ON FRONTIER AND EXTERIOR IN INTUITIONISTIC SUPRA α– CLOSED SET

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Abstract. The main aim of the study of this paper is to work with the properties of frontier and exterior in intuitionistic supra topological spaces. Considering this we have introduced intuitionistic supra α-frontier and intuitionistic α-exterior in intuitionistic supra topological space. We have also deliberated the properties of intuitionistic supra α-frontier and intuitionistic supra α-exterior in intuitionistic supra topological space. The comparative study has been done with the use of intuitionistic supra α-open set between Intuitionistic supra frontier, Intuitionistic supra exterior and intuitionistic supra α-frontier, intuitionistic α-exterior in intuitionistic supra topological space.

1. Introduction

In 1970, Levine[4] introduced the concept of generalized closed sets in topological spaces. Njastad.O[12] and Maki.H et al[6] introduced α-closed sets and go-closed sets in topological spaces. In 1965 ,O.Njastad[12] introduced α-open sets. The concept of intuitionistic set and intuitionistic topological spaces was introduced by Coker[1][2]. Supra topology was introduced by A.S.Mashhour et.al[6] Intuitionistic supra α-open set was introduced by the Author[8] on intuitionistic supra topological spaces and discussed the properties of Intuitionistic supra α-open sets in supra topological spaces.

The purpose of this paper is to study the properties of α-frontier and α-exterior in intuitionistic supra topological spaces. Also to study the comparison between Intuitionistic supra frontier, Intuitionistic supra exterior and intuitionistic supra α-frontier, α-exterior in intuitionistic supra topological space.

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2. Preliminaries

Definition 2.1 [1] Let X be a non-empty set, an intuitionistic set (IS in short) A is an object having the form \( A = (X, A_1, A_2) \), where \( A_1 \) and \( A_2 \) are subsets of X satisfying \( A_1 \cap A_2 = \emptyset \). The set \( A_1 \) is called the set members of A, while \( A_2 \) is called the set of non-members of A.

Definition 2.2 [1] Let X be a non-empty set, \( A = (X, A_1, A_2) \) and \( B = (X, B_1, B_2) \) be IS’s on X and let \( \{A_i : i \in J\} \) be an arbitrary family of IS’s in X, where \( A_i = (X, A_i^{(1)}, A_i^{(2)}) \). Then

(i) \( A \subseteq B \) iff \( A_1 \subseteq B_1 \) and \( A_2 \supseteq B_2 \).
(ii) \( A = B \) iff \( A \subseteq B \) and \( B \subseteq A \).
(iii) \( A = (X, A_2, A_1) \).
(iv) \( A \cup B = (X, A_1 \cup B_1, A_2 \cup B_2) \).
(v) \( A \cap B = (X, A_1 \cap B_1, A_2 \cap B_2) \).
(vi) \( \bigcup A_i = (X, \bigcup A_i^{(1)}, \bigcap A_i^{(2)}) \).
(vii) \( \bigcap A_i = (X, \bigcap A_i^{(1)}, \bigcup A_i^{(2)}) \).
(viii) \( A \cap B = A \cap B \).
(ix) \( \neg A = (X, A_1, (A_1)^c) \).
(x) \( \neg A = (X, (A_2)^c, A_2) \).
(xi) \( X = (X, X, \phi) \).
(xii) \( \phi = (X, \phi, X) \).

Definition 2.3 [6] An intuitionistic topology on a non-empty set X is a family \( \tau \) of IS’s in X satisfying the following axioms:

(i) \( X, \phi \in \tau \).
(ii) \( A_1 \cap A_2 \in \tau \) for any \( A_1, A_2 \in \tau \).
(iii) \( \bigcup A_i \in \tau \) for any arbitrary family \( \{A_i : i \in J\} \subseteq \tau \).

The pair \( (X, \tau) \) is called an intuitionistic topological space (ITS in short) and IS in \( \tau \) is known as an intuitionistic open set (IOS in short) in X, the complement of IOS is called an intuitionistic closed set (ICS in short).

