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Translative and Multiplicative Interpretation of Neutrosophic Cubic Set

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Abstract: In this paper, we introduce the idea of neutrosophic cubic translation (NCT) and neutrosophic cubic multiplication (NCM) and provide entirely new type of conditions for neutrosophic cubic translation and neutrosophic cubic multiplication on BF-algebra. This is the new kind of approach towards translation and multiplication which involves the indeterminacy membership function. We also define neutrosophic cubic magnified translation (NCMT) on BF-algebra which handles the neutrosophic cubic translation and neutrosophic cubic multiplication at the same time on membership function, indeterminacy membership function and non-membership function. We present the examples for better understanding of neutrosophic cubic translation, neutrosophic cubic multiplication, and neutrosophic cubic magnified translation, and investigate significant results of BF-ideal and BF-subalgebra by applying the ideas of NCT, NCM and NCMT. Intersection and union of neutrosophic cubic BF-ideals are also explained through this new type of translation and multiplication.

Keywords: BF-algebra, neutrosophic cubic translation, neutrosophic cubic multiplication, neutrosophic cubic BF ideal, neutrosophic cubic BF subalgebra, neutrosophic cubic magnified translation.

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1. Introduction

Zadeh [1] presented the theory of fuzzy set in 1965. Fuzzy idea has been applied to different algebraic structures like groups, rings, modules, vector spaces and topologies. In this way, Iseki and Tanaka [2] introduced the idea of BCK-algebra in 1978. Iseki [3] introduced the idea of BCI-algebra in 1980 and it is obvious that the class of BCK-algebra is a proper sub class of the class of BCI-algebra. Lee et al. [4] studied the fuzzy translation, (normalized, maximal) fuzzy extension and fuzzy multiplication of fuzzy subalgebra in BCK/BCI-algebra. Link among fuzzy translation, (normalized, maximal) fuzzy extension and fuzzy multiplication are also discussed. Ansari and Chandramouleeswaran [5] introduced the idea of fuzzy translation, fuzzy extension and fuzzy multiplication of fuzzy β ideal of β-algebra and investigated some of their properties. Satyanarayana [6] introduced the concepts of fuzzy ideals, fuzzy implicative ideals and fuzzy p-ideals in BF-algebras and investigate some of its properties. Andrzej [7] defined the BF-algebra. Lekkoksung [8] focused on fuzzy magnified translation in ternary hemirings, which is a extension of BCI / BCK/Q / KU / d-algebra. Senapati et al. [9] have done much work on intuitionistic fuzzy H-ideal in BCK/BCI-algebra. Jana et al. [10] wrote on intuitionistic fuzzy G-algebra. Senapati et al. [11] studied fuzzy translations of fuzzy H-ideals in BCK/BCI-algebra. Atanassov [12] introduced the intuitionistic fuzzy sets. Senapati [13] investigated the relationship among intuitionistic fuzzy translation, intuitionistic fuzzy extension and intuitionistic fuzzy multiplication in B-algebra. Kim and Jeong [14] defined the intuitionistic fuzzy structure of B-algebra. Senapati et al. [15] introduced the cubic subalgebras and cubic closed ideals of B-algebras. Senapati et al. [16] discussed the fuzzy dot subalgebra and fuzzy dot ideal of B-algebras. Priya and Ramachandran [17] worked on fuzzy translation and fuzzy multiplication in PS-algebra. Chandramouleeswaran et al. [18] worked on fuzzy translation and fuzzy multiplication in BF/BG-algebra. Jana et al. [19] studied the cubic G-subalgebra of G-algebra. Smarandache [20,21] extended the intuitionistic fuzzy set, paraconsistent set, and intuitionistic set to the neutrosophic set through Several examples. Jun et al. [22] studied the Cubic set and apply the idea of cubic sets in group and gave the definition of cubic subgroups. Saeid and Rezvani [23] introduced and studied fuzzy BF-algebra, fuzzy BF-subalgebras, level subalgebras,fuzzy topological BF-algebra. Jun et al. [24] defined the neutrosophic cubic set introduced truth-internal and truth-external and discuss the many properties. Jun et al. [25] investigated the commutative falling neutrosophic ideals in BCK-algebra. C. H. Park [26] defined the neutrosophic ideal in subtraction algebra and studied it through several properties, he also discussed conditions for a neutrosophic set to be a neutrosophic ideal along with properties of neutrosophic ideal. Khalid et al. [27] investigated the neutrosophic soft cubic subalgebra through significant characteristic like P-union, R-intersection etc. Khalid et al. [28] interestinly investigated the intuitionistic fuzzy translation and multiplication through subalgebra and ideals. Khalid et al. [29] defined the T-neutrosophic cubic set and studied this set through ideals and subalgebras and investigated many results.

The purpose of this paper is to introduce the idea of neutrosophic cubic translation (**NCT**), neutrosophic cubic multiplication **(NCM)** and neutrosophic cubic magnified translation **(NCMT)** on BF-algebra. In second section we discuss some fundamental definitions which are used to develop the paper. In third's first subsection we discuss the neutrosophic cubic translation (**NCT)** and neutrosophic cubic multiplication **(NCM)** of BF subalgebra. In second subsection we discuss the neutrosophic cubic translation (**NCT)** and neutrosophic cubic multiplication **(NCM)** of BF ideal. In third subsection we discuss the neutrosophic cubic magnified translation **(NCMT)** of BF ideal and BF subalgebra.

2 Preliminaries

First we discuss some definitions which are used to present this paper.

Definition 2.1 [3] An algebra $(Y,*,0)$ of type (2,0) is called a BCI-algebra if it satisfies the following conditions:

i) $(t_1 * t_2) * (t_1 * t_3) \leq (t_3 * t_2)$,

ii) $t_1 * (t_1 * t_2) \leq t_2$,

iii) $t_1 \leq t_1$,

iv) $t_1 \leq t_2$ and $t_2 \leq t_1 \Rightarrow t_1 = t_2$,

v) $t_1 \leq 0 \Rightarrow t_1 = 0$, where $t_1 \leq t_2$ is defined by $t_1 * t_2 = 0$, for all $t_1, t_2, t_3 \in Y$.

Definition 2.2 [1] An algebra $(Y,*,0)$ of type (2,0) is called a BCK-algebra if it satisfies the following conditions:

i) $(t_1 * t_2) * (t_1 * t_3) \leq (t_3 * t_2)$,

ii) $t_1 * (t_1 * t_2) \leq t_2$,

iii) $t_1 \leq t_1$,

iv) $t_1 \leq t_2$ and $t_2 \leq t_1 \Rightarrow t_1 = t_2$,

v) $0 \leq t_1 \Rightarrow t_1 = 0$, where $t_1 \leq t_2$ is defined by $t_1 * t_2 = 0$, for all $t_1, t_2, t_3 \in Y$.

Definition 2.3 [7] A nonempty set Y with a constant 0 and a binary operation $*$ is called BF–algebra when it fulfills these axioms.

i) $t_1 * t_1 = 0$

ii) $t_1 * 0 = 0$

iii) $0 * (t_1 * t_2) = t_2 * t_1$ for all $t_1, t_2 \in Y$.

A BF-algebra is denoted by $(Y,*,0)$.

Definition 2.4 [7] Let S be a nonempty subset of BF-algebra Y, then S is called a BF-subalgebra of Y if $t_1 * t_2 \in S$, for all $t_1, t_2 \in S$.

Definition 2.5 [6] Let Y ba a BF-algebra and I is a subset of Y, then I is called a BF ideal of Y if it satisfies the following conditions:

i) $0 \in I$,

ii) $t_2 * t_1 \in I$ and $t_2 \in I \rightarrow t_1 \in I$.

Definition 2.6 [6] Let Y be a BF-algebra. A fuzzy set B of Y is called a fuzzy BF ideal of Y if it satisfies the following conditions:

i) $\kappa(0) \geq \kappa(t_1)$,

ii) $\kappa(t_1) \geq \min\{\kappa(t_2 * t_1), \kappa(t_2)\}$, for all $t_1, t_2 \in Y$.

Definition 2.7 [1] Let Y be a group of objects denoted generally by t_1. Then a fuzzy set B of Y is defined as $B = \{< t_1, \kappa_B(t_1) > | t_1 \in Y\}$, where $\kappa_B(t_1)$ is called the membership value of t_1 in B and $\kappa_B(t_1) \in [0,1]$.

Definition 2.8 [23] A fuzzy set B of BF-algebra Y is called a fuzzy PS subalgebra of Y if $\kappa(t_1 * t_2) \geq \min\{\kappa(t_1), \kappa(t_2)\}$, for all $t_1, t_2 \in Y$.

Definition 2.9 [4,5] Let a fuzzy subset B of Y and $\alpha \in [0,1-\sup\{\kappa_B(t_1)|t_1 \in Y\}]$. A mapping $(\kappa_B)^T_\alpha|Y \in [0,1]$ is said to be a fuzzy α translation of κ_B if it satisfies $(\kappa_B)^T_\alpha(t_1) = \kappa_B(t_1) + \alpha$, for all $t_1 \in Y$.

Definition 2.9 [4,5] Let a fuzzy subset B of Y and $\alpha \in [0,1]$. A mapping $(\kappa_B)^M_\alpha: Y \to [0,1]$ is said to be a fuzzy α multiplication of B if it satisfies $(\kappa_B)^M_\alpha(t_1) = \alpha.(\kappa_B)(t_1)$, for all $t_1 \in Y$.

Definition 2.10 [12] An intuitionistic fuzzy set **(IFS)** B over Y is an object having the form $B = \{\langle t_1, \kappa_B(t_1), \upsilon_B(t_1)\rangle | t_1 \in Y\}$, where $\kappa_B(t_1): Y \to [0,1]$ and $\upsilon_B(t_1)|Y \to [0,1]$, with the condition $0 \leq \kappa_B(t_1) + \upsilon_B(t_1) \leq 1$, for all $t_1 \in Y$. $\kappa_B(t_1)$ and $\upsilon_B(t_1)$ represent the degree of membership and the degree of non-membership of the element t_1 in the set B respectively.

