



Intuitionistic Fuzzy T*-Ideal

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Abstract-- In this paper, we presented the thought of Intuitionistic Fuzzy T*-Ideal and Intuitionistic Fuzzy p*-Ideal and interpretation of Intuitionistic Fuzzy T*-Ideal and examined a portion of their outcomes.

Keywords-- *Intuitionistic Fuzzy T*-Ideal, Intuitionistic Fuzzy P*-Ideal, Interpretation of Intuitionistic Fuzzy T*-Ideal*

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I. INTRODUCTION

The idea of the fuzzy set was introduced [5] in 1965. Numerous specialists investigated on the speculation of the thought of fuzzy sets. The idea of Intuitionistic fuzzy T-ideal in TM-algebra was presented [4] in 2011 and Balamurugan. M [2] presented the idea of translation of Intuitionistic Fuzzy soft structure of B-algebras and C.Ragavan [1] presented the idea of Cartesian product of antagonistic- intuitionistic Fuzzy H-ideal in division BG-algebras and Jaikumar. S [3] Intuitionistic Fuzzification of Intuitionistic Fuzzy T-ideal in BCI-algebra and Senthilkumar. S [6] presented the idea of Interpretations of intuitionistic fuzzy T-ideal in BCK/BCI-algebras.

In 1996, two classes of abstracts algebras, BCK-algebras and BCI-algebras presented.

We present a thought of Intuitionistic Fuzzy T*-Ideal, which is a speculation of Intuitionistic Fuzzy T-Ideal in TM-algebras. In this paper, we propose an idea of Interpretation of Intuitionistic Fuzzy T*-Ideal and explore a few properties.

II. PRELIMINARIES

In this area, this paper incorporated some essential basic angles.

DEFINITION 2.1:

A B-algebra is a non-empty set X with a constant 0 and a binary operation* fulfilling the accompanying conditions:

- (i) $x*x=0$
- (ii) $x*0=x$
- (iii) $(x*y)*z=x*(z*(0*y))$ for all $x, y, z \in X$.

DEFINITION 2.2:

A BCI – algebra is a non-empty set X with a constant 0 and a binary operation *following conditions:

- (i) $((x*y)*(x*z))*(z*y)=0$ for all $x, y, z \in X$.
- (ii) $(x*(x*y))*y=0$ for all $x, y \in X$.
- (iii) $x*x=0$ for all $x \in X$.

- (iv) $x*y=0 \ y*x=0 \Rightarrow x = y$ for all $x, y \in X$.

We can characterize a partial order " \leq " by $x \leq y$ if and just if $x*y=0$. Any BCI-algebra X has the accompanying properties

- (i) $x*0=x$ for all $x \in X$.
- (ii) $(x*y)*z=(x*z)*y$ for all $x, y, z \in X$.
- (iii) $x \leq y, x*y \leq y*x, z*y \leq z*x$ for all $x, y, z \in X$.

DEFINITION 2.3:

An Intuitionistic Fuzzy set $A=(X, \mu_A, \lambda_A)$ in a BCI-algebra X is called Intuitionistic Fuzzy S* of A on the off chance that it fulfills

- (i) $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$
- (ii) $\mu_A(x*y) \geq \min\{\mu_A(x), \mu_A(y)\}$
- (iii) $\lambda_A(x) \leq \max\{\lambda_A(x*y), \lambda_A(y)\}$ for all $x, y \in X$.

DEFINITION 2.4:

Let X be a B-algebra. A fuzzy set μ in X is called an Intuitionistic Fuzzy M*-ideal of X in the event that it fulfills:

- (i) $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$
- (ii) $\mu_A(x) \geq \min\{\mu_A(x*y), \mu_A(y)\}$
- (iii) $\lambda_A(x) \leq \max\{\lambda_A(x*y), \lambda_A(y)\}$ for all $x, y \in X$.

DEFINTION 2.5:

A fuzzy set μ in BCK-algebra X is Intuitionistic Fuzzy u*-ideal of X is it fulfills:

- (i) $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$
- (ii) $\mu_A(x) \geq \min\{\mu_A((x*z)*(z*y)), \mu_A(y)\}$
- (iii) $\lambda_A(x) \leq \max\{\lambda_A((x*z)*(z*y)), \lambda_A(y)\}$ for all $x, y, z \in X$.

