Advances in Computer Science Research, volume 65
3rd International Conference on Communications, Information Management and Network Security (CIMNS 2018)

Intuitionistic Anti-fuzzy Subincline of Incline

Fengxiao Wang
College of Mathematics and Statistics, Kashigar University Kashi, 844000, China

***Abstract*—Fuzzy subalgebras is an important research field of fuzzy algebras. In order to understand the characteristics of incline algebras, the intuitionistic anti-fuzzy subalgebra of incline algebra is introduced. The related properties of intuitionistic anti-fuzzy subalgebra are discussed. Furthermore, it is proved that the union and homomorphism images of intuitionistic anti-fuzzy subalgebra in incline algebra are also intuitionistic anti-fuzzy subalgebra.**

Keywords—incline algebra; intuitionistic anti-fuzzy subalgebra; union; homomorphism

I. INTRODUCTION

Incline algebra was put forward by Chinese cybernetics expert Cao Zhiqiang [1]. The related concepts and theories of incline algebra were detail introduced in the monograph by Cao Zhiqiang, Kim and Roush[2]. Incline algebra and its related theories have been applied to many fields such as automation theory, cybernetics, nervous system and so on. After the concept of fuzzy sets by Zadeh[3], the concept of fuzzy sets has been widely applied in many field. The concept of fuzzy subgroup is put forward[4], which indicates that the research of fuzzy algebra has entered a new field. Subsequently, fuzzy sets and related theories are widely used in algebraic systems, and a wealth of research results have been achieved [5-6]. Jun applies the theory of fuzzy set to incline algebra, gives the concept of fuzzy subincline algebra and fuzzy ideal of incline algebra, and obtains some equivalent conditions and properties of fuzzy subincline algebra and fuzzy ideal of incline algebra[7]. The intuitionistic fuzzy ideals of incline algebras and T- fuzzy ideals of incline algebras are discussed in references [8] and [9]. Subsequently, many scholars carried out a series of studies on incline algebra, and obtained research results [10-12]. References [13-14] discuss the properties of interval-valued fuzzy subincline algebras and interval-valued fuzzy ideals of incline algebras.

In this paper, the notion of intuitionistic fuzzy sets are applied to incline algebra, the concept of intuitionistic anti-fuzzy subincline of incline algebra is introduced, and related properties are discussed. The relations between intuitionistic anti-fuzzy subincline and fuzzy subincline are investigated.

II. PRELIMINARIES

In this section, we review some basic facts for incline algebra and intuitionistic fuzzy set(see [2],[8]).

An incline algebra is a set X with two binary operations denoted by "+" and "*" satisfies the following conditions: for any $x, y, z \in S$.

$$x + y = y + x \tag{1}$$

$$x + (y + z) = (x + y) + z \tag{2}$$

$$x * (y * z) = (x * y) * z \tag{3}$$

$$x * (y + z) = (x * y) + (x * z) \tag{4}$$

$$(y + z) * x = (y * x) + (z * x) \tag{5}$$

$$x + x = x \tag{6}$$

$$x + x * y = x \tag{7}$$

$$y + x * y = y \tag{8}$$

Every distributive lattice is an incline. Note that $x \le y$ if and only if $x + y = y$ for all $x, y \in X$. A subincline of incline algebra X is a subset of X closed under two binary operations. By a homomorphism of incline X into an incline Y such that

$$f(x * y) = f(x) * f(y), \ f(x + y) = f(x) + f(y)$$

for all $x, y \in X$.

An intuitionistic fuzzy set (briefly, IFS) A in a nonempty set X is an object having the form

$$A = \{(x, \alpha_A(x), \beta_A(x)) \mid x \in X\}$$

where $0 \le \alpha_A(x) + \beta_A(x) \le 1$ and α_A and β_A are mapping from X to [0,1]. For the sake of simplicity, we shall use the symbol $A = (\alpha_A, \beta_A)$ for the IFS A.

Definition2.1 (see [7]) A fuzzy set A of incline algebra X is called a fuzzy subincline of X if

$$A(x+y)\wedge A(x*y)\geq A(x)\wedge A(y)$$

for all $x, y\in X$.

