Generalized Pre-semi Homeomorphisms in Intuitionistic Fuzzy Topological Spaces

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Abstract—In this paper we introduce intuitionistic fuzzy generalized pre-semi homeomorphisms and intuitionistic fuzzy i-generalized pre-semi homeomorphisms. We investigate some of their properties.

Keywords–Intuitionistic fuzzy topology, intuitionistic fuzzy generalized pre-semi closed set, intuitionistic fuzzy generalized pre-semi homeomorphism and intuitionistic fuzzy i-generalized pre-semi homeomorphism.

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1. Introduction

In 1965, Zadeh [15] introduced fuzzy sets and in 1968, Chang [2] introduced fuzzy topology. After the introduction of fuzzy set and fuzzy topology, several authors were conducted on the generalization of this notion. The notion of intuitionistic fuzzy sets was introduced by Atanassov [1] as a generalization of fuzzy sets. 1997, Coker [3] introduced the concept of intuitionistic fuzzy topological spaces. In this paper we introduce intuitionistic fuzzy generalized pre-semi homeomorphisms and intuitionistic fuzzy i-generalized pre-semi homeomorphisms. We investigate some of their properties. We also provide the relationship among various homeomorphisms.

2. Preliminaries

Definition 2.1: [1] Let X be a non-empty fixed set. 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 $\mu_A: X \to [0,1]$ and $\nu_A : X \to [0,1]$ 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

(i) $A \subseteq B$ if and only if $\mu_A(x) \leq \mu_B(x)$ and $\nu_A(x) \geq \nu_B(x)$ for all $x \in X$.
(ii) $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$.
(iii) $A^c = \{ \langle x, \nu_A(x), \mu_A(x)\rangle / x \in X \}$.
(iv) $A \cap B = \{ \langle x, \mu_A(x) \wedge \mu_B(x), \nu_A(x) \vee \nu_B(x)\rangle / x \in X \}$.
(v) $A \cup B = \{ \langle x, \mu_A(x) \vee \mu_B(x), \nu_A(x) \wedge \nu_B(x)\rangle / x \in X \}$.

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 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 $A = \langle x, \mu_A, \nu_A\rangle$ be an IFS in X. Then

(i) $int(A) = \cup\{ G / G$ is an IFOS in X and $G \subseteq A \}$.
(ii) $cl(A) = \cap\{ K / K$ is an IFCS in X and $A \subseteq K \}$.
(iii) $cl(A^c) = (int(A))^c$.
(iv) $int(A^c) = (cl(A))^c$.

Definition 2.5: [4] Let $A = <x, \mu_A, \nu_A>$ be an IFS in X. Then

(i) $pint(A) = \cup\{G : G$ is an IF P OS in X and $G \subseteq A\}$.
(ii) $pcl(A) = \cap\{K : K$ is an IF P CS in X and $A \subseteq K\}$.

Definition 2.6: [4] An IFS A of an IFTS (X, τ) is an

(i) intuitionistic fuzzy semiclosed set (IFSCS in short) if $int(cl(A)) \subseteq A$.

(ii) intuitionistic fuzzy semiopen set (IFSOS in short) if A ⊆ cl(int(A)).

Definition 2.7: [8] An IFS A in an IFTS (X, τ) is said to be an intuitionistic fuzzy generalized pre-semi closed set (IFGPSCS for short) if pcl(A) ⊆ U whenever A ⊆ U and U is an IFSOS in (X, τ). An IFS A is said to be an intuitionistic fuzzy generalized pre-semi open set (IFGPSOS for short) in (X, τ) if the complement A^c is an IFGPSCS in X.

Definition 2.8: [4] Let f: (X, τ) → (Y, σ) be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an

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

Definition 2.9: [9] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized pre-semi continuous (IFGPS continuous for short) mappings if $f^{-1}(V)$ is an IFGPSCS in (X, τ) for every IFCS V of (Y, σ).

Definition 2.10: [11] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized semi-pre continuous (IFGSP continuous for short) mapping if $f^{-1}(V)$ is an IFGSPCS in (X, τ) for every IFCS V of (Y, σ).

Definition 2.11: [5] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized semipre regular continuous (IFGSPR continuous for short) mapping if $f^{-1}(V)$ is an IFGSPRCS in (X, τ) for every IFCS V of (Y, σ).

Definition 2.12: [9] A mapping f: (X, τ) → (Y, σ) be an intuitionistic fuzzy generalized pre-semi irresolute (IFGPS irresolute) mapping if $f^{-1}(V)$ is an IFGPSCS in (X, τ) for every IFGPSCS V of (Y, σ).