Definition 2.11 [12] Let $B = \{\langle t_1, \kappa_B(t_1), \upsilon_B(t_1)\rangle | t_1 \in Y\}$ and $B = \{\langle t_1, \kappa_B(t_1), \upsilon_B(t_1)\rangle | t_1 \in Y\}$ be two **IFSs** on Y. Then intersection and union of A and B are indicated by $A \cap B$ and $A \cup B$ respectively and are given by

$$A \cap B = \{\langle t_1, \min(\kappa_A(t_1), \kappa_B(t_1)), \max(\upsilon_A(t_1), \upsilon_B(t_1))\rangle | t_1 \in Y\},$$

$$A \cup B = \{\langle t_1, \max(\kappa_A(t_1), \kappa_B(t_1)), \min(\upsilon_A(t_1), \upsilon_B(t_1))\rangle | t_1 \in Y\}.$$

Definition 2.12 [14] An **IFS** $B = \{\langle t_1, \kappa_B(t_1), \upsilon_B(t_1)\rangle | t_1 \in Y\}$ of Y is called an **IFSU** of Y if it satisfies these two conditions:

(i) $\kappa_B(t_1 * t_2) \geq \min\{\kappa_B(t_1), \kappa_B(t_2)\}$,

(ii) $\upsilon_B(t_1 * t_2) \leq \max\{\upsilon_B(t_1), \upsilon_B(t_2)\}$, for all $t_1, t_2 \in Y$.

Definition 2.13 An **IFS** $B = \{\langle t_1, \kappa_B(t_1), \upsilon_B(t_1)\rangle | t_1 \in Y\}$ of Y is said to be an **IFID** of Y if it satisfies these three conditions:

(i) $\kappa_B(0) \geq \kappa_B(t_1), \upsilon_B(0) \leq \upsilon_B(t_1)$,

(ii) $\kappa_B(t_1) \geq \min\{\kappa_B(t_1 * t_2), \kappa_B(t_2)\}$,

(iii) $\upsilon_B(t_1) \leq \max\{\upsilon_B(t_1 * t_2), \upsilon_B(t_2)\}$, for all $t_1, t_2 \in Y$.

Definition 2.14 [8] Let κ be a fuzzy subset of Y, $\alpha \in [0,T]$ and $\beta \in [0,1]$. A mapping $\kappa^{M\,T}_{\beta\,\alpha}|Y \to [0,1]$ is said to be a fuzzy magnified $\beta\alpha$ translation of κ if it satisfies: $\kappa^{M\,T}_{\beta\,\alpha}(t_1) = \beta.\kappa(t_1) + \alpha$ for all $t_1 \in Y$.

Jun et al. [22,24]introduced neutrosophic cubic set and investigated several properties.

Definition 2.15 [24] Suppose X be a nonempty set. A neutrosophic cubic set in X is pair $\mathcal{C} = (\kappa, \sigma)$ where $\kappa = \{\langle t_1; \kappa_E(t_1), \kappa_I(t_1), \kappa_N(t_1)\rangle \, | t_1 \in X\}$ is an interval neutrosophic set in X and $\sigma = \{\langle t_1; \sigma_E(t_1), \sigma_I(t_1), \sigma_N(t_1)\rangle \, | t_1 \in X\}$ is a neutrosophic set in X.

Definition 2.16 [15] Let $C = \{\langle t_1, \kappa(t_1), \sigma(t_1)\rangle\}$ be a cubic set, where $\kappa(t_1)$ is an interval-valued fuzzy set in X, $\sigma(t_1)$ is a fuzzy set in X. Then C is cubic subalgebra under binary operation "$*$", if following axioms are satisfied:

i) $\kappa(t_1 * t_2) \geq \text{rmin}\{\kappa(t_1), \kappa(t_2)\}$,

ii) $\sigma(t_1 * t_2) \leq \max\{\sigma(t_1), \sigma(t_2)\} \; \forall \; t_1, t_2 \in X$.

Definition 2.17 [28] Let $A = (\kappa_A, \upsilon_A)$ be an **IFS** of G-algebra and let $\alpha \in [0, ¥]$. An object of the form $A^T_\alpha = ((\kappa_A)^T_\alpha, (\upsilon_A)^T_\alpha)$ is called an intuitionistic fuzzy α-translation (**IFAT**) of A when $(\kappa_A)^T_\alpha(t_1) = \kappa_A(t_1) + \alpha$ and $(\upsilon_A)^T_\alpha(t_1) = \upsilon_A(t_1) - \alpha$ for all $t_1 \in Y$.

3 Translative and Multiplicative Interpretation of Neutrosophic Cubic Set

For our simplicity, we use the notation $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ for the NCS $B = \{\langle t_1, \kappa_{T,I,F}(t_1), \upsilon_{T,I,F}(t_1)\rangle | t_1 \in Y\}$. In this paper, we used $ℸ = [1,1] - rsup\{\kappa_{\{T,I\}}(t_1)|t_1 \in Y\}$, $¥ = rinf\{\kappa_F(t_1)|t_1 \in Y\}$, $\Gamma = 1 - sup\{\upsilon_{\{T,I\}}(t_1)|t_1 \in Y\}$, $£ = inf\{\upsilon_F(t_1)|t_1 \in Y$ for any NCS $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ of Y.

3.1 Translative and Multiplicative Interpretation of Neutrosophic Cubic Subalgebra

Definition 3.1.1 Let $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ be a **NCS** of Y and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. An object of the form $B^T_{\alpha,\beta,\gamma} = ((\kappa_{T,I,F})^T_{\alpha,\beta,\gamma}, (\upsilon_{T,I,F})^T_{\alpha,\beta,\gamma})$ is called a **NCT** of B, when $(\kappa_T)^T_\alpha(t_1) = \kappa_B(t_1) + \alpha$, $(\kappa_I)^T_\beta(t_1) = \kappa_B(t_1) + \beta$, $(\kappa_F)^T_\gamma(t_1) = \kappa_F(t_1) - \gamma$ and $(\upsilon_T)^T_\alpha(t_1) = \upsilon_T(t_1) + \alpha$, $(\upsilon_I)^T_\beta(t_1) = \upsilon_B(t_1) + \beta$, $(\upsilon_F)^T_\gamma(t_1) = \upsilon_B(t_1) - \gamma$ for all $t_1 \in Y$.

Example 3.1.1 Let $Y = \{0,1,2\}$ be a BF-algebra with the following Cayley table:

*	0	1	2
0	0	1	2
1	0	0	1
2	0	2	0

Let $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ be a **NCS** of Y is defined as

$$\kappa_T(t_1) = \begin{cases} [0.1, 0.3] & \text{if } t_1 = 0 \\ [0.4, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_I(t_1) = \begin{cases} [0.2, 0.4] & \text{if } t_1 = 0 \\ [0.5, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_F(t_1) = \begin{cases} [0.4, 0.6] & \text{if } t_1 = 0 \\ [0.3, 0.8] & \text{if otherwise} \end{cases}$$

and

$$\upsilon_T(t_1) = \begin{cases} 0.1 & \text{if } t_1 = 0 \\ 0.4 & \text{if otherwise} \end{cases}$$

$$\upsilon_I(t_1) = \begin{cases} 0.2 & \text{if } t_1 = 0 \\ 0.3 & \text{if otherwise} \end{cases}$$

$$\upsilon_F(t_1) = \begin{cases} 0.5 & \text{if } t_1 = 0 \\ 0.7 & \text{if otherwise.} \end{cases}$$

Then B is a neutrosophic cubic subalgebra. Here we choose for $\upsilon_{T,I,F}$, $\alpha = 0.01, \beta = 0.02,\ \gamma = 0.03$, and for $\kappa_{T,I,F}$, $\alpha = [0.1,0.2],\ \beta = [0.2,0.25],\ \gamma = [0.2,0.3]$ then the mapping $B^T: Y \to [0,1]$ is given by

$$(\kappa_T)^T_{[0.1,0.2]}(t_1) = \begin{cases} [0.2, 0.5] & \text{if } t_1 = 0 \\ [0.5, 0.9] & \text{if otherwise} \end{cases}$$

$$(\kappa_I)^T_{[0.2,0.25]}(t_1) = \begin{cases} [0.4, 0.7] & \text{if } t_1 = 0 \\ [0.7, 0.95] & \text{if otherwise} \end{cases}$$

$$(\kappa_F)^T_{[0.2,0.3]}(t_1) = \begin{cases} [0.2, 0.3] & \text{if } t_1 = 0 \\ [0.1, 0.5] & \text{if otherwise} \end{cases}$$

and

$$(\upsilon_T)^T_{0.01}(t_1) = \begin{cases} 0.11 & \text{if } t_1 = 0 \\ 0.41 & \text{if otherwise.} \end{cases}$$

$$(\upsilon_I)^T_{0.02}(t_1) = \begin{cases} 0.22 & \text{if } t_1 = 0 \\ 0.32 & \text{if otherwise.} \end{cases}$$

$$(\upsilon_F)^T_{0.03}(t_1) = \begin{cases} 0.47 & \text{if } t_1 = 0 \\ 0.67 & \text{if otherwise,} \end{cases}$$

which imply $(\kappa_T)^T_{[0.1,0.2]}(t_1) = \kappa_T(t_1) + [0.1,0.2]$, $(\kappa_I)^T_{[0.2,0.25]}(t_1) = \kappa_I(t_1) + [0.2,0.25\ \ ]$, $(\kappa_F)^T_{[0.2,0.3]}(t_1) = \kappa_F(t_1) - [0.2,0.3]$ and $(\upsilon_T)^T_{0.01}(t_1) = \upsilon_T(t_1) + 0.01$, $(\upsilon_I)^T_{0.02}(t_1) = \upsilon_I(t_1) + 0.02$, $(\upsilon_F)^T_{0.03}(t_1) = \upsilon_F(t_1) - 0.03$ for all $t_1 \in Y$. Hence B^T is a neutrosophic cubic translation.

Theorem 3.1.1 Let B be a **NCSU** of Y and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCSU** of Y.