Definition 2.4 [6] The supra closure of a set A is denoted by \( cl^\mu(A) \), and is defined as,

\[
\text{supra } cl(A) = \bigcap \{B : B \text{ is supra closed and } A \subseteq B\}.
\]

The supra interior of a set A is denoted by \( int^\mu(A) \), and is defined as

\[
\text{supra } int(A) = \bigcup \{B : B \text{ is supra open and } A \supseteq B\}.
\]

Definition 2.5 [1] An Intuitionistic supra topology on a non-empty set X is a family \( \tau \) of IS’s in X satisfying the following axioms:

(i) \( X, \phi \in \tau \).
(ii) \( \bigcup A_i \in \tau \) for any arbitrary family \( \{A_i : i \in J\} \subseteq \tau \).
The pair \((X, \tau)\) is called intuitionistic supra topological space (ISTS in short) and IS in \(\tau\) is known as an intuitionistic supra open set (ISOS in short) in \(X\), the complement of ISOS is called intuitionistic supra closed set (ISCS in short).

**Definition 2.6** Let \((X, \tau)\) be an ISTS and let \(A = \langle X, A_1, A_2 \rangle\) be an IS in \(X\), then the supra closure and supra interior of \(A\) are defined by:
\[
\begin{align*}
\text{cl}^\mu(A) &= \bigcap \{K : K \text{ is an ISCS in } X \text{ and } A \subseteq K\}, \\
\text{int}^\mu(A) &= \bigcup \{K : K \text{ is an ISOS in } X \text{ and } A \supseteq K\}.
\end{align*}
\]

**Definition 2.7** Let \((X, \tau)\) be an ISTS and let \(A = \langle X, A_1, A_2 \rangle\) be an IS in \(X\), then the supra closure and supra interior of \(A\) are defined by:
\[
\begin{align*}
\text{Icl}^\mu(A) &= \bigcap \{K : K \text{ is an ISCS in } X \text{ and } A \subseteq K\}, \\
\text{Iint}^\mu(A) &= \bigcup \{K : K \text{ is an ISOS in } X \text{ and } A \supseteq K\}.
\end{align*}
\]

**Definition 2.8** Let \((X, \tau)\) be an intuitionistic supra topological space. An intuitionistic set \(A\) is called intuitionistic supra -closed set (ISCS in short) if \(\text{cl}^\mu(\text{int}^\mu(\text{cl}^\mu(A))) \subseteq U\), whenever \(A \subseteq U\), \(U\) is intuitionistic supra -open set (ICOS).

The complement of intuitionistic supra -closed set is intuitionistic supra -open set (ISOS in short).

### 3. Intuitionistic supra Frontier

**Definition 3.1** Let \(X\) be an ISTS and for a subset \(A\) of a ISTS \(X\), \(\text{IFr}^\mu(A) = \text{Icl}^\mu(A) - \text{Iint}^\mu(A)\) is said to be Intuitionistic supra Frontier of \(A\).

**Theorem 3.2** Let \(X\) be an ISTS then and for any a subset \(A\) of IS in ISTS \(X\), the following statements hold:
\[
\begin{align*}
(i) & \quad \text{IFr}^\mu(A) = \text{Icl}^\mu(A) \cap \text{Icl}^\mu(X - A), \\
(ii) & \quad \text{IFr}^\mu(A) = \text{IFr}^\mu(X - A), \\
(iii) & \quad \text{IFr}^\mu(\text{IFr}^\mu(A)) \subseteq \text{IFr}^\mu(A), \\
(iv) & \quad \text{Icl}^\mu(A) = \text{Iint}^\mu(A) \cup \text{IFr}^\mu(A). \\
(v) & \quad \text{Iint}^\mu(A) \cap \text{IFr}^\mu(A) = \emptyset, \\
(vi) & \quad \text{IFr}^\mu(X) = \phi, \text{IFr}^\mu(\phi) = X, \\
(vii) & \quad \text{IFr}^\mu(\text{Icl}^\mu(A)) \subseteq \text{IFr}^\mu(A).
\end{align*}
\]

**Proof.** Let \(A\) be a IS in ISTS \(X\).
\[
\begin{align*}
(i) & \quad \text{IFr}^\mu(A) = \text{Icl}^\mu(A) - \text{Iint}^\mu(A) = \text{Icl}^\mu(A) \cap \text{Icl}^\mu(X - A), \\
(ii) & \quad \text{IFr}^\mu(A) = \text{Icl}^\mu(A) - \text{Iint}^\mu(A) = (X - \text{Iint}^\mu(A)) - (X - \text{Icl}^\mu(A)) = \text{Icl}^\mu(X - A) - \text{Iint}^\mu(X - A) = \text{IFr}^\mu(X - A).
\end{align*}
\]
Let Example 3.3

Consider a set $A$ in the space $X$. The following theorem states that $\text{Int}^\alpha(A) \cap (\text{Id}^\alpha(A) - \text{Int}^\alpha(A)) = \phi$. Hence $\text{Int}^\alpha(A) \subseteq \text{Id}^\alpha(A)$. Similarly, $\text{Id}^\alpha(A) \cap (\text{Int}^\alpha(A) - \text{Id}^\alpha(A)) = \phi$. Hence $\text{Id}^\alpha(A) \subseteq \text{Int}^\alpha(A)$.