Definition2.2 (see [8]) An IFS $A=(\alpha_A,\beta_A)$ in incline algebra X is called an intuitionistic fuzzy subincline of X if

$$\alpha_A(x+y)\wedge\alpha_A(x*y)\geq\alpha_A(x)\wedge\alpha_A(y) \quad (9)$$

$$\beta_A(x+y)\vee\beta_A(x*y)\leq\beta_A(x)\vee\beta_A(y) \quad (10)$$

for all $x, y\in X$.

III. Main Results

Definition 3.1 An IFS $A=(\alpha_A,\beta_A)$ in incline algebra X is called an intuitionistic anti-fuzzy subincline of X if

$$\alpha_A(x+y)\vee\alpha_A(x*y)\leq\alpha_A(x)\vee\alpha_A(y) \quad (11)$$

$$\beta_A(x+y)\wedge\beta_A(x*y)\geq\beta_A(x)\wedge\beta_A(y) \quad (12)$$

for all $x, y\in X$.

Theorem 3.1 IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X if and only if $\overline{\alpha}_A=1-\alpha_A$ and β_A are both fuzzy subincline of X.

Proof Let IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X. Clearly β_A is a fuzzy subincline of X and for all $x, y\in X$, we have

$$\alpha_A(x+y)\vee\alpha_A(x*y)\leq\alpha_A(x)\vee\alpha_A(y)$$

Hence

$$\begin{aligned}&\overline{\alpha}_A(x+y)\wedge\overline{\alpha}_A(x*y)\\&=(1-\alpha_A(x+y))\wedge(1-\alpha_A(x*y))\\&=1-(\alpha_A(x+y)\vee\alpha_A(x*y))\\&\geq 1-(\alpha_A(x)\vee\alpha_A(y))=\overline{\alpha}_A(x)\wedge\overline{\alpha}_A(y)\end{aligned}$$

It follows from Definition1.1that $\overline{\alpha}_A$ is a fuzzy subincline.

Conversely, assume that $\overline{\alpha}_A$ and β_A are both fuzzy subincline of X, then (1) of Definition 3.1 is true. For all $x, y\in X$, we have

$$\begin{aligned}&\alpha_A(x+y)\vee\alpha_A(x*y)\\&=(1-\overline{\alpha}_A(x+y))\vee(1-\overline{\alpha}_A(x*y))\\&=1-(\overline{\alpha}_A(x+y)\wedge\overline{\alpha}_A(x*y))\\&\leq 1-(\overline{\alpha}_A(x)\vee\overline{\alpha}_A(y))\\&=(1-\overline{\alpha}_A(x))\vee(1-\overline{\alpha}_A(y))\\&=\alpha_A(x)\wedge\alpha_A(y)\end{aligned}$$

This shows that IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X.

Corollary 3.1 Let IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X. Then $\Box A=(\alpha_A(x),\overline{\alpha}_A(x))$ is also an intuitionistic anti-fuzzy subincline of X.

Corollary 3.2 Let IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X. Then $\Diamond A=(\overline{\beta}_A,\beta_A)$ is also an intuitionistic anti-fuzzy subincline of X.

Theorem 3.2 IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X if and only if IFS $\overline{A}=(\overline{\beta}_A,\overline{\alpha}_A)$ is intuitionistic anti-fuzzy subincline of X.

Theorem 3.3 IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X if and only if for all $0\leq s,t\leq 1$, the nonempty $U(\beta_A;t)$ and $L(\alpha_A;s)$ are both subincline of X.

Where

$$U(\beta_A;t)=\{x\in X\mid\beta_A(x)\geq t\}$$
$$L(\alpha_A;s)=\{x\in X\mid\alpha_A(x)\leq t\}$$

Proof Assume IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of X and let $s,t\in[0,1]$ be such that $U(\beta_A;t)$ and $L(\alpha_A;s)$ are non-empty. Then

$$\alpha_A(x+y)\vee\alpha_A(x*y)\leq\alpha_A(x)\vee\alpha_A(y)$$
$$\beta_A(x+y)\wedge\beta_A(x*y)\geq\beta_A(x)\wedge\beta_A(y)$$

for all $x, y\in X$.