Proof. Assume $t_1, t_2 \in Y$. Then

$$(\kappa_T)^T_\alpha(t_1 * t_2) = \kappa_T(t_1 * t_2) + \alpha$$

$$\geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\} + \alpha$$

$$= \text{rmin}\{\kappa_T(t_1) + \alpha, \kappa_T(t_2) + \alpha\}$$

$$(\kappa_T)^T_\alpha(t_1 * t_2) = \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_\alpha(t_2)\},$$

$$(\kappa_I)^T_\beta(t_1 * t_2) = \kappa_I(t_1 * t_2) + \beta$$

$$\geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\} + \beta$$

$$= \text{rmin}\{\kappa_I(t_1) + \beta, \kappa_I(t_2) + \beta\}$$

$(\kappa_I)^T_\beta(t_1 * t_2) = \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_\beta(t_2)\},$

$(\kappa_F)^T_\gamma(t_1 * t_2) = \kappa_F(t_1 * t_2) - \gamma$

$\geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\} - \gamma$

$= \text{rmin}\{\kappa_F(t_1) - \gamma, \kappa_F(t_2) - \gamma\}$

$(\kappa_F)^T_\gamma(t_1 * t_2) = \text{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_\gamma(t_2)\}$

and

$(\upsilon_T)^T_\alpha(t_1 * t_2) = \upsilon_T(t_1 * t_2) + \alpha$

$\leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\} + \alpha$

$= \max\{\upsilon_T(t_1) + \alpha, \upsilon_T(t_2) + \alpha\}$

$(\upsilon_T)^T_\alpha(t_1 * t_2) = \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_\alpha(t_2)\},$

$(\upsilon_I)^T_\beta(t_1 * t_2) = \upsilon_I(t_1 * t_2) + \beta$

$\leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\} + \beta$

$= \max\{\upsilon_I(t_1) + \beta, \upsilon_I(t_2) + \beta\}$

$(\upsilon_I)^T_\beta(t_1 * t_2) = \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_\beta(t_2)\},$

$(\upsilon_F)^T_\gamma(t_1 * t_2) = \upsilon_F(t_1 * t_2) - \gamma$

$\leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\} - \gamma$

$= \max\{\upsilon_F(t_1) - \gamma, \upsilon_F(t_2) - \gamma\}$

$(\upsilon_F)^T_\gamma(t_1 * t_2) = \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_\gamma(t_2)\}.$

Hence **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCSU** of Y.

Theorem 3.1.2 Let B be a **NCS** of Y such that **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCSU** of Y for some $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then B is a **NCSU** of Y.

Proof. Let $B^T_{\alpha,\beta,\gamma} = ((\kappa_{T,I,F})^T_{\alpha,\beta,\gamma}, (\upsilon_{T,I,F})^T_{\alpha,\beta,\gamma})$ be a **NCSU** of Y for some $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $t_1, t_2 \in Y$. Then

$\kappa_T(t_1 * t_2) + \alpha = (\kappa_T)^T_\alpha(t_1 * t_2)$

$\geq \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_\alpha(t_2)\}$

$= \text{rmin}\{\kappa_T(t_1) + \alpha, \kappa_T(t_2) + \alpha\}$

$\kappa_T(t_1 * t_2) + \alpha = \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\} + \alpha,$

$\kappa_I(t_1 * t_2) + \beta = (\kappa_I)^T_\beta(t_1 * t_2)$

$\geq \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_\beta(t_2)\}$

$= \text{rmin}\{\kappa_I(t_1) + \beta, \kappa_I(t_2) + \beta\}$

$\kappa_I(t_1 * t_2) + \beta = \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\} + \beta,$

$\kappa_F(t_1 * t_2) - \gamma = (\kappa_F)^T_\gamma(t_1 * t_2)$

$\geq \text{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_\gamma(t_2)\}$

$= \text{rmin}\{\kappa_F(t_1) - \gamma, \kappa_F(t_2) - \gamma\}$

$\kappa_F(t_1 * t_2) - \gamma = \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\} - \gamma$

and

$\upsilon_T(t_1 * t_2) + \alpha = (\upsilon_T)^T_\alpha(t_1 * t_2)$

$\leq \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_\alpha(t_2)\}$

$= \max\{\upsilon_T(t_1) + \alpha, \upsilon_B(t_2) + \alpha\}$

$\upsilon_T(t_1 * t_2) + \alpha = \max\{\upsilon_T(t_1), \upsilon_T(t_2)\} + \alpha,$

$\upsilon_I(t_1 * t_2) + \beta = (\upsilon_I)^T_\beta(t_1 * t_2)$

$\leq \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_\beta(t_2)\}$

$= \max\{\upsilon_I(t_1) + \beta, \upsilon_B(t_2) + \beta\}$

$\upsilon_I(t_1 * t_2) + \beta = \max\{\upsilon_I(t_1), \upsilon_I(t_2)\} + \beta,$

$\upsilon_F(t_1 * t_2) - \gamma = (\upsilon_F)^T_\gamma(t_1 * t_2)$

$\leq \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_\gamma(t_2)\}$

$= \max\{\upsilon_F(t_1) - \gamma, \upsilon_B(t_2) - \gamma\}$

$\upsilon_F(t_1 * t_2) - \gamma = \max\{\upsilon_F(t_1), \upsilon_F(t_2)\} - \gamma,$

which imply $\kappa_T(t_1 * t_2) \geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$, $\kappa_I(t_1 * t_2) \geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$, $\kappa_F(t_1 * t_2) \geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$, and $\upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$, $\upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$, $\upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$, for all $t_1, t_2 \in Y$. Hence B is a **NCSU** of Y.

Definition 3.1.2 Let B be a **NCS** of Y and $\delta \in [0,1]$. An object having the form $B^M_\delta = (((\kappa_T)^M_\delta, (\kappa_I)^M_\delta, (\kappa_F)^M_\delta), ((\upsilon_T)^M_\delta, (\upsilon_I)^M_\delta, (\upsilon_F)^M_\delta))$ is called a **NCM** of B, when $(\kappa_T)^M_\delta(t_1) = \delta.\kappa_T(t_1)$, $(\kappa_I)^M_\delta(t_1) = \delta.\kappa_I(t_1)$, $(\kappa_F)^M_\delta(t_1) = \delta.\kappa_F(t_1)$ and $(\upsilon_T)^M_\delta(t_1) = \delta.\upsilon_T(t_1)$, $(\upsilon_I)^M_\delta(t_1) = \delta.\upsilon_I(t_1)$,$(\upsilon_F)^M_\delta(t_1) = \delta.\upsilon_F(t_1)$ for all $t_1 \in Y$.

Example 3.1.2 Let $Y = \{0,1,2\}$ be a BF-algebra with the following Cayley table:

*	0	1	2
0	0	1	2
1	0	0	1
2	0	2	0

Let $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ be a **NCS** of Y is defined as

$$\kappa_T(t_1) = \begin{cases} [0.1, 0.3] & \text{if } t_1 = 0 \\ [0.4, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_I(t_1) = \begin{cases} [0.2, 0.4] & \text{if } t_1 = 0 \\ [0.5, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_F(t_1) = \begin{cases} [0.4, 0.6] & \text{if } t_1 = 0 \\ [0.3, 0.8] & \text{if otherwise} \end{cases}$$

and

$$\upsilon_T(t_1) = \begin{cases} 0.1 & \text{if } t_1 = 0 \\ 0.4 & \text{if otherwise} \end{cases}$$

$$\upsilon_I(t_1) = \begin{cases} 0.2 & \text{if } t_1 = 0 \\ 0.3 & \text{if otherwise} \end{cases}$$

$$\upsilon_F(t_1) = \begin{cases} 0.5 & \text{if } t_1 = 0 \\ 0.7 & \text{if otherwise.} \end{cases}$$

Then B is a neutrosophic cubic subalgebra, choose $\delta = 0.01$ for υ and $\delta = [0.1,0.2]$ for κ then the mapping $B^M_\delta | Y \to [0,1]$ is given by

$$(\kappa_T)^M_{[0.1,0.2]}(t_1) = \begin{cases} [0.01, 0.06] & \text{if } t_1 = 1 \\ [0.04, 0.14] & \text{if otherwise,} \end{cases}$$

$$(\kappa_I)^M_{[0.1,0.2]}(t_1) = \begin{cases} [0.02, 0.08] & \text{if } t_1 = 1 \\ [0.05, 0.14] & \text{if otherwise,} \end{cases}$$

$$(\kappa_F)^M_{[0.1,0.2]}(t_1) = \begin{cases} [0.04, 0.12] & \text{if } t_1 = 1 \\ [0.03, 0.16] & \text{if otherwise} \end{cases}$$

and

$$(\upsilon_T)^M_{0.01}(t_1) = \begin{cases} 0.001 & \text{if } t_1 = 0 \\ 0.004 & \text{if otherwise,} \end{cases}$$

$$(\upsilon_I)^M_{0.01}(t_1) = \begin{cases} 0.002 & \text{if } t_1 = 0 \\ 0.003 & \text{if otherwise,} \end{cases}$$

$$(\upsilon_F)^M_{0.01}(t_1) = \begin{cases} 0.005 & \text{if } t_1 = 0 \\ 0.007 & \text{if otherwise,} \end{cases}$$

which imply $(\kappa_T)^M_{[0.1,0.2]}(t_1) = \kappa_T(t_1).[0.1,0.2]$, $(\kappa_I)^M_{[0.1,0.2]}(t_1) = \kappa_I(t_1).[0.1,0.2]$, $(\kappa_F)^M_{[0.1,0.2]}(t_1) = \kappa_F(t_1).[0.1,0.2]$ and $(\upsilon_T)^M_{0.01}(t_1) = \upsilon_T(t_1).(0.01)$, $(\upsilon_I)^M_{0.01}(t_1) = \upsilon_I(t_1).(0.01)$, $(\upsilon_F)^M_{0.01}(t_1) = \upsilon_F(t_1).(0.01)$ for all $t_1 \in Y$. Hence B^M_δ is a neutrosophic cubic multiplication.

Theorem 3.1.3 Let B be a **NCS** of Y such that **NCM** B^M_δ of B is a **NCSU** of Y for some $\delta \in [0,1]$. Then B is a **NCSU** of Y.