The converse of the above theorem need not be true. It is shown in the following example.

**Example 3.3** Let $X = \{a, b, c\}$. The topology $\tau = \{X, \emptyset, \{a\}, \{b, c\}\}$, where $A_1 = \{X, \{a\}, \{b, c\}\}$, $A_2 = \{X, \{b\}, \{c\}\}$, and $A_3 = \{X, \{a\}\}$. Let $A = \{X, \{a\}, \{c\}\}$.

Theorem 3.5

For a subset $A$ of ISTS, $\alpha \text{Fr}^\alpha(A) \subseteq \text{Fr}^\alpha(A)$.

**Proof** Let $x \in \alpha \text{Fr}^\alpha(A)$ then $x \in \alpha \text{Id}^\alpha(A) - \alpha \text{Int}^\alpha(A)$, implies $x \in \text{Id}^\alpha(A) - \text{Int}^\alpha(A)$, since every intuitionistic supra closed set is intuitionistic supra $\alpha$-closed set. Hence $x \in \text{Fr}^\alpha(A)$. Therefore $\alpha \text{Fr}^\alpha(A) \subseteq \text{Fr}^\alpha(A)$.

Conversely, the above theorem need not be true. It is shown in the following example.

**Example 3.6** Let $X = \{a, b, c\}$. The topology $\tau = \{X, \emptyset, \{a\}, \{b, c\}\}$, where $A_1 = \{X, \{a\}, \{b, c\}\}$, $A_2 = \{X, \{b\}, \{c\}\}$, and $A_3 = \{X, \{a, b\}, \{c\}\}$.
Let $A = \langle X, \{a\}, \{a\} \rangle$, $IFr^\mu(A) = \langle X, \{b, c\}, \{a\} \rangle$, and $IaFr^\mu(A) = \langle X, \phi \{a\} \rangle$. 

Here $IaFr^\mu(A) \subseteq IFr^\mu(A)$ is true but converse is not true.

**Theorem 3.7** Let $X$ be an ISTS then and for any a subset $A$ of IS in ISTS $X$, the following statements holds:

(i) $IaFr^\mu(A) = Iacl^\mu(A) \cap Iacl^\mu(X - A)$.

(ii) $IaFr^\mu(A) = IaFr^\mu(X - A)$.

(iii) $IaFr^\mu(IaFr^\mu(A)) \subseteq IaFr^\mu(A)$.

(iv) $Iacl^\mu(A) = Iaint^\mu(A) \cup IaFr^\mu(A)$.

(v) $Iaint^\mu(A) \cap IaFr^\mu(A) = \phi$.

(vi) $IaFr^\mu(X) = \phi$, $IaFr^\mu(\phi) = X$.

(vii) $IaFr^\mu(Iacl^\mu(A)) \subseteq IaFr^\mu(A)$.

**Proof**

(i) $IaFr^\mu(A) = Iacl^\mu(A) - Iaint^\mu(A) = Iacl^\mu(A) \cap Iacl^\mu(X - A)$.

(ii) $IaFr^\mu(A) = Iacl^\mu(A) - Iaint^\mu(A) = (X - Iaint^\mu(A)) - (X - Iacl^\mu(A)) = Iacl^\mu(X - A) - Iaint^\mu(A)$.

(iii) $IaFr^\mu(IaFr^\mu(A)) = Iacl^\mu(IaFr^\mu(A)) \cap Iacl^\mu(X - IaFr^\mu(A)) \subseteq Iacl^\mu IaFr^\mu(A) = IaFr^\mu(X - A)$. Hence $IaFr^\mu(IaFr^\mu(A)) \subseteq IaFr^\mu(A)$.

(iv) $Iaint^\mu(A) \cup IaFr^\mu(A) = Iaint^\mu(A) \cup Iacl^\mu(A) - Iaint^\mu(A) = Iacl^\mu(A) = IaFr^\mu(A)$.

(v) $Iaint^\mu(A) \cap IaFr^\mu(A) = Iaint^\mu(A) \cap (Iacl^\mu(A) - Iaint^\mu(A)) = \phi$.

