

Proof: Let A be an IFCS in Z. Then $g^{-1}(A)$ is an IFGCS in Y. Since Y is $(\alpha^{**}g - T_{1/2})$ space then $g^{-1}(A)$ is an IFCS in Y. Therefore, $(g \circ f)^{-1}(A) = f^{-1}(g^{-1}(A))$ is an IFα^{**}GCS in X. Hence $g \circ f$ is IFα^{**}G- continuous.
Theorem 4.18: Let $f:(X,\tau) \to (Y,\sigma)$ be a mapping and let $f^{-1}(A)$ be an IFRCS in X for every IFCS A in Y. Then f is an IFα^{**}G-continuous mapping.
Proof: Let A be an IFCS in Y. Then $f^{-1}(A)$ is an IFRCS in X. Since every IFRCS is an IFα^{**}GCS, $f^{-1}(A)$ is an IFα^{**}GCS in X. Hence f is an IF$\alpha^{**}G$-continuous mapping.
Theorem4.19: Let $f:(X,\tau) \to (Y,\sigma)$ be an IFα^{**}G-continuous mapping. Then the following conditions are hold:

(i) $f(\alpha^{**}gcl(A)) \subseteq cl(f(A))$, for every IFS A in X
(ii) $\alpha^{**}gcl(f^{-1}(B)) \subseteq f^{-1}(cl(B))$, for every IFS B in Y.

Proof: (i) Since $cl(f(A))$ is an IFCS in Y and f is an IFα^{**}G-continuous mapping, then $f^{-1}(cl(f(A)))$ is IFα^{**}GCS in X. That is $\alpha^{**}gcl(A) \subseteq f^{-1}(cl(f(A)))$. Therefore $f(\alpha^{**}gcl(A)) \subseteq cl(f(A))$, for every IFS A in X.
(ii) Replacing A by $f^{-1}(B)$ in (i), we have $f\left(\alpha^{**}gcl(f^{-1}(B))\right) \subseteq cl\left(f(f^{-1}(B))\right) \subseteq cl(B)$.
Hence $\alpha^{**}gcl(f^{-1}(B)) \subseteq f^{-1}(cl(B))$, for every IFS B in Y.

V. INTUITIONISTIC FUZZY $\alpha^{**}g$- OPEN MAPPING

In this section we introduced the concept of intuitionistic fuzzy $\alpha^{**}g$- open mapping and studied some of its properties.
Definition 5.1: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy $\alpha^{**}g$-open mapping (briefly IFα^{**}G-open mapping) if the image of every IFOS in X is IFα^{**}GOS in Y.
Example 5.2: Let X = {a, b}, Y = {x, y} and A= < x, (0.4, 0.6), (0.5, 0.2) >, B = < y, (0.2, 0.3), (0.1, 0.4) >. Then $\tau = \{0_{\sim}, A, 1_{\sim}\}$, $\sigma = \{0_{\sim}, B, 1_{\sim}\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = x and f(b) = y. Then f is an IFα^{**}G-open mapping.
Theorem 5.3: Every intuitionistic fuzzy open map is an IFα^{**}G-open map but converse may not be true.
Proof: Let $f:(X,\tau) \to (Y,\sigma)$ be an intuitionistic fuzzy open mapping. Let A be an IFOS in X. Since f is an intuitionistic fuzzy open mapping, $f(A)$ is an IFOS in Y. Since every IFOS is an IFα^{**}GOS, $f(A)$ is an IFα^{**}GOS in Y. Hence f is an IFα^{**}G-open mapping.
Example 5.4: Let X = {a, b}, Y = {x, y} and A= < x, (0.4, 0.6), (0.5, 0.2) >, B = < y, (0.2, 0.3), (0.1, 0.4) >. Then $\tau = \{0_{\sim}, A, 1_{\sim}\}$, $\sigma = \{0_{\sim}, B, 1_{\sim}\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = x and f(b) = y. Then f is an IFα^{**}G-open mapping but not an intuitionistic fuzzy open

mapping since S = < a, (0.4, 0.6), (0.5, 0.2) > is an IFα^{**}GOS but $f(S)$ is not an IFOS in Y.