Definition 2.13: [14] A map f: (X, τ) → (Y, σ) is called an

(i) intuitionistic fuzzy closed mapping (IFCM for short) if f(A) is an IFCS in Y for each IFCS A in X.
(ii) intuitionistic fuzzy α-open mapping (IFαOM for short) if f(A) is an IFαOS in Y for each IFOS A in X.

Definition 2.14: [10] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized pre-semi closed mapping (IFGPSCM for short) if f(A) is an IFGPSCS in Y for each IFCS A in X.

Definition 2.15: **[**10**]** A mapping f: (X, τ) → (Y, σ) is said to be an intuitionistic fuzzy generalized presemi open mapping (IFGPSOM for short) if f(A) is an IFGPSOS in Y for each IFOS in X.

Definition 2.16: [12] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized semipre closed mapping (IFGSPCM for short) if f (A) is an IFGSPCS in Y for each IFCS A in X.

Definition 2.17: [6] A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy generalized semipre regular closed mapping (IFGSPRCM for short) if f (A) is an IFGSPRCS in Y for each IFCS A in X.

Definition 2.18: [10] A mapping f: (X, τ) → (Y, σ) is said to be an intuitionistic fuzzy i-generalized presemi closed mapping (IFiGPSCM for short) if f(A) is an IFGPSCS in Y for every IFGPSCS A in X.

Definition 2.19: [10] A mapping f: (X, τ) → (Y, σ) is said to be an intuitionistic fuzzy i-generalized presemi open mapping (IFiGPSOM for short) if f(A) is an IFGPSOS in Y for every IFGPSOS A in X.

Definition 2.20: [8] If every IFGPSCS in (X, τ) is an IFPCS in (X, τ), then the space can be called as an intuitionistic fuzzy presemi $T_{1/2}$ ($IFPST_{1/2}$ space for short) space.

Definition 2.21: [8] An IFTS (X, τ) is said to be an intuitionistic fuzzy presemi $T^*_{1/2}$ space ($IFPST^*_{1/2}$ space for short) if every IFGPSCS is an IFCS in (X, τ).

Definition 2.22: [7] 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 (IF α homeomorphism in short) if f and f^{-1} are IF α continuous mappings.

Definition 2.23: [6] Let f : (X, τ) → (Y, σ) be a bijective mapping. Then f is said to be an intuitionistic fuzzy generalized semi-pre regular homeomorphism (IFGSPRHM for short) if f is both an IFGSPR continuous mapping and an IFGSPR closed mapping.

Definition 2.24: [13] Let f : (X, τ) → (Y, σ) be a bijective mapping. Then f is said to be an intuitionistic fuzzy generalized semi-pre homeomorphism (IFGSPHM for short) if f is both an IFGSP continuous mapping and an IFGSP closed mapping.

3. Generalized Pre-Semi Homeomorphisms in Intuitionistic Fuzzy Topological Spaces

In this paper we have introduced intuitionistic fuzzy generalized pre-semi homeomorphisms and investigated some properties.

Definition 3.1: Let f : (X, τ) → (Y, σ) be a bijective mapping. Then f is said to be an intuitionistic fuzzy generalized pre-semi homeomorphism (IFGPSHM for short) if f is both an IFGPS continuous mapping and an IFGPS closed mapping.

For the sake of simplicity, we shall use the notation A= ⟨x, (μ, μ), (ν, ν)⟩ instead of A= $\langle x,(a/\mu_a, b/\mu_b), (a/\nu_a, b/\nu_b)\rangle$ in all the examples used in this paper. Similarly we shall use the notation B= ⟨x, (μ, μ), (ν, ν)⟩ instead of B= $\langle x,(u/\mu_u, v/\mu_v), (u/\nu_u, v/\nu_v)\rangle$ in the following examples.

Definition 3.2: Let A be an IFS in an IFTS (X, τ). Then generalized pre-semi interior of A (gpsint(A) for short) and generalized pre-semi closure of A (gpscl(A) for short) are defined by

(i) gpsint (A) = ∪{ G / G is an IFGPSOS in X and G ⊆A }.
(ii) gpscl (A) = ∩{ K / K is an IFGPSCS in X and A ⊆K }.
Note that for any IFS A in (X, τ), we have $gpscl(A^c) = (gpsint(A))^c$ and $gpsint(A^c) = (gpscl(A))^c$.

Theorem 3.3: Every IFHM is an IFGPSHM.

Proof: Let f : (X, τ) → (Y, σ) be an IFHM. Then f is IF continuous and IF closed. Since every IF continuous function is IFGPS continuous and every IF closed mapping is an IFGPS closed mapping, f is IFGPS continuous and IFGPS closed. Hence f is an IFGPSHM.