Let $a,b\in L(\alpha_A;s)$, then $\alpha_A(a)\leq s,\alpha_A(b)\leq s$. so

$$\alpha_A(a+b)\vee\alpha_A(a*b)\leq\alpha_A(a)\vee\alpha_A(b)\leq s$$

Hence $a+b \in L(\alpha_A;s)$, $a*b \in L(\alpha_A;s)$ and $L(\alpha_A;s)$ is a subalgebra of *S*.

Assume $c,d \in U(\beta_A;t)$, then $\beta_A(c) \geq t, \beta_A(d) \geq t$, so $\beta_A(c+d) \wedge \beta_A(c*d) \geq \beta_A(c) \wedge \beta_A(d) \geq t$

Hence $c+d \in U(\beta_A;t)$, $c*d \in U(\beta_A;t)$ and $U(\beta_A;t)$ is a subalgebra of *X*.

Conversely, suppose that $U(\beta_A;t)$ and $L(\alpha_A;s)$ are subalgebras for every $s,t \in [0,1]$. If there exists $x,y \in X$ such that $\alpha_A(x+y) \vee \alpha_A(x*y) > \alpha_A(x) \vee \alpha_A(y)$, then let $u \in [0,1]$ such that

$$\alpha_A(x+y) \vee \alpha_A(x*y) > u > \alpha_A(x) \vee \alpha_A(y)$$

Hence $\alpha_A(x) \leq u$, $\alpha_A(y) \leq u$, that is $x,y \in L(\alpha_A;u)$.

Since $L(\alpha_A;u)$ is subincline of *X*, then $x+y \in L(\alpha_A;u)$, $x*y \in L(\alpha_A;u)$, so $\alpha_A(x+y) \vee \alpha_A(x*y) \leq u$. This is a contradiction, and thus

$$\alpha_A(x+y) \vee \alpha_A(x*y) \leq \alpha_A(x) \vee \alpha_A(y)$$

for all $x,y \in X$.

If $\beta_A(a+b) \wedge \beta_A(a*b) < \beta_A(a) \wedge \beta_A(b)$ for some $a,b \in X$ and let $t \in [0,1]$ such that

$$\beta_A(a+b) \wedge \beta_A(a*b) < t < \beta_A(a) \wedge \beta_A(b)$$

then $a,b \in U(\beta_A;t)$ and $a+b, a*b \in U(\beta_A;t)$. That is $\beta_A(a+b) \wedge \beta_A(a*b) \geq t$. This is a contradiction. Hence

$$\beta_A(x+y) \wedge \beta_A(x*y) \geq \beta_A(x) \wedge \beta_A(y)$$

for all $x,y \in X$. Consequently IFS $A=(\alpha_A,\beta_A)$ is an intuitionistic anti-fuzzy subincline of *X*.

Let IFS $A=(\alpha_A,\beta_A)$ and IFS $B=(\alpha_B,\beta_B)$ be two intuitionistic fuzzy set. Define IFS $A \cup B$, where

$$A \cup B = (\alpha_A \vee \alpha_B, \beta_A \wedge \beta_B)$$

The IFS $A \cup B$ is called the union of A and B.

Theorem 3.4 Let IFS $A=(\alpha_A,\beta_A)$ and $B=(\alpha_B,\beta_B)$ be two intuitionistic anti-fuzzy subinclines of *X*. Then $A \cup B$ is an intuitionistic anti-fuzzy subinclines of *X*.