Theorem 5.5: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-open mapping if and only if for every IFS U of X $f(int(U)) \subseteq \alpha^{**}gint(f(U))$

Proof:

Necessity: Let f be an IFα^{**}G-open mapping and U be an IFOS in X. Now, $int(U) \subseteq U$ which implies that $f(int(U)) \subseteq f(U)$. Since f is an IFα^{**}G-open mapping, $f(int(U))$ is an IFα^{**}GOS in Y such that $f(int(U)) \subseteq f(U)$ therefore, $f(int(U)) \subseteq \alpha^{**}gint(f(U))$.

Sufficiency: For the converse, suppose that U is an IFOS of X. Then $f(U) = f(int(U)) \subseteq \alpha^{**}gint(f(U))$. But $\alpha^{**}gint(f(U)) \subseteq f(U)$. Consequently $f(U) = \alpha^{**}gint(U)$ which implies that $f(U)$ is an IFα^{**}GOS in Y and hence f is an IFα^{**}G-open mapping.

Theorem 5.6: If $f:(X,\tau) \to (Y,\sigma)$ is IFα^{**}G- open map then $int(f^{-1}(G)) \subseteq f^{-1}(\alpha^{**}gint(G))$ for every IFS G of Y.

Proof: Let G be an IFS of Y. Then $int(f^{-1}(G))$ is an IFOS in X. Since f is an IFα^{**}G-open map $f(int(f^{-1}(G)))$ is IFα^{**}GOS in Y and hence $f(int(f^{-1}(G))) \subseteq \alpha^{**}gint(f(f^{-1}(G))) \subseteq \alpha^{**}gint\,(G)$. Thus $int(f^{-1}(G)) \subseteq f^{-1}(\alpha^{**}gint(G))$.

Theorem 5.7: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-open if and only if for each IFS S of Y and for each IFCS U of X containing $f^{-1}(S)$ there is an IFα^{**}GCS V of Y such that $S \subseteq V$ and $f^{-1}(V) \subseteq int(cl(U))$.

Proof:

Necessity: Suppose that f is an IFα^{**}G-open map. Let S be the IFCS of Y and U be an IFCS of X such that $f^{-1}(S) \subseteq U$. Then $V = (f^{-1}(U^c))^c$ is an IFα^{**}GCS of Y such that $f^{-1}(V) \subseteq int(cl(U))$.

Sufficiency: Suppose that F is an IFOS of X. Then $f^{-1}(f(F))^c \subseteq F^c$ and F^c is an IFCS in X. By hypothesis there is an IFα^{**}GCS V of Y such that $(f(F))^c \subseteq V$ and $f^{-1}(V) \subseteq F^c$. Therefore $F \subseteq (f^{-1}(V))^c$. Hence $V^c \subseteq f(F) \subseteq f((f^{-1}(V))^c) \subseteq V^c$ which implies $f(F) = V^c$, since V^c is an IFα^{**}GOS of Y. Hence $f(F)$ is an IFα^{**}GOS in Y and thus f is an IFα^{**}G-open map.

Theorem 5.8: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an IFα^{**}G-open if and only if $f^{-1}(\alpha^{**}gcl(B)) \subseteq cl(f^{-1}(B))$ for every IFS B of Y.

Proof:Necessity: Suppose that f is an IFα^{**}G-open map. For any IFS B of Y, $f^{-1}(B) \subseteq cl(f^{-1}(B))$. Therefore by Theorem (5.7) there exists an IFα^{**}GCS F of Y such that $B \subseteq F$ and $f^{-1}(F) \subseteq cl(f^{-1}(B))$. Therefore we obtain that $f^{-1}(\alpha^{**}gcl(B)) \subseteq f^{-1}(F) \subseteq cl(f^{-1}(B))$.