(vi) $IaFr^\mu(X) = \phi$, $IaFr^\mu(\phi) = X$.

(vii) $IaFr^\mu(Iacl^\mu(A)) = Iacl^\mu(Iacl^\mu(A)) - Iaint^\mu(Iacl^\mu(A)) \subseteq Iacl^\mu(A) - Iaint^\mu(A) = IaFr^\mu(A)$. Hence $IaFr^\mu(Iacl^\mu(A)) \subseteq IaFr^\mu(A)$.

**Example 3.8** Let $X = \{a, b, c\}$, $\tau = \{X, \phi, A_1, A_2, A_3\}$, where $A_1 = \langle X, \{a\}, \{b, c\} \rangle$, $A_2 = \langle X, \{c\}, \{a, b\} \rangle$, and $A_3 = \langle X, \{a, c\}, \{b\} \rangle$.

Let $A = \langle X, \{b\}, \{a, c\} \rangle$, $X - A = \langle X, \{a, c\}, \{b\} \rangle$. $Iaint^\mu(A) = \phi$, $Iacl^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$, $IaFr^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$.

(i) $IaFr^\mu(A) = Iacl^\mu(A) - Iaint^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$, and $Iacl^\mu(A) \cap Iacl^\mu(X - A) = \langle X, \{b\}, \{a, c\} \rangle$.

(ii) $IaFr^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$ and $Iacl^\mu(X - A) = \langle X, \{b\}, \{a, c\} \rangle$.

(iii) $IaFr^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$. $IaFr^\mu(IaFr^\mu(A)) = \langle X, \{b\}, \{a, c\} \rangle$. Hence $IaFr^\mu(IaFr^\mu(A)) \subseteq IaFr^\mu(A)$.

(iv) $Iaint^\mu(A) \cup IaFr^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$. $Iacl^\mu(A) = \langle X, \{b\}, \{a, c\} \rangle$. Hence $Iacl^\mu(A) = Iaint^\mu(A) \cup IaFr^\mu(A)$.
I\text{int}^\mu(A) \cap I\text{Fr}^\mu(A) = \phi.

(vi) I\text{Fr}^\mu(X) = \phi, I\text{Fr}^\mu(\phi) = X.

(vii) I\text{Fr}^\mu(I\text{cl}^\mu(A)) = \{X, \{b\}, \{a, c\}\}. Hence I\text{Fr}^\mu(I\text{cl}^\mu(A)) \subseteq I\text{Fr}^\mu(A).

4. Intuitionistic supra Exterior

**Definition 4.1** Let X be an ISTS and for a subset A of a ISTS X, I\text{Ext}^\mu(A) = I\text{int}^\mu(X - A) s said to be Intuitionistic supra Exterior of A.

**Theorem 4.2** Let X be an ISTS then and for any a subset A of IS in ISTS X, the following statements hold:

(i) I\text{Ext}^\mu(A) = X - I\text{cl}^\mu(A).

(ii) I\text{Ext}^\mu(I\text{Ext}^\mu(A)) = I\text{int}^\mu(I\text{cl}^\mu(A)) \supseteq I\text{int}^\mu(A).

(iii) A \subseteq B \Rightarrow I\text{Ext}^\mu(A) \subseteq I\text{Ext}^\mu(B).

(iv) I\text{Ext}^\mu(A \cup B) = I\text{Ext}^\mu(A) \cap I\text{Ext}^\mu(B).

(v) I\text{Ext}^\mu(A \cap B) = I\text{Ext}^\mu((X - A) \cup (X - B)) \supseteq I\text{int}^\mu(X - A) \cup I\text{int}^\mu(X - B).

Hence I\text{Ext}^\mu(A \cup B) = I\text{Ext}^\mu(A) \cap I\text{Ext}^\mu(B).

(vi) I\text{Ext}^\mu(X) = \phi, I\text{Ext}^\mu(\phi) = X.

(vii) I\text{Ext}^\mu(X - I\text{Ext}^\mu(A)) = I\text{Ext}^\mu(X - I\text{int}^\mu(X - A)) = I\text{int}^\mu(X - A).