Example 3.4: Let X = {a, b}, Y = {u, v} and G_1 = ⟨x, (0.6, 0.7), (0.4, 0.2)⟩, G_2 = ⟨y, (0.5, 0.4), (0.5, 0.6)⟩. 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 bijective mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFGPSHM but not an IFHM.

Theorem 3.5: Every IFαHM is an IFGPSHM.

Proof: Let f : (X, τ) → (Y, σ) be an IFαHM. Then f is IFα continuous and IFα closed. Since every IFα continuous function is IFGPS continuous and every IFα closed mapping is an IFGPS closed mapping, f is IFGPS continuous and IFGPS closed. Hence f is an IFGPSHM.

Example 3.6: In Example the bijective mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v is an IFGPSHM but not an IFαHM.

Theorem 3.7: Every IFGPSHM is an IFGSPRHM.

Proof: Let f : (X, τ) → (Y, σ) be an IFGPSHM. Then f is IFGPS continuous and IFGPS closed. Since every IFGPS continuous function is IFGSPR continuous and every IFGPS closed mapping is an IFGSPR closed mapping, f is IFGSPR continuous and IFGSPR closed. Hence f is an IFGSPRHM.

Example 3.8: Let X = {a, b}, Y = {u, v} and G_1 = ⟨x, (0.3, 0.2), (0.7, 0.8)⟩, G_2 = ⟨y, (0.5, 0.6), (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 bijective mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFGSPRHM but not an IFGPSHM.

Theorem 3.9: Every IFGPSHM is an IFGSPHM.

Proof: Let f : (X, τ) → (Y, σ) be an IFGPSHM. Then f is IFGPS continuous and IFGPS closed. Since every IFGPS continuous function is IFGSP continuous and every IFGPS closed mapping is an IFGSP closed mapping, f is IFGSP continuous and IFGSP closed. Hence f is an IFGSPHM.

Example 3.10: In Example the bijective mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v is an IFGSPHM but not an IFGPSHM.

Theorem 3.11: Let f: (X, τ) → (Y, σ) be an IFGPSHM, then f is an IFHM if X and Y are $IFPST^*_{1/2}$ space.

Proof: Let B be an IFCS in Y. Then $f^{-1}(B)$ is an IFGPSCS in X, by hypothesis. Since X is an $IFPST^*_{1/2}$ space, $f^{-1}(B)$ is an IFCS in X. Hence f is an IF continuous mapping. By hypothesis f^{-1}: (Y, σ) → (X, τ) is an IFGPS continuous mapping. Let A be an IFCS in X. Then $(f^{-1})^{-1}(A) = f(A)$ is an IFGPSCS in Y, by hypothesis. Since Y is an $IFPST^*_{1/2}$ space, f(A) is an IFCS in Y. Hence f^{-1} is an IF continuous mapping. Therefore the mapping f is an IFHM.

Theorem 3.12: Let f : (X, τ) → (Y, σ) be a bijective mapping. If f is an IFGPS continuous mapping, then the following statements are equivalent:

(i) f is an IFGPS open mapping.
(ii) f is an IFGPSHM.
(iii) f is an IFGPS closed mapping.

Proof: Straightforward.

Remark 3.13: The composition of two IFGPSHMs need not be an IFGPSHM in general.

Example 3.14: Let X = {a, b}, Y = {c, d} and Z = {e, f}. Let G_1 = ⟨x, (0.3, 0.2), (0.7, 0.8)⟩, G_2 = ⟨y, (0.1, 0.9), (0.9, 0.1)⟩, G_3 = ⟨z, (0.5, 0.6), (0.5, 0.4)⟩. Then τ = {$0_\sim$, G_1, $1_\sim$}, σ = {$0_\sim$,

G_2, $1_\sim$} and η = {$0_\sim$, G_3, $1_\sim$} are IFTs on X, Y and Z respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = c and f(b) = d and g : (Y, σ) → (Z, η) by g(c) = e and g(d) = f. Then f and g are IFGPSHMs but their composition g ∘ f : (X, τ) →(Z, η) is not an IFGPSHM.

4. i-Generalized Pre-Semi Homeomorphisms in Intuitionistic Fuzzy Topological Spaces

In this paper we have introduced intuitionistic fuzzy i-generalized pre-semi homeomorphisms and investigated some properties.