Sufficiency: Suppose that B is an IFS of Y and F is an IFCS of X containing $f^{-1}(B)$. Put $V = cl(B)$, then $B \subseteq V$ and V is IFα^{**}GCS and $f^{-1}(V) \subseteq cl(f^{-1}(B) \subseteq F$. Then by Theorem (5.7) f is an IFα^{**}G-open map.

VI. INTUITIONISTIC FUZZY $\alpha^{**}g$- CLOSED MAPPING

In this section we introduced the concept of intuitionistic fuzzy $\alpha^{**}g$- closed mapping and studied some of its properties.

Definition 6.1: A mapping $f:(X,\tau) \to (Y,\sigma)$ is an intuitionistic fuzzy $\alpha^{**}g$-closed mapping (briefly IF$\alpha^{**}G$-closed mapping) if the image of every IFCS in X is IFα^{**}GCS in Y.

Example 6.2: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = x and f(b) = y. Then f is an IFα^{**}G-closed mapping.

Theorem 6.3: Every intuitionistic fuzzy closed map is an IFα^{**}G-closed map but converse may not be true.

Proof: Let $f:(X,\tau) \to (Y,\sigma)$ be an intuitionistic fuzzy closed mapping. Let A be an IFCS in X. Since f is an intuitionistic fuzzy closed mapping, $f(A)$ is an IFCS in Y. Since every IFCS is an IFα^{**}GCS, $f(A)$ is an IFα^{**}GCS in Y. Hence f is an IFα^{**}G-closed mapping.

Example 6.4: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = x and f(b) = y. Then f is an IFα^{**}G-closed mapping but not intuitionistic fuzzy closed mapping since S = < a, (0.2, 0.5), (0.3, 0.5) > is an IFCS in X but $f(S)$ is not an IFCS in Y.

Theorem 6.5: Every intuitionistic fuzzy α-closed map is an IFα^{**}G-closed map but converse may not be true.

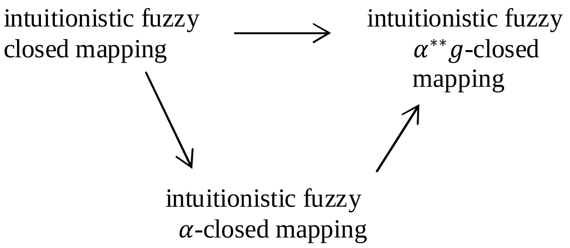
Proof: Let $f:(X,\tau) \to (Y,\sigma)$ be an intuitionistic fuzzy α-closed mapping. Let A be an IFCS in X. Since f is an intuitionistic fuzzy α-closed mapping, $f(A)$ is an IFαCS in Y. Since every IFαCS is an IFα^{**}GCS, $f(A)$ is an IFα^{**}GCS in Y. Hence f is an IFα^{**}G-closed mapping.

Example 6.6: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \to (Y,\sigma)$ by f(a) = x and f(b) = y. Then f is an IFα^{**}G-closed mapping but not intuitionistic fuzzy α-closed mapping since S = < a, (0.2, 0.5), (0.3, 0.5) > is an IFCS in X but $f(S)$ is not an IFαCS in Y.

Theorem 6.7: A mapping $f:(X,\tau) \rightarrow (Y,\sigma)$ is an IFα^{**}G-closed mapping if and only if the image of each IFOS in X is an IFα^{**}GOS in Y.

Proof: Let A be an IFOS in X. This implies A^c is IFCS in X. Since f is an IFα^{**}G-closed mapping, $f(A^c)$ is an IFα^{**}GCS in Y. Since $f(A^c) = (f(A))^c$, $f(A)$ is an IFα^{**}GOS in Y.

The relation between various types of intuitionistic fuzzy closed mappings are given in the following diagram.



Theorem 6.8: A mapping $f:(X,\tau) \rightarrow (Y,\sigma)$ is an IFα^{**}G-closed if and only if for each IFS S of Y and for each IFOS U of X containing $f^{-1}(S)$ there is an IFα^{**}GOS V of Y such that $S \subseteq V$ and $f^{-1}(V) \subseteq int(cl(U))$.