Proof Assume that $A=(\alpha_A,\beta_A)$ and $B=(\alpha_B,\beta_B)$ are intuitionistic anti-fuzzy subinclines of *X*, then

$$\begin{aligned}
&\alpha_A(x+y) \vee \alpha_A(x*y) \leq \alpha_A(x) \vee \alpha_A(y)\\
&\beta_A(x+y) \wedge \beta_A(x*y) \geq \beta_A(x) \wedge \beta_A(y)\\
&\alpha_B(x+y) \vee \alpha_B(x*y) \leq \alpha_B(x) \vee \alpha_B(y)\\
&\beta_B(x+y) \wedge \beta_B(x*y) \geq \beta_B(x) \wedge \beta_B(y)
\end{aligned}$$

for all $x,y \in X$. Hence

$$\begin{aligned}
&(\alpha_A \vee \alpha_B)(x+y) \vee (\alpha_A \vee \alpha_B)(x*y)\\
&= (\alpha_A(x+y) \vee \alpha_B(x+y)) \vee (\alpha_A(x*y) \vee \alpha_B(x*y))\\
&= (\alpha_A(x+y) \vee \alpha_A(x*y)) \vee (\alpha_B(x+y) \vee \alpha_B(x*y))\\
&\leq (\alpha_A(x) \vee \alpha_A(y)) \vee (\alpha_B(x) \vee \alpha_B(y))\\
&= (\alpha_A(x) \vee \alpha_B(x)) \vee (\alpha_A(y) \vee \alpha_B(y))\\
&= (\alpha_A \vee \alpha_B)(x) \vee (\alpha_A \vee \alpha_B)(y)
\end{aligned}$$

$$\begin{aligned}
&(\beta_A \wedge \beta_B)(x+y) \wedge (\beta_A \wedge \beta_B)(x*y)\\
&= (\beta_A(x+y) \wedge \beta_B(x+y)) \wedge (\beta_A(x*y) \wedge \beta_B(x*y))\\
&= (\beta_A(x+y) \wedge \beta_A(x*y)) \wedge (\beta_B(x+y) \wedge \beta_B(x*y))\\
&\geq (\beta_A(x) \wedge \beta_A(y)) \wedge (\beta_B(x) \wedge \beta_B(y))\\
&= (\beta_A(x) \wedge \beta_B(x)) \wedge (\beta_A(y) \wedge \beta_B(y))\\
&= (\beta_A \wedge \beta_B)(x) \wedge (\beta_A \wedge \beta_B)(y)
\end{aligned}$$

Therefore $A \cup B$ is an intuitionistic anti-fuzzy subinclines of *X*.

Definition 32 Let *A* and *B* be two IFSs of *X* and *Y*, respectively. The anti-direct product $A \times B : X \times Y \to [0,1]$ of A and B is defined by

$$\begin{aligned}
\alpha_{A\times B}(x,y) &= \alpha_A(x) \vee \alpha_B(y)\\
\beta_{A\times B}(x,y) &= \beta_A(x) \wedge \beta_B(y)
\end{aligned}$$

Lemma 3.1 Let $(X,+,*)$ and $(Y,+,*)$ be two incline algebras, for all $(x_1,y_1),(x_2,y_2) \in X \times Y$, define

$$(x_1, y_1) + (x_2, y_2) = (x_1 + x_2, y_1 + y_2)$$
$$(x_1, y_1) * (x_2, y_2) = (x_1 * x_2, y_1 * y_2)$$

Then $(X \times Y, +, *)$ is also an incline algebra.

Theorem 3.5 Let *A* and *B* are intuitionistic anti-fuzzy subinclines of incline algebras *X* and *Y*, respectively. Then $A \times B$ is an intuitionistic anti-fuzzy subincline $X \times Y$.

Proof Suppose *A* and *B* are intuitionistic anti-fuzzy subinclines of incline algebras *X* and *Y*, respectively. Then for all $(x_1, y_1), (x_2, y_2) \in X \times Y$, we have

$$\alpha_A(x_1 + x_2) \vee \alpha_A(x_1 * x_2) \le \alpha_A(x_1) \vee \alpha_A(x_2)$$
$$\beta_A(x_1 + x_2) \wedge \beta_A(x_1 * x_2) \ge \beta_A(x_1) \wedge \beta_A(x_2)$$
$$\alpha_B(y_1 + y_2) \vee \alpha_B(y_1 * y_2) \le \alpha_B(y_1) \vee \alpha_B(y_2)$$
$$\alpha_B(y_1 + y_2) \vee \alpha_B(y_1 * y_2) \le \alpha_B(y_1) \vee \alpha_B(y_2)$$