Definition 4.1: Let f : (X, τ) → (Y, σ) be a bijective mapping. Then f is said to be an intuitionistic fuzzy i-generalized pre-semi homeomorphism (IFiGPSHM for short) if f is both an IFGPS irresolute mapping and an IFiGPS open mapping.

The family of all IFiGPSHM in X is denoted by IFiGPSHM (X).

Theorem 4.2: Every IFiGPSHM is an IFGPSHM but not conversely.

Proof: Assume that f : (X, τ) → (Y, σ) be an IFiGPSHM. Let A ⊆ Y be an IFCS. Then A is an IFGPSCS in Y. By hypothesis, f^{-1}(A) is an IFGPSCS in X. Hence f is an IFGPS continuous mapping. Let B ⊆ X be an IFOS. Then B is an IFGPSOS in X. By hypothesis, f(B) is an IFGPSOS in Y. Hence f is an IFGPS open mapping. Thus f is an IFGPSHM.

Example 4.3: Let X = {a, b} and Y = {u, v}. Let G_1 = ⟨x, (0.3, 0.2), (0.7, 0.8)⟩ and G_2 = ⟨y, (0.1, 0.9), (0.9, 0.1)⟩. 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 is an IFGPSHM but not an IFiGSPHM.

Theorem 4.4: The composition of two IFiGPSHMs is an IFiGPSHM.

Proof: Assume that f : (X, τ) → (Y, σ) and g : (Y, σ) → (Z, η) are any two IFiGPSHMs. Let A ⊆ Z be an IFGPSCS. Then by hypothesis, g^{-1}(A) is an IFGPSCS in Y. Again by hypothesis, f^{-1}(g^{-1}(A)) is an IFGPSCS in X. Therefore g ∘ f is an IFGPS irresolute mapping. Now let B ⊆ X be an IFGPSOS. Then by hypothesis, f(B) is an IFGPSOS in Y and also g(f(B)) is an IFGPSOS in Z. This implies g ∘ f is an IFiGPSHM.

Theorem 4.5: Let f : (X, τ) → (Y, σ) be a bijective mapping. If f is an IFGPS irresolute mapping, then the following statements are equivalent.

(i) f is an IFiGPSOM.
(ii) f is an IFiGPSHM.
(iii) f is an IFiGPSCM.

Proof: Straightforward.

Theorem 4.6: If f : (X, τ) → (Y, σ) is an IFiGPSHM, then gpscl(f^{-1}(B)) ⊆ f^{-1}(pcl(B)) for every IFS B in Y.

Proof: Let B ⊆ Y. Then pcl(B) is an IFGPSCS in Y. Since f is an IFSPG irresolute mapping, f^{-1}(pcl(B)) is an IFGPSCS in X. This implies gpscl(f^{-1}(pcl(B))) = f^{-1}(pcl(B)). Now gpscl (f^{-1}(B)) ⊆ gpscl(f^{-1}(pcl(B))) = f^{-1}(pcl(B)).

Theorem 4.7: If f : (X, τ) → (Y, σ) is an IFiGPSHM, where X and Y are $IFPST_{1/2}$ spaces, then pcl(f^{-1}(B)) = f^{-1}(pcl(B)) for every IFS B in Y.

Proof: Since f is an IFiGPSHM, f is an IFGPS irresolute mapping. Let B ⊆ Y. Then since pcl(B) is an IFGPSCS in Y, f^{-1}(pcl(B)) is an IFGPSCS in X. Since X is an $IFPST_{1/2}$ spaces, f^{-1}(pcl(B)) is an IFPCS in X. Now, f^{-1}(B) ⊆ f^{-1}(pcl(B)). We have pcl(f^{-1}(B)) ⊆ pcl(f^{-1}(pcl(B))) = f^{-1}(pcl(B)). This implies pcl(f^{-1}(B)) ⊆ f^{-1}(pcl(B)) (*). Again since f is an IFiGPSHM, f^{-1} is IFGPS irresolute mapping. Since pcl(f^{-1}(B)) is an IFGPSCS in X, $(f^{-1})^{-1}$(pcl(f^{-1}(B))) = f(pcl(f^{-1}(B))) is an IFGPSCS in Y. Now B ⊆ $(f^{-1})^{-1}$(f^{-1}(B)) ⊆ $(f^{-1})^{-1}$(pcl(f^{-1}(B))) = f(pcl(f^{-1}(B))). Therefore pcl(B) ⊆ pcl(f(pcl(f^{-1}(B)))) = f(pcl(f^{-1}(B))), since Y is an $IFPST_{1/2}$ spaces. Hence f^{-1}(pcl(B)) ⊆ f^{-1}(f(pcl(f^{-1}(B)))) ⊆ pcl(f^{-1}(B)). That is f^{-1}(pcl(B)) ⊆ pcl(f^{-1}(B)) (**). Thus from (*) and (**) we get pcl(f^{-1}(B)) = f^{-1}(pcl(B)) and hence the proof.