Proof. Assume B^M_δ of B is a **NCSU** of Y for some $\delta \in [0,1]$. Now for all $t_1, t_2 \in Y$, we have

$$\kappa_T(t_1 * t_2).\delta = (\kappa_T)^M_\delta(t_1 * t_2)$$
$$\geq \mathrm{rmin}\{(\kappa_T)^M_\delta(t_1), (\kappa_T)^M_\delta(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_T(t_1).\delta, \kappa_T(t_2).\delta\}$$
$$\kappa_T(t_1 * t_2).\delta = \mathrm{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}.\delta,$$

$$\kappa_I(t_1 * t_2).\delta = (\kappa_I)^M_\delta(t_1 * t_2)$$
$$\geq \mathrm{rmin}\{(\kappa_I)^M_\delta(t_1), (\kappa_I)^M_\delta(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_I(t_1).\delta, \kappa_I(t_2).\delta\}$$
$$\kappa_I(t_1 * t_2).\delta = \mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}.\delta,$$

$$\kappa_F(t_1 * t_2).\delta = (\kappa_F)^M_\delta(t_1 * t_2)$$
$$\geq \mathrm{rmin}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_\delta(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_F(t_1).\delta, \kappa_F(t_2).\delta\}$$
$$\kappa_F(t_1 * t_2).\delta = \mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}.\delta$$

and

$$\upsilon_T(t_1 * t_2).\delta = (\upsilon_T)^M_\delta(t_1 * t_2)$$
$$\leq \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_\delta(t_2)\}$$
$$= \max\{\upsilon_T(t_1).\delta, \upsilon_T(t_2).\delta\}$$
$$\upsilon_T(t_1 * t_2).\delta = \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}.\delta,$$

$$\upsilon_I(t_1 * t_2).\delta = (\upsilon_I)^M_\delta(t_1 * t_2)$$
$$\leq \max\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_\delta(t_2)\}$$
$$= \max\{\upsilon_I(t_1).\delta, \upsilon_I(t_2).\delta\}$$
$$\upsilon_I(t_1 * t_2).\delta = \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}.\delta,$$

$$\upsilon_F(t_1 * t_2).\delta = (\upsilon_F)^M_\delta(t_1 * t_2)$$

$\leq \max\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_\delta(t_2)\}$

$= \max\{\upsilon_F(t_1).\delta, \upsilon_F(t_2).\delta\}$

$\upsilon_F(t_1 * t_2).\delta = \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}.\delta,$

which imply $\kappa_T(t_1 * t_2) \geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$, $\kappa_I(t_1 * t_2) \geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$, $\kappa_F(t_1 * t_2) \geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$ and $\upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$, $\upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$, $\upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$ for all $t_1, t_2 \in Y$. Hence B is a **NCSU** of Y.

Theorem 3.1.4 Let B be a **NCSU** of Y for $\delta \in [0,1]$. Then **NCM** B^M_δ of B is a **NCSU** of Y.

Proof. Assume $t_1, t_2 \in Y$. Then

$(\kappa_T)^M_\delta(t_1 * t_2) = \delta.\kappa_T(t_1 * t_2)$

$\geq \delta.\text{rmin}\{(\kappa_T)(t_1), (\kappa_T)(t_2)\}$

$= \text{rmin}\{\delta.\kappa_T(t_1), \delta.\kappa_T(t_2)\}$

$= \text{rmin}\{(\kappa_T)^M_\delta(t_1), (\kappa_T)^M_\delta(t_2)\}$

$(\kappa_T)^M_\delta(t_1 * t_2) \geq \text{rmin}\{(\kappa_T)^M_\delta(t_1), (\kappa_T)^M_\delta(t_2)\},$

$(\kappa_I)^M_\delta(t_1 * t_2) = \delta.\kappa_I(t_1 * t_2)$

$\geq \delta.\text{rmin}\{(\kappa_I)(t_1), (\kappa_I)(t_2)\}$

$= \text{rmin}\{\delta.\kappa_I(t_1), \delta.\kappa_I(t_2)\}$

$= \text{rmin}\{(\kappa_I)^M_\delta(t_1), (\kappa_I)^M_\delta(t_2)\}$

$(\kappa_I)^M_\delta(t_1 * t_2) \geq \text{rmin}\{(\kappa_I)^M_\delta(t_1), (\kappa_I)^M_\delta(t_2)\},$

$(\kappa_F)^M_\delta(t_1 * t_2) = \delta.\kappa_F(t_1 * t_2)$

$\geq \delta.\text{rmin}\{(\kappa_F)(t_1), (\kappa_F)(t_2)\}$

$= \text{rmin}\{\delta.\kappa_F(t_1), \delta.\kappa_F(t_2)\}$

$= \text{rmin}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_\delta(t_2)\}$

$(\kappa_F)^M_\delta(t_1 * t_2) \geq \text{rmin}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_\delta(t_2)\}$

and

$(\upsilon_T)^M_\delta(t_1 * t_2) = \delta.\upsilon_T(t_1 * t_2)$

$\leq \delta.\max\{(\upsilon_T)(t_1), (\upsilon_T)(t_2)\}$

$= \max\{\delta.\upsilon_T(t_1), \delta.\upsilon_T(t_2)\}$

$= \max\{(\kappa_B)^M_\delta(t_1), (\kappa_B)^M_\delta(t_2)\}$

$(\upsilon_T)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_\delta(t_2)\},$

$(\upsilon_I)^M_\delta(t_1 * t_2) = \delta.\upsilon_I(t_1 * t_2)$

$\leq \delta.\max\{(\upsilon_I)(t_1), (\upsilon_I)(t_2)\}$

$= \max\{\delta.\upsilon_I(t_1), \delta.\upsilon_I(t_2)\}$

$= \max\{(\kappa_B)^M_\delta(t_1), (\kappa_B)^M_\delta(t_2)\}$

$(\upsilon_I)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_\delta(t_2)\}$,

$(\upsilon_F)^M_\delta(t_1 * t_2) = \delta.\upsilon_F(t_1 * t_2)$

$\leq \delta.\max\{(\upsilon_F)(t_1), (\upsilon_F)(t_2)\}$

$= \max\{\delta.\upsilon_F(t_1), \delta.\upsilon_F(t_2)\}$

$= \max\{(\kappa_B)^M_\delta(t_1), (\kappa_B)^M_\delta(t_2)\}$

$(\upsilon_F)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_\delta(t_2)\}$,

which imply $\kappa_T(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$, $\kappa_I(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$, $\kappa_F(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$ and $\upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$, $\upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$, $\upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$ for all $t_1, t_2 \in Y$. Hence B^M_δ is a **NCSU** of Y.

3.2 Translative and Multiplicative Interpretation of Neutrosophic Cubic Ideal

In this section, neutrosophic cubic translation of **NCID**, neutrosophic cubic multiplication of **NCID**, union and intersection of neutrosophic cubic translation of **NCID** are investigated through some results.

Theorem 3.2.1 If **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a neutrosophic cubic BF ideal, then it fulfills the conditions $(\kappa_T)^T_\alpha(t_1 * (t_2 * t_1)) \geq (\kappa_T)^T_\alpha(t_2)$, $(\kappa_I)^T_\beta(t_1 * (t_2 * t_1)) \geq (\kappa_I)^T_\beta(t_2)$, $(\kappa_F)^T_\gamma(t_1 * (t_2 * t_1)) \geq (\kappa_F)^T_\gamma(t_2)$ and $(\upsilon_T)^T_\alpha(t_1 * (t_2 * t_1)) \leq (\upsilon_T)^T_\alpha(t_2)$, $(\upsilon_I)^T_\beta(t_1 * (t_2 * t_1)) \leq (\upsilon_I)^T_\beta(t_2)$, $(\upsilon_F)^T_\gamma(t_1 * (t_2 * t_1)) \leq (\upsilon_F)^T_\gamma(t_2)$.

Proof. Let **NCT** $B^T_{\alpha,\beta,\gamma}$ of B be a neutrosophic cubic BF ideal. Then

$(\kappa_T)^T_\alpha(t_1 * (t_2 * t_1)) = \kappa_T(t_1 * (t_2 * t_1)) + \alpha$

$\geq \mathrm{rmin}\{\kappa_T(t_2 * (t_1 * (t_2 * t_1))) + \alpha, \kappa_T(t_2) + \alpha\}$

$= \mathrm{rmin}\{\kappa_T(0) + \alpha, \kappa_T(t_2) + \alpha\}$

$= \mathrm{rmin}\{(\kappa_T)^T_\alpha(0), (\kappa_T)^T_\alpha(t_2)\}$

$(\kappa_T)^T_\alpha(t_1 * (t_2 * t_1)) = (\kappa_T)^T_\alpha(t_2)$,

$(\kappa_I)^T_\alpha(t_1 * (t_2 * t_1)) = \kappa_I(t_1 * (t_2 * t_1)) + \beta$

$\geq \mathrm{rmin}\{\kappa_I(t_2 * (t_1 * (t_2 * t_1))) + \beta, \kappa_I(t_2) + \beta\}$