According to Definition 3.2 andLemma3.1, we have

$$A \times B((x_1, y_1) + (x_2, y_2)) = A \times B(x_1 + x_2, y_1 + y_2)$$
$$A \times B((x_1, y_1) * (x_2, y_2)) = A \times B(x_1 * x_2, y_1 * y_2)$$

So

$$\alpha_{A\times B}((x_1, y_1) + (x_2, y_2)) = \alpha_{A\times B}(x_1 + x_2, y_1 + y_2)$$
$$= \alpha_A(x_1 + x_2) \vee \alpha_B(y_1 + y_2)$$

$$\alpha_{A\times B}((x_1, y_1) * (x_2, y_2)) = \alpha_{A\times B}(x_1 * x_2, y_1 * y_2)$$
$$= \alpha_A(x_1 * x_2) \vee \alpha_B(y_1 * y_2)$$

Hence

$$\alpha_{A\times B}((x_1, y_1) + (x_2, y_2)) \vee \alpha_{A\times B}((x_1, y_1) * (x_2, y_2))$$
$$= (\alpha_A(x_1 + x_2) \vee \alpha_B(y_1 + y_2)) \vee \alpha_A(x_1 * x_2) \vee \alpha_B(y_1 * y_2)$$
$$= (\alpha_A(x_1 + x_2) \vee \alpha_A(x_1 * x_2)) \vee (\alpha_B(y_1 + y_2) \vee \alpha_B(y_1 * y_2))$$
$$\le (\alpha_A(x_1) \vee \alpha_A(x_2)) \vee (\alpha_B(y_1) \vee \alpha_B(y_2))$$
$$= (\alpha_A(x_1) \vee \alpha_B(y_1)) \vee (\alpha_A(x_2) \vee \alpha_B(y_2))$$
$$= \alpha_{A\times B}(x_1, y_1) \vee \alpha_{A\times B}(x_2, y_2)$$

$$\beta_{A\times B}((x_1, y_1) + (x_2, y_2)) \wedge \beta_{A\times B}((x_1, y_1) * (x_2, y_2))$$
$$= (\beta_A(x_1 + x_2) \wedge \beta_B(y_1 + y_2)) \wedge \beta_A(x_1 * x_2) \wedge \beta_B(y_1 * y_2)$$
$$= (\beta_A(x_1 + x_2) \wedge \beta_A(x_1 * x_2)) \wedge (\beta_B(y_1 + y_2) \wedge \beta_B(y_1 * y_2))$$
$$\ge (\beta_A(x_1) \wedge \beta_A(x_2)) \wedge (\beta_B(y_1) \wedge \beta_B(y_2))$$
$$= (\beta_A(x_1) \wedge \beta_B(y_1)) \wedge (\beta_A(x_2) \wedge \beta_B(y_2))$$
$$= \beta_{A\times B}(x_1, y_1) \wedge \beta_{A\times B}(x_2, y_2)$$

Therefore $A \times B$ is an intuitionistic anti-fuzzy subincline $X \times Y$

Theorem 3.6 Let f be a surjective homomorphism from incline algebra X to incline algebra Y. If $A = (\alpha_A, \beta_A)$ is an intuitionistic anti-fuzzy subincline of X, then IFS $f(A)$ is also an intuitionistic anti-fuzzy subincline of Y. Where $f(A) = (\alpha_f, \beta_f)$ satisfies

$$\alpha_f(y) = \max\{\alpha_A(x) \mid f(x) = y\}$$
$$\beta_f(y) = \min\{\beta_A(x) \mid f(x) = y\}$$

Proof Let f be a surjective homomorphism from incline algebra *X* to incline algebra *Y*. Then for all $y_1, y_2 \in Y$, there exists $x_1, x_2 \in X$ such that $f(x_1) = y_1, f(x_2) = y_2$