DEFINITION 3.1:

An Intuitionistic Fuzzy set $A=(X, \mu_A, \lambda_A)$ in a BCI-algebra X is called an Intuitionistic Fuzzy T*-Ideal of An in the event that it fulfills the accompanying conditions:

- (i) $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$
- (ii) $\mu_A(x*z) \geq \min\{\mu_A(x*(y*(z*0))), \mu_A(y)\}$
- (iii) $\lambda_A(x*z) \geq \max\{\lambda_A(x*(y*(z*0))), \lambda_A(y)\}$ for all $x, y, z \in X$.

DEFINITION 3.2:



Let X be a BCI-algebra is called Intuitionistic Fuzzy P^* -ideal on the off chance that it fulfils the accompanying conditions:

- (i) $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$
- (ii) $\mu_A(x) \geq \min\{\mu_A(x^*(y^*x)), \mu_A(y^*z)\}$
- (iii) $\lambda_A(x) \leq \max\{\lambda_A(z^*(y^*x)), \lambda_A(y^*z)\}$ for all $x, y, z \in X$

THEOREM: 3.3

Each Intuitionistic Fuzzy T^* -ideal is an Intuitionistic Fuzzy S^* -Ideal in BCI-algebra.

PROOF:

For all $x, y, z \in X$

We have

$$\begin{aligned} \mu_A(0) &\geq \mu_A(x) \text{ and } \lambda_A(0) \leq \lambda_A(x) \\ \mu_A(x^*z) &\geq \min\{\mu_A(x^*(y^*(z^*0))), \mu_A(y)\} \\ \mu_A(x^*z) &\geq \min\{\mu_A(x^*(y^*z)), \mu_A(y)\} \\ \text{put } z=y \\ \mu_A(x^*y) &\geq \min\{\mu_A(x^*(y^*y)), \mu_A(y)\} \\ &\geq \min\{\mu_A(x^*0), \mu_A(y)\} \\ \mu_A(x^*y) &\geq \min\{\mu_A(x), \mu_A(y)\} \\ \lambda_A(x^*z) &\leq \max\{\lambda_A(x^*(y^*(z^*0))), \lambda_A(y)\} \\ \lambda_A(x^*z) &\leq \max\{\lambda_A(x^*(y^*z)), \lambda_A(y)\} \\ \text{put } z=y \\ \lambda_A(x^*y) &\leq \max\{\lambda_A(x^*(y^*y)), \lambda_A(y)\} \\ &\leq \max\{\lambda_A(x^*0), \lambda_A(y)\} \\ \lambda_A(x^*y) &\leq \max\{\lambda_A(x), \lambda_A(y)\} \end{aligned}$$

THEOREM: 3.4

Each Intuitionistic Fuzzy T^* -ideal is an Intuitionistic Fuzzy u^* -Ideal in BCK-algebra.

PROOF:

For all $x, y, z \in X$

We have

$$\begin{aligned} \mu_A(0) &\geq \mu_A(x) \text{ and } \lambda_A(0) \leq \lambda_A(x) \\ \mu_A(x^*z) &\geq \min\{\mu_A(x^*(y^*(z^*0))), \mu_A(y)\} \\ \mu_A(x^*z) &\geq \min\{\mu_A(x^*(y^*z)), \mu_A(y)\} \\ \mu_A(x^*z) &\geq \min\{\mu_A(x^*z)^*y, \mu_A(y)\} \\ &\geq \min\{\mu_A(x^*z)^*(y^*0), \mu_A(y)\} \\ \text{Put } z=0 \\ \mu_A(x^*0) &\geq \min\{\mu_A(x^*z)^*(y^*z), \mu_A(y)\} \\ \mu_A(x) &\geq \min\{\mu_A(x^*(z^*0))^*(y^*z), \mu_A(y)\} \\ \lambda_A(x^*z) &\leq \max\{\lambda_A(x^*(y^*(z^*0))), \lambda_A(y)\} \\ \lambda_A(x^*z) &\leq \max\{\lambda_A(x^*(y^*z)), \lambda_A(y)\} \\ \lambda_A(x^*z) &\leq \max\{\lambda_A(x^*(y^*z)), \lambda_A(y)\} \end{aligned}$$