Proof:

Necessity: Suppose that f is an IFα^{**}G-closed map. Let S be the IFCS of Y and U be an IFOS of X such that $f^{-1}(S) \subseteq U$. Then $V = Y - f^{-1}(U^c)$ is an IFα^{**}GOS of Y such that $f^{-1}(V) \subseteq int(cl(U))$.

Sufficiency: For the converse, suppose that F is an IFCS of X. Then $(f(F))^c$ is an IFS in Y and F^c is an IFOS in X such that $f((f^{-1}(F))^c) \subseteq F^c$. By hypothesis there is an IFα^{**}GOS V of Y such that $(f(F))^c \subseteq V$ and $f^{-1}(V) \subseteq F^c$. Therefore $F \subseteq (f^{-1}(V))^c$. Hence $V^c \subseteq f(F) \subseteq f((f^{-1}(V))^c) \subseteq V^c$ which implies $f(F) = V^c$, since V^c is an IFα^{**}GCS of Y. Hence $f(F)$ is an IFα^{**}GCS in Y and thus f is an IFα^{**}G-closed map.

Theorem 6.9: If $f:(X,\tau) \rightarrow (Y,\sigma)$ is an intuitionistic fuzzy closed map and $g:(Y,\sigma) \rightarrow (Z,\mu)$ is an IFα^{**}G-closed map, then $g \circ f:(X,\tau) \rightarrow (Z,\mu)$ is IFα^{**}G-closed mapping.

Proof: Let H be an IFCS of an IFTS (X,τ). Then $f(H)$ is IFCS of (Y,σ), because f is intuitionistic fuzzy closed map. Now $g \circ f(H) = g(f(H))$ is an IF$\alpha^{**}GCS$ in (Z,μ) because g is IFα^{**}G-closed map. Thus $g \circ f:(X,\tau) \rightarrow (Z,\mu)$ is IFα^{**}G-closed mapping.

Theorem 6.10: Let $f:(X,\tau) \rightarrow (Y,\sigma)$ and $g:(Y,\sigma) \rightarrow (Z,\mu)$ are two IFα^{**}G-closed mappings. If (Y,σ) is intuitionistic fuzzy $\alpha^{**}g - T_{1/2}$space. Then $g \circ f:(X,\tau) \rightarrow (Z,\mu)$ is IFα^{**}G-closed mapping.

Proof: Let H be an IFCS of an IFTS (X,τ). Then $f(H)$ is IF$\alpha^{**}GCS$ of (Y,σ), because f is IFα^{**}G-closed mapping. Now $g \circ f(H) = g(f(H))$ is an IF$\alpha^{**}GCS$ in (Z,μ) because g is IFα^{**}G-closed map. Thus $g \circ f:(X,\tau) \rightarrow (Z,\mu)$ is IFα^{**}G-closed mapping.

Theorem 6.11: Let $f:(X,\tau) \rightarrow (Y,\sigma)$ and $g:(Y,\sigma) \rightarrow (Z,\mu)$ are two intuitionistic fuzzy mappings such that their composition $g \circ f:(X,\tau) \rightarrow (Z,\mu)$ is IFα^{**}G-closed mapping. If f is intuitionistic fuzzy continuous and surjective, then g is IFα^{**}G-closed.

Proof: Let A be an IFCS of Y Since f is intuitionistic fuzzy continuous f^{-1}(A) is IFCS in X. Since $g \circ f$ is IFα^{**}G-closed, $g \circ f(f^{-1}$(A)) is intuitionistic fuzzy $\alpha^{**}g$-closed in Z. That is $g(A)$ is IFα^{**}G-closed in Y, because f is surjective. Therefore g is IFα^{**}G-closed.

(iii)→(i): Let F be an IFCS in X. By assumption, $f(F) = (f^{-1})^{-1}(F)$ is IFα^{**}GCS in Y. Therefore f^{-1} is an IFα^{**}G-continuous.

VII. INTUITIONISTIC FUZZY $\alpha^{**}g$-HOMEOMORPHISMS

In this section we introduced the concept of intuitionistic fuzzy $\alpha^{**}g$- homeomorphisms and studied some of its properties.