Since $A = (\alpha_A, \beta_A)$ is an intuitionistic anti-fuzzy subincline of X, so for all $x_1, x_2 \in X$,we have

$$\alpha_A(x_1 + x_2) \vee \alpha_A(x_1 * x_2) \le \alpha_A(x_1) \vee \alpha_A(x_2)$$
$$\beta_A(x_1 + x_2) \wedge \beta_A(x_1 * x_2) \ge \beta_A(x_1) \wedge \beta_A(x_2)$$
$$\alpha_f(y_1 + y_2) \vee \alpha_f(y_1 * y_2)$$
$$= \max\{\alpha_A(x_1 + x_2) \mid f(x_1 + x_2) = y_1 + y_2\} \vee$$
$$\max\{\alpha_A(x_1 * x_2) \mid f(x_1 * x_2) = y_1 * y_2\}$$
$$= \max\{\alpha_A(x_1 + x_2) \mid f(x_1) = y_1, f(x_2) = y_2\} \vee$$
$$\max\{\alpha_A(x_1 * x_2) \mid f(x_1) = y_1, f(x_2) = y_2\}$$
$$= \max\{\alpha_A(x_1 + x_2) \vee \alpha_A(x_1 * x_2) \mid$$

$$f(x_1) = y_1, f(x_2) = y_2\}$$
$$\le \max\{\alpha_A(x_1) \vee \alpha_A(x_2) \mid f(x_1) = y_1, f(x_2) = y_2\}$$
$$= \max\{\alpha_A(x_1) \mid f(x_1) = y_1\}\} \vee$$
$$\max\{\alpha_A(x_2) \mid f(x_2) = y_2\}$$
$$= \alpha_f(y_1) \vee \alpha_f(y_2)$$

Using the same method, we have, for all $y_1, y_2 \in Y$,

$$\beta_f(y_1 + y_2) \wedge \beta_f(y_1 * y_2) \geq \beta_f(y_1) \wedge \beta_f(y_2)$$

Hence IFS $f(A)$ is also an intuitionistic anti-fuzzy subincline of Y.

Definition 3.3 Let f be a mapping on X. If $B = (\alpha_B, \beta_B)$ is an intuitionistic fuzzy set in $f(X)$, $A = (\alpha_A, \beta_A)$ is a intuitionistic fuzzy set in X, then intuitionistic fuzzy set $A = (\alpha_A, \beta_A) = B \circ f$

$$\alpha_A(x) = (\alpha_B \circ f)(x) = \alpha_B(f(x))$$
$$\beta_A(x) = (\beta_B \circ f)(x) = \beta_B(f(x))$$

in X is called preimage of $A = (\alpha_A, \beta_A)$ under f.

Theorem 2.11 An epimorphism preimage of intuitionistic anti-fuzzy subincline of X is an intuitionistic anti-fuzzy subincline **.**

Proof Let X be incline algebra and $f: X \to Y$ be an epimorphism. let $B = (\alpha_B, \beta_B)$ is an intuitionistic fuzzy set in $f(X)$, and $A = (\alpha_A, \beta_A)$ be the preimage of B under f. Then for any $x_1, x_2 \in X$, we have

$$\alpha_A(x_1 + x_2) = (\alpha_B \circ f)(x_1 + x_2)$$
$$= \alpha_B(f(x_1 + x_2)) = \alpha_B(f(x_1) + f(x_2))$$
$$\alpha_A(x_1 * x_2) = (\alpha_B \circ f)(x_1 * x_2)$$
$$= \alpha_B(f(x_1 * x_2)) = \alpha_B(f(x_1) * f(x_2))$$
$$\beta_A(x_1 + x_2) = (\beta_B \circ f)(x_1 + x_2)$$
$$= \beta_B(f(x_1 + x_2)) = \beta_B(f(x_1) + f(x_2))$$
$$\beta_A(x_1 + x_2) = (\beta_B \circ f)(x_1 + x_2)$$
$$= \beta_B(f(x_1 + x_2)) = \beta_B(f(x_1) + f(x_2))$$