$$\lambda_A(x^*z) \leq \max\{\lambda_A(x^*(y^*z)), \lambda_A(y)\}$$

$$\leq \max\{\lambda_A((x^*z)^*(y^*0)), \lambda_A(y)\}$$

Put $z=0$

$$\lambda_A(x^*0) \leq \max\{\lambda_A((x^*z)^*(y^*z)), \lambda_A(y)\}$$

$$\lambda_A(x) \leq \max\{\lambda_A((x^*(z^*0))^*(y^*z)), \lambda_A(y)\}$$

THEOREM: 3.5

Each Intuitionistic Fuzzy T^* -Ideal is an Intuitionistic Fuzzy M^* -Ideal in of X .

PROOF:

For all $x, y \in X$

We have

$$\mu_A(0) \geq \mu_A(x) \text{ and } \lambda_A(0) \leq \lambda_A(x)$$

$$\mu_A(x^*z) \geq \min\{\mu_A(x^*(y^*(z^*0))), \mu_A(y)\}$$

put $z=0$

$$\mu_A(x^*0) \geq \min\{\mu_A(x^*(y^*0)), \mu_A(y)\}$$

$$\mu_A(x) \geq \min\{\mu_A(x^*y), \mu_A(y)\}$$

$$\lambda_A(x^*z) \leq \max\{\lambda_A(x^*(y^*(z^*0))), \lambda_A(y)\}$$

put $z=0$

$$\lambda_A(x^*0) \leq \max\{\lambda_A(x^*(y^*0)), \lambda_A(y)\}$$

$$\lambda_A(x) \leq \max\{\lambda_A(x^*y), \lambda_A(y)\}$$

THEOREM: 3.6

Each Intuitionistic Fuzzy T^* -Ideal is an Intuitionistic Fuzzy P^* -Ideal in of X .

PROOF:

For all $x, y \in X$, We have

$$\mu_A(0) \geq \mu_A(x) \text{ and } \lambda_A(0) \leq \lambda_A(x)$$

$$\mu_A(x^*z) \geq \min\{\mu_A(x^*(y^*(z^*0))), \mu_A(y)\}$$

$$\mu_A(x^*z) \geq \min\{\mu_A(x^*(y^*z)), \mu_A(y)\}$$

$$\mu_A(x^*z) \geq \min\{\mu_A(x^*(0^*(z^*y))), \mu_A(y)\}$$

$$\mu_A(x^*z) \geq \min\{\mu_A((0^*(z^*y))^*x), \mu_A(y)\}$$

take $z=0$

$$\mu_A(x^*0) \geq \min\{\mu_A(z^*(y^*x)), \mu_A(y^*0)\}$$

$$\mu_A(x) \geq \min\{\mu_A(z^*(y^*x)), \mu_A(y^*z)\}$$

$$\lambda_A(x^*z) \leq \max\{\lambda_A(x^*(y^*(z^*0))), \lambda_A(y)\}$$

$$\lambda_A(x^*z) \leq \max\{\lambda_A(x^*(y^*z)), \lambda_A(y)\}$$

$$\lambda_A(x^*z) \leq \max\{\lambda_A((0^*(z^*y))^*x), \lambda_A(y)\}$$

take $z=0$

$$\lambda_A(x^*0) \leq \max\{\lambda_A(z^*(y^*x)), \lambda_A(y^*0)\}$$

$$\lambda_A(x) \leq \max\{\lambda_A(z^*(y^*x)), \lambda_A(y^*z)\}$$



IV INTERPRETATION OF INTUITIONISTIC FUZZY T*-IDEAL

We will utilize the image $A = (\mu_A, \lambda_A)$ for the Intuitionistic Fuzzy subset $A = \{<x, \mu_A(x), \lambda_A(x)> : x \in X\}$ all through this point we take $I = \inf\{\lambda_A(x)/x \in X\}$ for any Intuitionistic Fuzzy set $A = (\mu_A, \lambda_A)$ of X

DEFINITION 4.1:

Let $A = (\mu_A, \lambda_A)$ be an Intuitionistic Fuzzy subset and let $\alpha \in [0, I]$.