$= \mathrm{rmin}\{\kappa_I(0) + \beta, \kappa_I(t_2) + \beta\}$

$$= \mathrm{rmin}\{(\kappa_I)^T_\beta(0), (\kappa_I)^T_\beta(t_2)\}$$

$$(\kappa_I)^T_\beta(t_1 * (t_2 * t_1)) = (\kappa_I)^T_\beta(t_2),$$

$$(\kappa_F)^T_\gamma(t_1 * (t_2 * t_1)) = \kappa_F(t_1 * (t_2 * t_1)) - \gamma$$

$$\geq \mathrm{rmin}\{\kappa_F(t_2 * (t_1 * (t_2 * t_1))) - \gamma, \kappa_F(t_2) - \gamma\}$$

$$= \mathrm{rmin}\{\kappa_F(0) - \gamma, \kappa_F(t_2) - \gamma\}$$

$$= \mathrm{rmin}\{(\kappa_F)^T_\gamma(0), (\kappa_F)^T_\gamma(t_2)\}$$

$$(\kappa_F)^T_\gamma(t_1 * (t_2 * t_1)) = (\kappa_F)^T_\gamma(t_2)$$

and

$$(\upsilon_T)^T_\alpha(t_1 * (t_2 * t_1)) = \upsilon_T(t_1 * (t_2 * t_1)) + \alpha$$

$$\leq \max\{\upsilon_T(t_2 * (t_1 * (t_2 * t_1))) + \alpha, \upsilon_T(t_2) + \alpha\}$$

$$= \max\{\upsilon_T(0) + \alpha, \upsilon_T(t_2) + \alpha\}$$

$$= \max\{(\upsilon_T)^T_\alpha(0), (\upsilon_T)^T_\alpha(t_2)\}$$

$$(\upsilon_T)^T_\alpha(t_1 * (t_2 * t_1)) = (\upsilon_T)^T_\alpha(t_2),$$

$$(\upsilon_I)^T_\alpha(t_1 * (t_2 * t_1)) = \upsilon_I(t_1 * (t_2 * t_1)) + \beta$$

$$\leq \max\{\upsilon_I(t_2 * (t_1 * (t_2 * t_1))) + \beta, \upsilon_I(t_2) + \beta\}$$

$$= \max\{\upsilon_I(0) + \beta, \upsilon_I(t_2) + \beta\}$$

$$= \max\{(\upsilon_I)^T_\beta(0), (\upsilon_I)^T_\beta(t_2)\}$$

$$(\upsilon_I)^T_\beta(t_1 * (t_2 * t_1)) = (\upsilon_I)^T_\beta(t_2),$$

$$(\upsilon_F)^T_\gamma(t_1 * (t_2 * t_1)) = \upsilon_F(t_1 * (t_2 * t_1)) - \gamma$$

$$\leq \max\{\upsilon_F(t_2 * (t_1 * (t_2 * t_1))) - \gamma, \upsilon_F(t_2) - \gamma\}$$

$$= \max\{\upsilon_F(0) - \gamma, \upsilon_F(t_2) - \gamma\}$$

$$= \max\{(\upsilon_F)^T_\gamma(0), (\upsilon_F)^T_\gamma(t_2)\}$$

$$(\upsilon_F)^T_\gamma(t_1 * (t_2 * t_1)) = (\upsilon_F)^T_\gamma(t_2).$$

Hence $(\kappa_T)^T_\alpha(t_1 * (t_2 * t_1)) \geq (\kappa_T)^T_\alpha(t_2)$, $(\kappa_I)^T_\beta(t_1 * (t_2 * t_1)) \geq (\kappa_I)^T_\beta(t_2)$, $(\kappa_F)^T_\gamma(t_1 * (t_2 * t_1)) \geq (\kappa_F)^T_\gamma(t_2)$ and $(\upsilon_T)^T_\alpha(t_1 * (t_2 * t_1)) \leq (\upsilon_T)^T_\alpha(t_2)$, $(\upsilon_I)^T_\beta(t_1 * (t_2 * t_1)) \leq (\upsilon_I)^T_\beta(t_2)$, $(\upsilon_F)^T_\gamma(t_1 * (t_2 * t_1)) \leq (\upsilon_F)^T_\gamma(t_2)$.

Theorem 3.2.2 Let B be a **NCID** of Y and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCID** of Y.

Proof. Let B be a **NCID** of Y and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then $(\kappa_T)^T_\alpha(0) = \kappa_T(0) + \alpha \geq \kappa_T(t_1) + \alpha = (\kappa_T)^T_\alpha(t_1)$, $(\kappa_I)^T_\beta(0) = \kappa_I(0) + \beta \geq$

$\kappa_I(t_1)+\beta=(\kappa_I)^T_\beta(t_1)$, $(\kappa_F)^T_\gamma(0)=\kappa_F(0)-\gamma\geq\kappa_F(t_1)-\gamma=(\kappa_F)^T_\gamma(t_1)$ and $(\upsilon_T)^T_\alpha(0)=\upsilon_T(0)+\alpha\leq\upsilon_T(t_1)+\alpha=(\upsilon_T)^T_\alpha(t_1)$, $(\upsilon_I)^T_\beta(0)=\upsilon_I(0)+\beta\leq\upsilon_I(t_1)+\beta=(\upsilon_I)^T_\beta(t_1)$, $(\upsilon_F)^T_\gamma(0)=\upsilon_F(0)-\gamma\leq\upsilon_F(t_1)-\gamma=(\upsilon_F)^T_\gamma(t_1)$. So

$$(\kappa_T)^T_\alpha(t_1)=\kappa_T(t_1)+\alpha$$
$$\geq \mathrm{rmin}\{\kappa_T(t_1*t_2),\kappa_T(t_2)\}+\alpha$$
$$=\mathrm{rmin}\{\kappa_T(t_1*t_2)+\alpha,\kappa_T(t_2)+\alpha\}$$
$$(\kappa_T)^T_\alpha(t_1)=\mathrm{rmin}\{(\kappa_T)^T_\alpha(t_1*t_2),(\kappa_T)^T_\alpha(t_2)\},$$
$$(\kappa_I)^T_\beta(t_1)=\kappa_I(t_1)+\beta$$
$$\geq \mathrm{rmin}\{\kappa_I(t_1*t_2),\kappa_I(t_2)\}+\beta$$
$$=\mathrm{rmin}\{\kappa_I(t_1*t_2)+\beta,\kappa_I(t_2)+\beta\}$$
$$(\kappa_I)^T_\beta(t_1)=\mathrm{rmin}\{(\kappa_I)^T_\beta(t_1*t_2),(\kappa_I)^T_\beta(t_2)\},$$
$$(\kappa_F)^T_\alpha(t_1)=\kappa_F(t_1)-\gamma$$
$$\geq \mathrm{rmin}\{\kappa_F(t_1*t_2),\kappa_F(t_2)\}-\gamma$$
$$=\mathrm{rmin}\{\kappa_F(t_1*t_2)-\gamma,\kappa_F(t_2)-\gamma\}$$
$$(\kappa_F)^T_\gamma(t_1)=\mathrm{rmin}\{(\kappa_F)^T_\gamma(t_1*t_2),(\kappa_F)^T_\gamma(t_2)\}$$

and

$$(\upsilon_T)^T_\alpha(t_1)=\upsilon_T(t_1)+\alpha$$
$$\leq \max\{\upsilon_T(t_1*t_2),\upsilon_T(t_2)\}+\alpha$$
$$=\max\{\upsilon_T(t_1*t_2)+\alpha,\upsilon_T(t_2)+\alpha\}$$
$$(\upsilon_T)^T_\alpha(t_1)=\max\{(\upsilon_T)^T_\alpha(t_1*t_2),(\upsilon_T)^T_\alpha(t_2)\},$$
$$(\upsilon_I)^T_\beta(t_1)=\upsilon_I(t_1)+\beta$$
$$\leq \max\{\upsilon_I(t_1*t_2),\upsilon_I(t_2)\}+\beta$$
$$=\max\{\upsilon_I(t_1*t_2)+\beta,\upsilon_I(t_2)+\beta\}$$
$$(\upsilon_I)^T_\beta(t_1)=\max\{(\upsilon_I)^T_\beta(t_1*t_2),(\upsilon_I)^T_\beta(t_2)\},$$
$$(\upsilon_F)^T_\gamma(t_1)=\upsilon_F(t_1)-\gamma$$
$$\leq \max\{\upsilon_F(t_1*t_2),\upsilon_F(t_2)\}-\gamma$$
$$=\max\{\upsilon_F(t_1*t_2)-\gamma,\upsilon_F(t_2)-\gamma\}$$
$$(\upsilon_F)^T_\gamma(t_1)=\max\{(\upsilon_F)^T_\gamma(t_1*t_2),(\upsilon_F)^T_\gamma(t_2)\},$$

for all $t_1, t_2 \in Y$ and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ٦]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Hence $B^T_{\alpha,\beta,\gamma}$ of B is a **NCID** of Y.

Theorem 3.2.3 Let B be a neutrosophic cubic set of Y such that **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCID** of Y for all $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ٦]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then B is a **NCID** of Y.

Proof. Suppose $B^T_{\alpha,\beta,\gamma}$ is a **NCID** of Y, where for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ٦]$ and $\gamma \in [[0,0], ¥]$, and for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $t_1, t_2 \in Y$. Then

$$\kappa_T(0) + \alpha = (\kappa_T)^T_\alpha(0) \geq (\kappa_T)^T_\alpha(t_1) = \kappa_T(t_1) + \alpha,$$
$$\kappa_I(0) + \beta = (\kappa_I)^T_\beta(0) \geq (\kappa_I)^T_\beta(t_1) = \kappa_I(t_1) + \beta,$$
$$\kappa_F(0) - \gamma = (\kappa_F)^T_\gamma(0) \geq (\kappa_F)^T_\gamma(t_1) = \kappa_F(t_1) - \gamma,$$

and

$$\upsilon_T(0) + \alpha = (\upsilon_T)^T_\alpha(0) \leq (\upsilon_T)^T_\alpha(t_1) = \upsilon_T(t_1) + \alpha,$$
$$\upsilon_I(0) + \beta = (\upsilon_I)^T_\beta(0) \leq (\upsilon_I)^T_\beta(t_1) = \upsilon_I(t_1) + \beta$$
$$\upsilon_F(0) - \gamma = (\upsilon_F)^T_\gamma(0) \leq (\upsilon_F)^T_\gamma(t_1) = \upsilon_F(t_1) - \gamma,$$

which imply $\kappa_T(0) \geq \kappa_T(t_1)$, $\kappa_I(0) \geq \kappa_I(t_1)$, $\kappa_F(0) \geq \kappa_F(t_1)$ and $\upsilon_T(0) \leq \upsilon_T(t_1)$, $\upsilon_I(0) \leq \upsilon_I(t_1)$, $\upsilon_F(0) \leq \upsilon_F(t_1)$, now

$$\kappa_T(t_1) + \alpha = (\kappa_T)^T_\alpha(t_1) \geq \mathrm{rmin}\{(\kappa_T)^T_\alpha(t_1 * t_2), (\kappa_T)^T_\alpha(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_T(t_1 * t_2) + \alpha, \kappa_T(t_2) + \alpha\}$$
$$\kappa_T(t_1) + \alpha = \mathrm{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\} + \alpha,$$

$$\kappa_I(t_1) + \beta = (\kappa_I)^T_\beta(t_1) \geq \mathrm{rmin}\{(\kappa_I)^T_\beta(t_1 * t_2), (\kappa_I)^T_\beta(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_I(t_1 * t_2) + \beta, \kappa_I(t_2) + \beta\}$$
$$\kappa_I(t_1) + \beta = \mathrm{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\} + \beta,$$

$$\kappa_F(t_1) - \gamma = (\kappa_F)^T_\gamma(t_1) \geq \mathrm{rmin}\{(\kappa_F)^T_\gamma(t_1 * t_2), (\kappa_F)^T_\gamma(t_2)\}$$
$$= \mathrm{rmin}\{\kappa_F(t_1 * t_2) - \gamma, \kappa_F(t_2) - \gamma\}$$
$$\kappa_F(t_1) - \gamma = \mathrm{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\} - \gamma,$$

and

$$\upsilon_T(t_1) + \alpha = (\upsilon_T)^T_\alpha(t_1) \leq \max\{(\upsilon_T)^T_\alpha(t_1 * t_2), (\upsilon_T)^T_\alpha(t_2)\}$$
$$= \max\{\upsilon_T(t_1 * t_2) + \alpha, \upsilon_T(t_2) + \alpha\}$$