$$\alpha_A(x_1 + x_2) \vee \alpha_A(x_1 * x_2)$$
$$= \alpha_B(f(x_1) + f(x_2)) \vee \alpha_B(f(x_1) * f(x_2))$$
$$\leq \alpha_B(f(x_1)) \vee \alpha_B(f(x_2)) = \alpha_A(x_1) \vee \alpha_A(x_2)$$
$$\beta_A(x_1 + x_2) \wedge \beta_A(x_1 * x_2)$$
$$= \beta_B(f(x_1) + f(x_2)) \wedge \beta_B(f(x_1) * f(x_2))$$
$$\geq \beta_B(f(x_1)) \wedge \beta_B(f(x_2)) = \beta_A(x_1) \wedge \beta_A(x_2)$$

Hence, IFS $A = (\alpha_A, \beta_A)$ is also an intuitionistic anti-fuzzy subincline of X.

IV. Conclusion

In this paper, the concept of intuitionistic anti-fuzzy subincline algebra of incline algebra is given, and its related properties and homomorphic image of intuitionistic anti-fuzzy subincline of incline algebra are discussed. Some meaningful conclusions are obtained. These conclusions not only help to further grasp the fuzzy structure of incline algebra, but also help to promote the fusion between fuzzy set theory and incline algebra theory. The research methods used can be used for reference to other algebraic systems.

References

[1] Cao Zhiqiang. “A new algebraic system—slope”. Busefal, vol 6,no.1 pp. 22-27,1981.

[2] Cao Zhiqiang, Kim K H, Roush F W. Incline algebra and applications. New York: John Wiley, 1984.

[3] Zadeh L A. “Fuzzy sets”. Information and Control, 1965(8): 338-353.

[4] Rosenfeld. A. Fuzzy groups [J].Journal of Mathematical Analysis and Applications, 1971(35):512-517.

[5] F.X.Wang, “Fuzzy dot subalgebra in N(2,2,0)-algebras”, Journal of Heilongjiang University. vol 33, no.6, pp. 770-773,2016.

[6] Jun Y B , Ahn S S, Kim H S. “Fuzzy subinclines (ideals) of incline algebras”, Fuzzy Sets and Systems, vol 123,no.2,pp. 217-225,2001.

[7] Ma Xueling, Zhan Jianming. “Intuitionistic fuzzy ideals of incline algebras”, Scientiae Mathematicae Japonicae, vol,62, no. 1, pp.33-38, 2005.

[8] Zhan Jianming, Long Ming. “T-fuzzy ideals of incline algebras”, Scientiae Mathematicae Japonicae, Vol. 61,no.1, pp. 67-73, 2005.

[9] L.L.Liu , W.Q. Fu and S.G. Li. “The oreder aspects of fuzzy subinclines, fuzzy equivalence relations, and fuzzy congruence relations”, Fuzzy Systems and Mathemations, Vol.25,no.5,pp.43-49,2011.

[10] L.L.Liu , W.Q. Fu and S.G. Li. “Characterizations of fuzzy subinclines, fuzzy ideals, fuzzy filters and fuzzy congruence relations”, Journal of Shandong University, vol 46, no.11, pp. 48-52,2011.

[11] K. J. Lee, “Comparison of interval-valued fuzzy sets, intuitionistic fuzzy sets, and bipolar-valued fuzzy sets”, J. Fuzzy Logic Intelligent Systems. vol 14, no.2 pp.125-129,2004.

[12] F.X.Wang,“On (λ,μ)-fuzzy subalgebras in Boolean algebras”, Applied Mathematics A Journal of Chinese Universities (Ser.A). vol 26, no.2, pp. 495-500,2011.

[13] F.X.Wang, “Internal-value fuzzy subinclines of incline algebras”, Mathematics in Practice and Theory, vol.47, no.24, pp. 289-293,2017.

[14] F.X.Wang, “Internal-value fuzzy ideals of incline algebras”, Computer Engineering and Applications, Vol. 54, no.9, pp. 54-56, 2017.