Corollary 4.8: If f : (X, τ) → (Y, σ) is an IFiGPSHM, where X and Y are $IFPST_{1/2}$ spaces, then pcl(f(B)) = f(pcl(B)) for every IFS B in X.

Proof: Since f is an IFiGPSHM, f^{-1} is also an IFiGPSHM. Therefore by Theorem 4.7, pcl($(f^{-1})^{-1}$(B)) = $(f^{-1})^{-1}$(pcl(B)) for every B ⊆ X. That is pcl(f(B)) = f(pcl(B)) for every IFS B in X.

Corollary 4.9: If f : (X, τ) → (Y, σ) is an IFiGPSHM, where X and Y are $IFPST_{1/2}$ spaces, then pint(f(B)) = f(pint(B)) for every IFS B in X.

Proof: For any IFS B ⊆ X, pint(B) = $(\mathrm{pcl}(B^c))^c$. By Corollary 4.8, f(pint(B)) = $f(\mathrm{pcl}(B^c))^c$ = $(f(\mathrm{pcl}(B^c)))^c$ = $(\mathrm{pcl}(f(B^c)))^c$ = $\mathrm{pint}(f(B^c))^c$ = pint(f(B)).

Corollary 4.10: If f : (X, τ) → (Y, σ) is an IFiGPSHM, where X and Y are $IFPST_{1/2}$ spaces, then pint(f^{-1}(B)) = f^{-1}(pint(B)) for every IFS B in Y.

Proof: The proof is trivial.

REFERENCES

[1] K. Atanassov, *Intuitionistic fuzzy sets*, Fuzzy Sets and Systems, 20, 1986, 87-96.

[2] C. L. Chang, *Fuzzy topological spaces*, J.Math.Anal.Appl. 24, 1968, 182-190.

[3] D. Coker, *An introduction to intuitionistic fuzzy topological space*, Fuzzy Sets and Systems, 88, 1997, 81-89.

[4] H. Gurcay, Es. A. Haydar and D. Coker, *On fuzzy continuity in intuitionistic fuzzy topological spaces*, J.Fuzzy Math.5 (2) , 1997, 365-378.

[5] K. Ramesh, M. Thirumalaiswamy and S. Kavunthi, Generalized semipre regular continuous and irresolute mappings in intuitionistic fuzzy topological spaces, Vol. 2 Issue 8, Aug 2013.

[6] K. Ramesh and M. Thirumalaiswamy, On GSPR Closed Mappings and GSPR Homeomorphisms in Intuitionistic Fuzzy Topological Spaces.(accepted)

[7] K. Sakthivel, Alpha generalized homeomorphism in intuitionistic fuzzy topological space, Notes IFS 17(2011) 30-36.

[8] T. Sampoornam, Gnanambal Ilango and K. Ramesh, *On Generalized PreSemi Closed Sets in Intuitionistic Fuzzy Topological Spaces.*(submitted)

[9] T. Sampoornam, Gnanambal Ilango and K. Ramesh, *Generalized PreSemi Continuous and Irresolute Mappings in Intuitionistic Fuzzy Topological Space*, International Journal of Innovative Research in Science Engineering and Technology, Vol. 2, Issue 8, Aug 2013, 4034-4040.

[10] T. Sampoornam, Gnanambal Ilango and K. M. Arifmohammed, Generalized Presemi Closed Mappings in Intuitionistic Fuzzy Topological Spaces.(submitted)

[11] R. Santhi and D. Jayanthi, Intuitionistic Fuzzy Generalized Semi-Pre Continuous Mappings, Int. J. Contemp. Math. Sciences, Vol. 5, 2010, no. 30, 1455 – 1469.

[12] Santhi and D. Jayanthi, *Intuitionistic fuzzy generalized semipre closed mappings"*, Journal of Informatics and Mathematical Sciences, NIFS 16(2010), 3, 28-39.

[13] R. Santhi and D. Jayanthi, *Intuitionistic fuzzy generalized semi-pre homeomorphisms,* Journal of Pure Mathematics.(accepted)

[14] Seok Jong Lee and Eun Pyo Lee, *The category of intuitionistic fuzzy topological spaces*, Bull. Korean Math. Soc. *37*, *No. 1*, 2000, pp. 63-76.

[15] L. A. Zadeh, *Fuzzy sets*, Information and control, 8, 1965, 338-353.