$\upsilon_T(t_1) + \alpha = \max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\} + \alpha,$

$\upsilon_I(t_1) + \beta = (\upsilon_I)^T_\beta(t_1) \leq \max\{(\upsilon_I)^T_\beta(t_1 * t_2), (\upsilon_I)^T_\beta(t_2)\}$

$= \max\{\upsilon_I(t_1 * t_2) + \beta, \upsilon_I(t_2) + \beta\}$

$\upsilon_I(t_1) + \beta = \max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\} + \beta,$

$\upsilon_F(t_1) - \gamma = (\upsilon_F)^T_\gamma(t_1) \leq \max\{(\upsilon_F)^T_\gamma(t_1 * t_2), (\upsilon_F)^T_\gamma(t_2)\}$

$= \max\{\upsilon_F(t_1 * t_2) - \gamma, \upsilon_F(t_2) - \gamma\}$

$\upsilon_F(t_1) - \gamma = \max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\} - \gamma,$

which imply $\kappa_T(t_1) \geq \text{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\}$, $\kappa_I(t_1) \geq \text{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\}$, $\kappa_F(t_1) \geq \text{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\}$ and $\upsilon_T(t_1) \leq \max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\}$, $\upsilon_I(t_1) \leq \max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\}$, $\upsilon_F(t_1) \leq \max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\}$ for all $t_1, t_2 \in Y$. Hence B is a **NCID** of Y.

Theorem 3.2.4 Let B be a **NCID** of Y for some $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ᒣ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$. Then **NCT** $B^T_{\alpha,\beta,\gamma}$ of B is a **NCSU** of Y.

Proof. Assume $t_1, t_2 \in Y$. Then

$(\kappa_T)^T_\alpha(t_1 * t_2) = \kappa_T(t_1 * t_2) + \alpha$

$\geq \text{rmin}\{\kappa_T(t_2 * (t_1 * t_2)), \kappa_T(t_2)\} + \alpha$

$= \text{rmin}\{\kappa_T(0), \kappa_T(t_2)\} + \alpha$

$\geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\} + \alpha$

$= \text{rmin}\{\kappa_T(t_1) + \alpha, \kappa_T(t_2) + \alpha\}$

$(\kappa_T)^T_\alpha(t_1 * t_2) = \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_\alpha(t_2)\}$

$(\kappa_T)^T_\alpha(t_1 * t_2) \geq \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_\alpha(t_2)\},$

$(\kappa_I)^T_\beta(t_1 * t_2) = \kappa_I(t_1 * t_2) + \beta$

$\geq \text{rmin}\{\kappa_I(t_2 * (t_1 * t_2)), \kappa_I(t_2)\} + \beta$

$= \text{rmin}\{\kappa_I(0), \kappa_I(t_2)\} + \beta$

$\geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\} + \beta$

$= \text{rmin}\{\kappa_I(t_1) + \beta, \kappa_I(t_2) + \beta\}$

$(\kappa_I)^T_\beta(t_1 * t_2) = \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_\beta(t_2)\}$

$(\kappa_I)^T_\beta(t_1 * t_2) \geq \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_\beta(t_2)\},$

$(\kappa_F)^T_\gamma(t_1 * t_2) = \kappa_F(t_1 * t_2) - \gamma$

$\geq \mathrm{rmin}\{\kappa_F(t_2 * (t_1 * t_2)), \kappa_F(t_2)\} - \gamma$

$= \mathrm{rmin}\{\kappa_F(0), \kappa_F(t_2)\} - \gamma$

$\geq \mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\} - \gamma$

$= \mathrm{rmin}\{\kappa_F(t_1) - \gamma, \kappa_F(t_2) - \gamma\}$

$(\kappa_F)^T_\gamma(t_1 * t_2) = \mathrm{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_\gamma(t_2)\}$

$(\kappa_F)^T_\gamma(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_\gamma(t_2)\}$

and

$(\upsilon_T)^T_\alpha(t_1 * t_2) = \upsilon_T(t_1 * t_2) + \alpha$

$\leq \max\{\upsilon_T(t_2 * (t_1 * t_2)), \upsilon_T(t_2)\} + \alpha$

$= \max\{\upsilon_T(0), \upsilon_T(t_2)\} + \alpha$

$\leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\} + \alpha$

$= \max\{\upsilon_T(t_1) + \alpha, \upsilon_T(t_2) + \alpha\}$

$(\upsilon_T)^T_\alpha(t_1 * t_2) = \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_\alpha(t_2)\}$

$(\upsilon_T)^T_\alpha(t_1 * t_2) \leq \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_\alpha(t_2)\}$,

$(\upsilon_I)^T_\beta(t_1 * t_2) = \upsilon_I(t_1 * t_2) + \beta$

$\leq \max\{\upsilon_I(t_2 * (t_1 * t_2)), \upsilon_I(t_2)\} + \beta$

$= \max\{\upsilon_I(0), \upsilon_I(t_2)\} + \beta$

$\leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\} + \beta$

$= \max\{\upsilon_I(t_1) + \beta, \upsilon_I(t_2) + \beta\}$

$(\upsilon_I)^T_\beta(t_1 * t_2) = \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_\beta(t_2)\}$

$(\upsilon_I)^T_\beta(t_1 * t_2) \leq \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_\beta(t_2)\}$,

$(\upsilon_F)^T_\gamma(t_1 * t_2) = \upsilon_F(t_1 * t_2) - \gamma$

$\leq \max\{\upsilon_F(t_2 * (t_1 * t_2)), \upsilon_F(t_2)\} - \gamma$

$= \max\{\upsilon_F(0), \upsilon_F(t_2)\} - \gamma$

$\leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\} - \gamma$

$= \max\{\upsilon_F(t_1) - \gamma, \upsilon_F(t_2) - \gamma\}$

$(\upsilon_F)^T_\gamma(t_1 * t_2) = \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_\gamma(t_2)\}$

$(\upsilon_F)^T_\gamma(t_1 * t_2) \leq \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_\gamma(t_2)\}$.

Hence $B^T_{\alpha,\beta,\gamma}$ is a **NCSU** of Y.

Theorem 3.2.5 If **NCT** $B^{T}_{\alpha,\beta,\gamma}$ of B is a **NCID** of Y for some $\kappa_{T,I,F}$, $\alpha,\beta \in [[0,0],ℸ]$ and $\gamma \in [[0,0],¥]$, and for $\upsilon_{T,I,F}$, $\alpha,\beta \in [0,\Gamma]$ and $\gamma \in [0,£]$. Then B is a **NCSU** of Y.

Proof. Suppose $B^{T}_{\alpha,\beta,\gamma}$ of B is a **NCID** of Y. Then

$$(\kappa_T)(t_1 * t_2) + \alpha = (\kappa_T)^T_\alpha(t_1 * t_2)$$
$$\geq \text{rmin}\{(\kappa_T)^T_\alpha(t_2 * (t_1 * t_2)), (\kappa_T)^T_\alpha(t_2)\}$$
$$= \text{rmin}\{(\kappa_T)^T_\alpha(0), (\kappa_T)^T_\alpha(t_2)\}$$
$$\geq \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_\alpha(t_2)\}$$
$$= \text{rmin}\{\kappa_T(t_1) + \alpha, \kappa_T(t_2) + \alpha\}$$
$$(\kappa_T)(t_1 * t_2) + \alpha = \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\} + \alpha,$$

$$(\kappa_I)(t_1 * t_2) + \beta = (\kappa_I)^T_\beta(t_1 * t_2)$$
$$\geq \text{rmin}\{(\kappa_I)^T_\beta(t_2 * (t_1 * t_2)), (\kappa_I)^T_\beta(t_2)\}$$
$$= \text{rmin}\{(\kappa_I)^T_\beta(0), (\kappa_I)^T_\beta(t_2)\}$$
$$\geq \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_\beta(t_2)\}$$
$$= \text{rmin}\{\kappa_I(t_1) + \beta, \kappa_I(t_2) + \beta\}$$
$$(\kappa_I)(t_1 * t_2) + \beta = \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\} + \beta,$$

$$(\kappa_F)(t_1 * t_2) - \gamma = (\kappa_F)^T_\gamma(t_1 * t_2)$$
$$\geq \text{rmin}\{(\kappa_F)^T_\gamma(t_2 * (t_1 * t_2)), (\kappa_F)^T_\gamma(t_2)\}$$
$$= \text{rmin}\{(\kappa_F)^T_\gamma(0), (\kappa_F)^T_\gamma(t_2)\}$$
$$\geq \text{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_\gamma(t_2)\}$$
$$= \text{rmin}\{\kappa_F(t_1) - \gamma, \kappa_F(t_2) - \gamma\}$$
$$(\kappa_F)(t_1 * t_2) - \gamma = \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\} - \gamma$$