Definition 7.1: A bijection mapping $f:(X,\tau) \rightarrow (Y,\sigma)$ is called an intuitionistic fuzzy $\alpha^{**}g$ -homeomorphism (IF$\alpha^{**}g$-homeomorphism in short) if f and f^{-1} are IFα^{**}G-continuous mappings.

Example 7.2: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \rightarrow (Y,\sigma)$ by f(a) = x and f(b) = y. Then f and f^{-1} are IFα^{**}G-continuous mappings. Then f is an intuitionistic fuzzy $\alpha^{**}g$ -homeomorphism.

Theorem 7.3: Every IF homeomorphism is an IFα^{**}G-homeomorphism but converse may not be true.

Proof: Let $f:(X,\tau) \rightarrow (Y,\sigma)$ be an IF homeomorphism. Then f and f^{-1} are IF continuous mappings. This implies f and f^{-1} are IFα^{**}G-continuous mappings. Hence f is IFα^{**}G-homeomorphism.

Example 7.4: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f:(X,\tau) \rightarrow (Y,\sigma)$ by f(a) = x and f(b) = y.Then f is intuitionistic fuzzy $\alpha^{**}g$ -homeomorphism but not an IF homeomorphism since f and $f^{-1}$are not an IF continuous mappings.

Theorem 7.5: Every IFα homeomorphism is an IFα^{**}G-homeomorphism but converse may not be true.

Proof: Let $f:(X,\tau) \rightarrow (Y,\sigma)$ be an IFα-homeomorphism. Then f and f^{-1} are IFα-continuous mappings. This implies f and f^{-1} are IFα^{**}G-continuous mappings. Hence f is IFα^{**}G-homeomorphism.

Example 7.6: Let X = {a, b}, Y = {x, y} and A= < x, (0.3, 0.5), (0.2, 0.5) >, B = < y, (0.5, 0.2), (0.3, 0.6) >. Then $\tau = \{0_\sim, A, 1_\sim\}$, $\sigma = \{0_\sim, B, 1_\sim\}$ are intuitionistic fuzzy topologies on X and Y respectively. Define a mapping $f: (X, \tau) \rightarrow (Y, \sigma)$ by f(a) = x and f(b) = y.Then f is an intuitionistic fuzzy $\alpha^{**}g$-homeomorphism but not an IFα-homeomorphism since f and $f^{-1}$are not an IFα-continuous mappings.

Theorem 7.7: Let $f: (X, \tau) \rightarrow (Y, \sigma)$ be a bijective mapping . If f is an IFα^{**}G-continuous mapping, then the following are equivalent.

(i) f is an IFα^{**}G- closed mapping
(ii) f is an IFα^{**}G- open mapping
(iii) f is an IFα^{**}G- homeomorphism.

Proof: (i)→(ii): Let $f: (X, \tau) \rightarrow (Y, \sigma)$ be a bijective mapping and let f be an IFα^{**}G- closed mapping. This implies $f^{-1}: (Y, \sigma) \rightarrow (X, \tau)$ is IFα^{**}G- continuous mapping. That is every IFOS in X is an IF$\alpha^{**}GOS$ in Y. Hence f is an IFα^{**}G- open mapping.

(ii)→(iii): Let $f: (X, \tau) \rightarrow (Y, \sigma)$ be a bijective mapping and let f be an IFα^{**}G- open mapping. This implies $f^{-1}: (Y, \sigma) \rightarrow (X, \tau)$ is IFα^{**}G- continuous mapping. But f is an IFα^{**}G- continuous mapping by hypothesis. Hence f and $f^{-1}$are IFα^{**}G-continuous mappings. Thus, f is IFα^{**} G-homeomorphism.

(iii)→(i): Let f be an IFα^{**}G-homeomorphism.That is f and $f^{-1}$are IFα^{**}G-continuous mappings. Sine every IFCS in X is an IF$\alpha^{**}GCS$ in Y, f is an IFα^{**}G- closed mapping.

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