An item having the structure $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ is called an Intuitionistic Fuzzy α -interpretation of An if $(\mu_A)_\alpha^{T^*}(x) = \mu_A(x) + \alpha$ and $(\lambda_A)_\alpha^{T^*}(x) = \lambda_A(x) - \alpha$ for all $x \in X$

THEOREM: 4.2

On the off chance that $A = (\mu_A, \lambda_A)$ is an Intuitionistic Fuzzy T^* -Ideal of X then the Intuitionistic α -interpretation $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ of an Intuitionistic Fuzzy T^* -ideal of X for all $\alpha \in [0, I]$

PROOF:

Let $A = (\mu_A, \lambda_A)$ is an Intuitionistic Fuzzy T^* -Ideal of X and $\alpha \in [0, I]$ and

For all $x, y, z \in X$ Then $(\mu_A)_\alpha^{T^*}(0) = \mu_A(0) + \alpha$

$$\geq \mu_A(x) + \alpha$$

$$= (\mu_A)_\alpha^{T^*}(x) \text{ and}$$

$$(\lambda_A)_\alpha^{T^*}(0) = \lambda_A(0) - \alpha$$

$$\leq \lambda_A(x) - \alpha$$

$$= (\lambda_A)_\alpha^{T^*}(x)$$

$$(\mu_A)_\alpha^{T^*}(x * z) = \mu_A(x * z) + \alpha$$

$$\geq \min\{\mu_A(x * (y * (z * 0))), \mu_A(y)\} + \alpha$$

$$\geq \min\{\mu_A(x * (y * (z * 0))) + \alpha, \mu_A(y) + \alpha\}$$

$$\geq \min\{(\mu_A)_\alpha^{T^*}(x * (y * (z * 0))), (\mu_A)_\alpha^{T^*}(y)\}$$

$$(\lambda_A)_\alpha^{T^*}(x * z) = \lambda_A(x * z) - \alpha$$

$$\leq \max\{\lambda_A(x * (y * (z * 0))), \lambda_A(y)\} - \alpha$$

$$\leq \max\{\lambda_A(x * (y * (z * 0))) - \alpha, \lambda_A(y) - \alpha\}$$

$$\leq \max\{(\lambda_A)_\alpha^{T^*}(x * (y * (z * 0))), (\lambda_A)_\alpha^{T^*}(y)\}$$

Subsequently an Intuitionistic Fuzzy α -interpretation $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ is an Intuitionistic Fuzzy T^* -Ideal

THEOREM: 4.3

On the off chance that $A = (\mu_A, \lambda_A)$ be an Intuitionistic Fuzzy subset of X to such an extent that the Intuitionistic Fuzzy α -interpretation $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ is An Intuitionistic Fuzzy T^* -ideal of X for some $\alpha \in [0, I]$ then $A = (\mu_A, \lambda_A)$ is an intuitionistic fuzzy T^* -ideal of X .

PROOF:

Accept that $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ is an Intuitionistic Fuzzy T^* -Ideal of X for some of $X \alpha \in [0, I]$ and For all $x \in X$.

We have

$$\mu_A(0) + \alpha = (\mu_A)_\alpha^{T^*}(0)$$

$$\geq (\mu_A)_\alpha^{T^*}(x)$$

$$\geq \mu_A(x) + \alpha \text{ and}$$

$$\lambda_A(0) - \alpha = (\lambda_A)_\alpha^{T^*}(0)$$

$$\leq (\lambda_A)_\alpha^{T^*}(x)$$

$$\leq \lambda_A(x) - \alpha$$

which implies $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \leq \lambda_A(x)$.