$\Rightarrow \kappa_T(t_1 * t_2) \geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}, \kappa_I(t_1 * t_2) \geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$ and $\kappa_F(t_1 * t_2)$
$\geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$ and now

$$(\upsilon_T)(t_1 * t_2) + \alpha = (\upsilon_T)^T_\alpha(t_1 * t_2)$$
$$\leq \max\{(\upsilon_T)^T_\alpha(t_2 * (t_1 * t_2)), (\upsilon_T)^T_\alpha(t_2)\}$$
$$= \max\{(\upsilon_T)^T_\alpha(0), (\upsilon_T)^T_\alpha(t_2)\}$$
$$\leq \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_\alpha(t_2)\}$$
$$= \max\{\upsilon_T(t_1) + \alpha, \upsilon_T(t_2) + \alpha\}$$
$$(\upsilon_T)(t_1 * t_2) + \alpha = \max\{\upsilon_T(t_1), \upsilon_T(t_2)\} + \alpha,$$

$(\upsilon_I)(t_1 * t_2) + \beta = (\upsilon_I)^T_\beta(t_1 * t_2)$

$\leq \max\{(\upsilon_I)^T_\beta(t_2 * (t_1 * t_2)), (\upsilon_I)^T_\beta(t_2)\}$

$= \max\{(\upsilon_I)^T_\beta(0), (\upsilon_I)^T_\beta(t_2)\}$

$\leq \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_\beta(t_2)\}$

$= \max\{\upsilon_I(t_1) + \beta, \upsilon_I(t_2) + \beta\}$

$(\upsilon_I)(t_1 * t_2) + \beta = \max\{\upsilon_I(t_1), \upsilon_I(t_2)\} + \beta,$

$(\upsilon_F)(t_1 * t_2) - \gamma = (\upsilon_F)^T_\gamma(t_1 * t_2)$

$\leq \max\{(\upsilon_F)^T_\gamma(t_2 * (t_1 * t_2)), (\upsilon_F)^T_\gamma(t_2)\}$

$= \max\{(\upsilon_F)^T_\gamma(0), (\upsilon_F)^T_\gamma(t_2)\}$

$\leq \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_\gamma(t_2)\}$

$= \max\{\upsilon_F(t_1) - \gamma, \upsilon_F(t_2) - \gamma\}$

$(\upsilon_F)(t_1 * t_2) - \gamma = \max\{\upsilon_F(t_1), \upsilon_F(t_2)\} - \gamma$

$\Rightarrow \upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}, \upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$ and $\upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$. Hence B is a **NCSU** of Y.

Theorem 3.2.6 Intersection of any two neutrosophic cubic translations of a neutrosophic cubic BF ideals B of Y is a neutrosophic cubic BF ideal of Y.

Proof. Suppose $B^T_{\alpha,\beta,\gamma}$ and $B^T_{\alpha',\beta',\gamma'}$ are two neutrosophic cubic translations of neutrosophic cubic BF ideal B and C of Y respectively, where for $B^T_{\alpha,\beta,\gamma}$, for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$, $\gamma \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$, $\gamma \in [0, £]$ and for $B^T_{\alpha',\beta',\gamma'}$, for $\kappa_{T,I,F}$ $\alpha', \beta' \in [[0,0], ℸ]$, $\gamma' \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha', \beta' \in [0, \Gamma]$, $\gamma' \in [0, £]$ and $\alpha \leq \alpha'$, $\beta \leq \beta'$, $\gamma \leq \gamma'$ as we know that, $B^T_{\alpha,\beta,\gamma}$ and $B^T_{\alpha',\beta',\gamma'}$ are neutrosophic cubic BF ideals of Y. So

$((\kappa_T)^T_\alpha \cap (\kappa_T)^T_{\alpha'})(t_1) = \text{rmin}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_{\alpha'}(t_1)\}$
$= \text{rmin}\{\kappa_T(t_1) + \alpha, \kappa_T(t_1) + \alpha'\}$
$= \kappa_T(t_1) + \alpha$
$((\kappa_T)^T_\alpha \cap (\kappa_T)^T_{\alpha'})(t_1) = (\kappa_T)^T_\alpha(t_1),$

$((\kappa_I)^T_\beta \cap (\kappa_I)^T_{\beta'})(t_1) = \text{rmin}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_{\beta'}(t_1)\}$
$= \text{rmin}\{\kappa_I(t_1) + \beta, \kappa_I(t_1) + \beta'\}$
$= \kappa_I(t_1) + \beta$
$((\kappa_I)^T_\beta \cap (\kappa_I)^T_{\beta'})(t_1) = (\kappa_I)^T_\beta(t_1),$

$$((\kappa_F)^T_\gamma \cap (\kappa_F)^T_{\gamma'})(t_1) = \mathrm{rmin}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_{\gamma'}(t_1)\}$$
$$= \mathrm{rmin}\{\kappa_F(t_1) - \gamma, \kappa_F(t_1) - \gamma'\}$$
$$= \kappa_F(t_1) - \gamma'$$
$$((\kappa_F)^T_\gamma \cap (\kappa_F)^T_{\gamma'})(t_1) = (\kappa_F)^T_{\gamma'}(t_1)$$

and

$$((\upsilon_T)^T_\alpha \cap (\upsilon_T)^T_{\alpha'})(t_1) = \max\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_{\alpha'}(t_1)\}$$
$$= \max\{\upsilon_T(t_1) + \alpha, \upsilon_T(t_1) + \alpha'\}$$
$$= \upsilon_T(t_1) + \alpha'$$
$$((\upsilon_T)^T_\alpha \cap (\upsilon_T)^T_{\alpha'})(t_1) = (\upsilon_T)^T_{\alpha'}(t_1),$$

$$((\upsilon_I)^T_\beta \cap (\upsilon_I)^T_{\beta'})(t_1) = \max\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_{\beta'}(t_1)\}$$
$$= \max\{\upsilon_I(t_1) + \beta, \upsilon_I(t_1) + \beta'\}$$
$$= \upsilon_I(t_1) + \beta'$$
$$((\upsilon_I)^T_\beta \cap (\upsilon_I)^T_{\beta'})(t_1) = (\upsilon_I)^T_{\beta'}(t_1),$$

$$((\upsilon_F)^T_\gamma \cap (\upsilon_F)^T_{\gamma'})(t_1) = \max\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_{\gamma'}(t_1)\}$$
$$= \max\{\upsilon_F(t_1) - \gamma, \upsilon_F(t_1) - \gamma'\}$$
$$= \upsilon_F(t_1) - \gamma$$
$$((\upsilon_F)^T_\gamma \cap (\upsilon_F)^T_{\gamma'})(t_1) = (\upsilon_F)^T_\gamma(t_1).$$

Hence $B^T_{\alpha,\beta,\gamma} \cap B^T_{\alpha',\beta',\gamma'}$ is a neutrosophic cubic BF ideal of Y.

Theorem 3.2.7 Union of any two neutrosophic cubic translations of a neutrosophic cubic BF ideals B of Y is a neutrosophic cubic BF ideal of Y.

Proof. Suppose $B^T_{\alpha,\beta,\gamma}$ and $B^T_{\alpha',\beta',\gamma'}$ are two neutrosophic cubic translations of neutrosophic cubic BF ideal B of Y respectively, where for $B^T_{\alpha,\beta,\gamma}$, for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$, $\gamma \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$, $\gamma \in [0, £]$ and for $B^T_{\alpha',\beta',\gamma'}$, for $\kappa_{T,I,F}$ $\alpha', \beta' \in [[0,0], ℸ]$, $\gamma' \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha', \beta' \in [0, \Gamma]$, $\gamma' \in [0, £]$ and $\alpha \geq \alpha'$, $\beta \geq \beta'$, $\gamma \geq \gamma'$ as we know that, $B^T_{\alpha,\beta,\gamma}$ and $B^T_{\alpha',\beta',\gamma'}$ are neutrosophic cubic BF ideals of Y. Then

$$((\kappa_T)^T_\alpha \cup (\kappa_T)^T_{\alpha'})(t_1) = \mathrm{rmax}\{(\kappa_T)^T_\alpha(t_1), (\kappa_T)^T_{\alpha'}(t_1)\}$$
$$= \mathrm{rmax}\{\kappa_T(t_1) + \alpha, \kappa_T(t_1) + \alpha'\}$$
$$= \kappa_T(t_1) + \alpha$$
$$((\kappa_T)^T_\alpha \cup (\kappa_T)^T_{\alpha'})(t_1) = (\kappa_T)^T_\alpha(t_1),$$

$$((\kappa_I)^T_\beta \cup (\kappa_I)^T_{\beta'})(t_1) = \mathrm{rmax}\{(\kappa_I)^T_\beta(t_1), (\kappa_I)^T_{\beta'}(t_1)\}$$
$$= \mathrm{rmax}\{\kappa_I(t_1) + \beta, \kappa_I(t_1) + \beta'\}$$
$$= \kappa_I(t_1) + \beta$$
$$((\kappa_I)^T_\beta \cup (\kappa_I)^T_{\beta'})(t_1) = (\kappa_I)^T_\beta(t_1),$$

$((\kappa_F)^T_\gamma \cup (\kappa_F)^T_{\gamma'})(t_1) = \mathrm{rmax}\{(\kappa_F)^T_\gamma(t_1), (\kappa_F)^T_{\gamma'}(t_1)\}$

$= \mathrm{rmax}\{\kappa_F(t_1) - \gamma, \kappa_F(t_1) - \gamma'\}$

$= \kappa_F(t_1) - \gamma'$

$((\kappa_F)^T_\gamma \cup (\kappa_F)^T_{\gamma'})(t_1) = (\kappa_F)^T_{\gamma'}(t_1)$

and

$((\upsilon_T)^T_\alpha \cup (\upsilon_T)^T_{\alpha'})(t_1) = \min\{(\upsilon_T)^T_\alpha(t_1), (\upsilon_T)^T_{\alpha'}(t_1)\}$

$= \min\{\upsilon_T(t_1) + \alpha, \upsilon_T(t_1) + \alpha'\}$

$= \upsilon_T(t_1) + \alpha'$

$((\upsilon_T)^T_\alpha \cup (\upsilon_T)^T_{\alpha'})(t_1) = (\upsilon_T)^T_{\alpha'}(t_1)$,

$((\upsilon_I)^T_\beta \cup (\upsilon_I)^T_{\beta'})(t_1) = \min\{(\upsilon_I)^T_\beta(t_1), (\upsilon_I)^T_{\beta'}(t_1)\}$

$= \min\{\upsilon_I(t_1) + \beta, \upsilon_I(t_1) + \beta'\}$

$= \upsilon_I(t_1) + \beta'$

$((\upsilon_I)^T_\beta \cup (\upsilon_I)^T_{\beta'})(t_1) = (\upsilon_I)^T_\beta(t_1)$,

$((\upsilon_F)^T_\gamma \cup (\upsilon_F)^T_{\gamma'})(t_1) = \min\{(\upsilon_F)^T_\gamma(t_1), (\upsilon_F)^T_{\gamma'}(t_1)\}$

$= \min\{\upsilon_F(t_1) - \gamma, \upsilon_F(t_1) - \gamma'\}$

$= \upsilon_F(t_1) - \gamma$

$((\upsilon_F)^T_\gamma \cup (\upsilon_F)^T_{\gamma'})(t_1) = (\upsilon_F)^T_\gamma(t_1)$

Hence $B^T_{\alpha,\beta,\gamma} \cup B^T_{\alpha',\beta',\gamma'}$ is a neutrosophic cubic BF ideal of Y.