The proof of the above theorem is shown in the following example:

**Example 4.3** Let $X = \{a, b, c\}$. $\tau = \left\{ X, \phi, A_1, A_2, A_3 \right\}$, where $A_1 = \{X, \{a\}, \{b\}\}$, $A_2 = \{X, \{b\}, \{c\}\}$, and $A_3 = \{X, \{a, b\}, \{c\}\}$.
Let $A = \langle X, \{a, b\}, \{c\} \rangle$. $B = \langle X, \{a, b\}, \phi \rangle$. $X - A = \langle X, \{c\}, \{a, b\} \rangle$. $Int^\mu(A) = \langle X, \{a, b\}, \{c\} \rangle$. $Icl^\mu(A) = X$.

$Iint^\mu(X - A) = \langle X, \{c\}, \{a, b\} \rangle$. $Icl^\mu(X - A) = \phi$. $Iext^\mu(A) = \phi$. $Iext^\mu(B) = \phi$

(i) $X - Icl^\mu(A) = \phi$. Hence $IExt^\mu(A) = X - Icl^\mu(A)$.

(ii) $IExt^\mu(IExt^\mu(A)) = X$ Hence $IExt^\mu(IExt^\mu(A)) \supseteq Iint^\mu(A)$.

(iii) $A = \langle X, \{a, b\}, \{c\} \subseteq B = \langle X, \{a, b\}, \phi \rangle$ implies $IExt^\mu(A) = \phi$ and $IExt^\mu(B) = \phi$

implies $IExt^\mu(B) \subseteq IExt^\mu(A)$.

(iv) $IExt^\mu(A \cup B) = \phi$, $IExt^\mu(A) = \phi \cup IExt^\mu(B) = \phi$.

(v) $IExt^\mu(A \cap B) = \phi$, $IExt^\mu(A) = \phi \cap IExt^\mu(B) = \phi$.

(vi) $IExt^\mu(X) = \phi$, $IExt^\mu(\phi) = X$.

(vii) $IExt^\mu(X - IExt^\mu(A)) = \phi$.

**Definition 4.4** Let $X$ be an ISTS and for a subset $A$ of a ISTS $X$, $I\alpha Ext^\mu(A) = I\alpha int^\mu(X - A)$ said to be Intuitionistic supra $\alpha$-Exterior of $A$.

**Theorem 4.5** Let $X$ be an ISTS then and for any a subset $A$ of IS in ISTS $X$, the following statements hold:

(i) $I\alpha Ext^\mu(A) = X - I\alpha cl^\mu(A)$.

(ii) $I\alpha Ext^\mu(I\alpha Ext^\mu(A)) = I\alpha int^\mu(I\alpha cl^\mu(A)) \supseteq I\alpha int^\mu(A)$.

(iii) $A \subseteq B = I\alpha Ext^\mu(B) \subseteq I\alpha Ext^\mu(A)$.

(iv) $I\alpha Ext^\mu(A \cup B) = I\alpha Ext^\mu(A) \cap I\alpha Ext^\mu(B)$.

(v) $I\alpha Ext^\mu(A \cap B) = I\alpha Ext^\mu(A) \cup I\alpha Ext^\mu(B)$.

(vi) $I\alpha Ext^\mu(X) = \phi$, $I\alpha Ext^\mu(\phi) = X$.

(vii) $I\alpha Ext^\mu(A) = I\alpha Ext^\mu(X - I\alpha Ext^\mu(A))$.

**Proof**

(i) $I\alpha Ext^\mu(A) = I\alpha int^\mu(X - A) = X - I\alpha cl^\mu(A)$.

(ii) $I\alpha Ext^\mu(I\alpha Ext^\mu(A)) = I\alpha int^\mu(X - (I\alpha Ext^\mu(A)) = I\alpha int^\mu(I\alpha cl^\mu(A)) \supseteq I\alpha int^\mu(A)$.

(iii) $A \subseteq B$ implies $I\alpha int^\mu(A) \subseteq I\alpha int^\mu(B)$.

$I\alpha Ext^\mu(B) = I\alpha int^\mu(X - B) \subseteq I\alpha int^\mu(X - A) = I\alpha Ext^\mu(A)$ implies

$I\alpha Ext^\mu(B) \subseteq I\alpha Ext^\mu(A)$.

(iv) $I\alpha Ext^\mu(A \cup B) = I\alpha int^\mu(X - (A \cup B)) = I\alpha int^\mu((X - A) \cap (X - B)) \subseteq I\alpha int^\mu(X - A) \cap I\alpha int^\mu(X - B) = I\alpha Ext^\mu(A) \cap I\alpha Ext^\mu(B)$.

Hence $I\alpha Ext^\mu(A \cup B) = I\alpha Ext^\mu(A) \cap I\alpha Ext^\mu(B)$. 