Now We have,

$$\mu_A(x * z) + \alpha = (\mu_A)_\alpha^{T^*}(x * z)$$

$$\geq \min\{(\mu_A)_\alpha^{T^*}(x * (y * (z * 0))), (\mu_A)_\alpha^{T^*}(y)\}$$

$$\geq \min\{\mu_A(x * (y * (z * 0))) + \alpha, \mu_A(y) + \alpha\}$$

$$\geq \min\{\mu_A(x * (y * (z * 0))), \mu_A(y)\} + \alpha \text{ and}$$

$$\lambda_A(x * z) - \alpha = (\lambda_A)_\alpha^{T^*}(x * z)$$

$$\leq \max\{(\lambda_A)_\alpha^{T^*}(x * (y * (z * 0))), (\lambda_A)_\alpha^{T^*}(y)\}$$

$$\leq \max\{\lambda_A(x * (y * (z * 0))) - \alpha, \lambda_A(y) - \alpha\}$$

$$\leq \max\{\lambda_A(x * (y * (z * 0))), \lambda_A(y)\} - \alpha$$

THEOREM: 4.4

In the event that the Intuitionistic Fuzzy α -interpretation $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ is an Intuitionistic Fuzzy T^* -Ideal of X for some $\alpha \in [0, I]$ then it must be an Intuitionistic Fuzzy Ideal of X .

PROOF:

Let Intuitionistic Fuzzy α -interpretation $A_\alpha^{T^*} = ((\mu_A)_\alpha^{T^*}, (\lambda_A)_\alpha^{T^*})$ of A is an Intuitionistic Fuzzy T^* -Ideal of X .

Let $x, y, z \in X$

Let Intuitionistic Fuzzy α -interpretation

$$(\mu_A)_\alpha^{T^*}(x * z) \geq \min\{(\mu_A)_\alpha^{T^*}(x * (y * (z * 0))), (\mu_A)_\alpha^{T^*}(y)\}$$

And

$$(\lambda_A)_\alpha^{T^*}(x * z) \leq \max\{(\lambda_A)_\alpha^{T^*}(x * (y * (z * 0))), (\lambda_A)_\alpha^{T^*}(y)\}$$

Substitute $z = 0$ we get

$$(\mu_A)_\alpha^{T^*}(x * 0) \geq \min\{(\mu_A)_\alpha^{T^*}(x * (y * (0 * 0))), (\mu_A)_\alpha^{T^*}(y)\}$$

$$(\mu_A)_\alpha^{T^*}(x) \geq \min\{(\mu_A)_\alpha^{T^*}(x * y), (\mu_A)_\alpha^{T^*}(y)\}$$



$$\begin{aligned} (\lambda_A)_\alpha^{T^*}(x*0) &\leq \max \{ (\lambda_A)_\alpha^{T^*}(x*(y*(0*0))), \\ &(\lambda_A)_\alpha^{T^*}(y) \} \\ (\lambda_A)_\alpha^{T^*}(x) &\leq \max \{ (\lambda_A)_\alpha^{T^*}(x*y), (\lambda_A)_\alpha^{T^*}(y) \} \end{aligned}$$

consequently $A_\alpha^{T^*}$ is an Intuitionistic Fuzzy Ideal of X.

Affirmation:

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ALGORITHM FOR INTUITIONISTIC FUZZY T*-IDEAL

Input (X: BCI-Algebra, *: Binary operation, μ_A , λ_A are Fuzzy subsets of X);

Output ("A=(x, μ_A , λ_A) is Intuitionistic Fuzzy Ideal of X or not");

Begin

Stop:=false,

i:=1,

While $i \leq |X|$ and not (stop)do

If $\mu_A(0) \geq \mu_A(x)$ and $\lambda_A(0) \geq \lambda_A(x)$ then

Stop:= true,

End If

j:=1

While $j \leq |X|$ and not (stop)do

k:=1

While $k \leq |X|$ and not (stop)do

If $\mu_A(x*z) \geq \min\{\mu_A(x*(y*(z*0))), \mu_A(y)\}, \lambda_A(x*z) \leq \max\{\lambda_A(x*(y*(z*0))), \lambda_A(y)\}$

Then

Stop:=true;

End If

End while

End while

End while

If stop then

Output ("A=(x, μ_A , λ_A) is not Intuitionistic Fuzzy T*-ideal of X")

Else

Output ("A=(x, μ_A , λ_A) is Intuitionistic Fuzzy T*-ideal of X")

End If

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