Example 4.6

Let $X = (a, b, c)$. \(\tau = \{X, A, A_1, A_2, A_3\}\), where $A_1 = \{X, \{b\}, \{c\}\}$, $A_2 = \{X, \{a\}, \{c\}\}$, and $A_3 = \{X, \{a, b\}, \{c\}\}$.

Let $A = \{X, \{a, c\}, \{\phi\}\}$, $B = \{X, X, \phi\}$. $X - A = \{X, \{a, c\}\}$. $\alpha I\text{Ext}^p(X) = X$. $\alpha Fr(X) = \{X, \{a, b\}, \{c\}\}$.

$I\text{Ext}^p(X - A) = \{X, \{a, c\}\}$. $\alpha I\cl(X - A) = \phi$. $\alpha Fr(X - A) = \{X, \{a\}, \{c\}\}$.

$I\alpha \text{Ext}^p(A) = \phi$, $I\alpha \text{Ext}^p(B) = \phi$.

\[\begin{align*}
(i) &\quad X - I\text{Ext}^p(A) = \phi. \text{ Hence } I\alpha \text{Ext}^p(A) = X - I\text{Ext}^p(A). \\
(ii) &\quad I\alpha \text{Ext}^p(I\alpha \text{Ext}^p(A)) = X. \text{ Hence } I\alpha \text{Ext}^p(I\alpha \text{Ext}^p(A)) \supseteq I\text{Ext}^p(A). \\
(iii) &\quad A = \{X, \{a, c\}, \{\phi\}\} \subseteq B = \{X, X, \phi\} \text{ implies } I\alpha \text{Ext}^p(A) = \phi \text{ and } I\alpha \text{Ext}^p(B) = \phi \\
(iv) &\quad I\alpha \text{Ext}^p(A \cup B) = \phi, I\alpha \text{Ext}^p(A) = \phi \cup I\alpha \text{Ext}^p(B) = \phi. \\
(v) &\quad I\alpha \text{Ext}^p(A \cap B) = \phi, I\alpha \text{Ext}^p(A) = \phi \cap I\alpha \text{Ext}^p(B) = \phi. \\
(vi) &\quad I\alpha \text{Ext}^p(X) = \phi, I\alpha \text{Ext}^p(\phi) = X. \\
(vii) &\quad I\alpha \text{Ext}^p(X - I\alpha \text{Ext}^p(A)) = \phi. 
\end{align*}\]

References

[1] Coker, D., A note on intuitionistic sets and intuitionistic points, Turk.J.Math., 20-3 (1996), 343-351.
[2] Coker, D., An introduction to intuitionistic fuzzy topological spaces, Fuzzy sets and systems, (1997), 81-89.
[3] Coker, D., An introduction to Intuitionistic topological spaces, Busefal, 81 (2000), 51-56.
[4] Levin, N., semi open sets and semi continuity in topological spaces, Amer.Math.,12 (1991), 5-13.
[5] Devi, R., Sampathkumar, S., Caldas, M., On supra $\alpha$-open sets ans So-continuous functions, General Mathematics, 16(2) (2008),77-84.
[6] Mashhour, A.S., Allam, A.A., Mahmoud, F.S., Khedr, F.H., On Supra topological spaces, Indian J.Pure and Appl. Math., 14(4) (1983),502-510.
[7] Zadeh, L.A., Fuzzy sets, Information and control, 8 (1965), 338-353.
[8] Vidyarani, L., Vigneshwaran, M., On some intuitionistic supra closed sets on intuitionistic supra topological spaces, Bulletin of Mathematics and Statistics Research, 3(3) (2015), 1-9.
[9] Ilango, G., Albinaa, T.A., Properties of a α-interior and α-closure in intuitionistic topological spaces, *IOSR Journal of Mathematics*, 12 (2015), 91-95.

[10] Andrijevic, D., Some properties of the topology of α-sets, *Mat. Vesnik*, 36 (1984), 1-10.

[11] Girija, S., Selvanayaki, S., Ilango, G., Frontier and semi frontier in intuitionistic topological spaces, *EAI Endorsed Transactions on Energy Web and Information Technologies*, 5 (2018), 1-5.

[12] Njastad, O., On some classes of nearly open sets, *Pacific J.Math.*, 15 (1965), 961-970.

[13] Asmaa, Y.J., Raouf, G., On generalization closed set and generalized continuity on intuitionistic topological spaces, *J.of Al-anbar University of Pure Science* 3 (2009), 1-11.