Theorem 3.2.8 Let B be a **NCS** of Y such that **NCM** B^M_δ of B is a **NCID** of Y for $\delta \in (0,1]$ then B is a **NCID** of Y.

Proof. Suppose that B^M_δ is a NCID of Y for $\delta \in (0,1]$ and $t_1, t_2 \in$ Y. Then $\delta.\kappa_T(0) = (\kappa_T)^M_\delta(0) \geq (\kappa_T)^M_\delta(t_1) = \delta.\kappa_T(t_1)$, so $\kappa_T(0) \geq \kappa_T(t_1)$,$\delta.\kappa_I(0) = (\kappa_I)^M_\delta(0) \geq (\kappa_I)^M_\delta(t_1) = \delta.\kappa_I(t_1)$, so $\kappa_I(0) \geq \kappa_I(t_1)$, $\delta.\kappa_F(0) = (\kappa_F)^M_\delta(0) \geq (\kappa_F)^M_\delta(t_1) = \delta.\kappa_F(t_1)$, so $\kappa_F(0) \geq \kappa_F(t_1)$ and $\delta.\upsilon_T(0) = (\upsilon_T)^M_\delta(0) \leq (\upsilon_T)^M_\delta(t_1) = \delta.\upsilon_T(t_1)$, so $\upsilon_T(0) \leq \upsilon_T(t_1)$, $\delta.\upsilon_I(0) = (\upsilon_I)^M_\delta(0) \leq (\upsilon_I)^M_\delta(t_1) = \delta.\upsilon_I(t_1)$, so $\upsilon_I(0) \leq \upsilon_I(t_1)$, $\delta.\upsilon_F(0) = (\upsilon_F)^M_\delta(0) \leq (\upsilon_F)^M_\delta(t_1) = \delta.\upsilon_F(t_1)$, so $\upsilon_F(0) \leq \upsilon_F(t_1)$. Now

$\delta.\kappa_T(t_1) = (\kappa_T)^M_\delta(t_1)$

$\geq \mathrm{rmin}\{(\kappa_T)^M_\delta(t_1 * t_2), (\kappa_T)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_T(t_1 * t_2), \delta.\kappa_T(t_2)\}$

$\delta.\kappa_T(t_1) = \delta.\mathrm{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\}$,

$\delta.\kappa_I(t_1) = (\kappa_I)^M_\delta(t_1)$

$\geq \text{rmin}\{(\kappa_I)^M_\delta(t_1 * t_2), (\kappa_I)^M_\delta(t_2)\}$

$= \text{rmin}\{\delta.\kappa_I(t_1 * t_2), \delta.\kappa_I(t_2)\}$

$\delta.\kappa_I(t_1) = \delta.\text{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\},$

$\delta.\kappa_F(t_1) = (\kappa_F)^M_\delta(t_1)$

$\geq \text{rmin}\{(\kappa_F)^M_\delta(t_1 * t_2), (\kappa_F)^M_\delta(t_2)\}$

$= \text{rmin}\{\delta.\kappa_F(t_1 * t_2), \delta.\kappa_F(t_2)\}$

$\delta.\kappa_F(t_1) = \delta.\text{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\},$

so $\kappa_T(t_1) \geq \text{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\}, \kappa_I(t_1) \geq \text{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\}$ and $\kappa_F(t_1) \geq \text{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\}$ and also

$\delta.\upsilon_T(t_1) = (\upsilon_T)^M_\delta(t_1)$

$\leq \max\{(\upsilon_T)^M_\delta(t_1 * t_2), (\upsilon_T)^M_\delta(t_2)\}$

$= \max\{\delta.\upsilon_T(t_1 * t_2), \delta.\upsilon_T(t_2)\}$

$\delta.\upsilon_T(t_1) = \delta.\max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\},$

$\delta.\upsilon_I(t_1) = (\upsilon_I)^M_\delta(t_1)$

$\leq \max\{(\upsilon_I)^M_\delta(t_1 * t_2), (\upsilon_I)^M_\delta(t_2)\}$

$= \max\{\delta.\upsilon_I(t_1 * t_2), \delta.\upsilon_I(t_2)\}$

$\delta.\upsilon_I(t_1) = \delta.\max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\},$

$\delta.\upsilon_F(t_1) = (\upsilon_F)^M_\delta(t_1)$

$\leq \max\{(\upsilon_F)^M_\delta(t_1 * t_2), (\upsilon_F)^M_\delta(t_2)\}$

$= \max\{\delta.\upsilon_F(t_1 * t_2), \delta.\upsilon_F(t_2)\}$

$\delta.\upsilon_F(t_1) = \delta.\max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\},$

so $\upsilon_T(t_1) \leq \max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\}, \upsilon_I(t_1) \leq \max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\}$ and $\upsilon_F(t_1) \leq \max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\}$. Hence B is a **NCID** of Y.

Theorem 3.2.9 If B is a **NCID** of Y, then **NCM** B^M_δ of B is a **NCID** of Y, for all $\delta \in (0,1]$.

Proof. Let B be a **NCID** of Y and $\delta \in (0,1]$. Then we have $(\kappa_T)^M_\delta(0) = \delta.\kappa_T(0) \geq \delta.\kappa_T(t_1) \rightarrow (\kappa_T)^M_\delta(0) = (\kappa_T)^M_\delta(t_1)$, $(\kappa_I)^M_\delta(0) = \delta.\kappa_I(0) \geq \delta.\kappa_I(t_1) \rightarrow (\kappa_I)^M_\delta(0) = (\kappa_I)^M_\delta\ (\ t_1)$, $(\kappa_F)^M_\delta(0) = \delta.\kappa_F(0) \geq \delta.\kappa_F(t_1) \rightarrow (\kappa_F)^M_\delta(0) = (\kappa_F)^M_\delta(t_1)$ and $(\upsilon_T)^M_\delta(0) = \delta.\upsilon_T(0) \leq \delta.\upsilon_T(t_1) \rightarrow (\upsilon_T)^M_\delta(0) = (\upsilon_T)^M_\delta(t_1)$,

$(\upsilon_I)^M_\delta(0) = \delta.\upsilon_I(0) \leq \delta.\upsilon_I(t_1) \rightarrow (\upsilon_I)^M_\delta(0) = (\upsilon_I)^M_\delta(t_1)$, $(\upsilon_F)^M_\delta(0) = \delta.\upsilon_F(0) \leq \delta.\upsilon_F(t_1) \rightarrow (\upsilon_F)^M_\delta(0) = (\upsilon_F)^M_\delta(t_1)$.

Now

$$(\kappa_T)^M_\delta(t_1) = \delta.\kappa_T(t_1)$$
$$\geq \delta.\mathrm{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\}$$
$$= \mathrm{rmin}\{\delta.\kappa_T(t_1 * t_2), \delta.\kappa_T(t_2)\}$$
$$(\kappa_T)^M_\delta(t_1) = \mathrm{rmin}\{(\kappa_T)^M_\delta(t_1 * t_2), (\kappa_T)^M_\delta(t_2)\}$$
$$(\kappa_T)^M_\delta(t_1) \geq \mathrm{rmin}\{(\kappa_T)^M_\delta(t_1 * t_2), (\kappa_T)^M_\delta(t_2)\},$$

$$(\kappa_I)^M_\delta(t_1) = \delta.\kappa_I(t_1)$$
$$\geq \delta.\mathrm{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\}$$
$$= \mathrm{rmin}\{\delta.\kappa_I(t_1 * t_2), \delta.\kappa_I(t_2)\}$$
$$(\kappa_I)^M_\delta(t_1) = \mathrm{rmin}\{(\kappa_I)^M_\delta(t_1 * t_2), (\kappa_I)^M_\delta(t_2)\}$$
$$(\kappa_I)^M_\delta(t_1) \geq \mathrm{rmin}\{(\kappa_I)^M_\delta(t_1 * t_2), (\kappa_I)^M_\delta(t_2)\},$$

$$(\kappa_F)^M_\delta(t_1) = \delta.\kappa_F(t_1)$$
$$\geq \delta.\mathrm{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\}$$
$$= \mathrm{rmin}\{\delta.\kappa_F(t_1 * t_2), \delta.\kappa_F(t_2)\}$$
$$(\kappa_F)^M_\delta(t_1) = \mathrm{rmin}\{(\kappa_F)^M_\delta(t_1 * t_2), (\kappa_F)^M_\delta(t_2)\}$$
$$(\kappa_F)^M_\delta(t_1) \geq \mathrm{rmin}\{(\kappa_F)^M_\delta(t_1 * t_2), (\kappa_F)^M_\delta(t_2)\}$$

and

$$(\upsilon_T)^M_\delta(t_1) = \delta.\upsilon_T(t_1)$$
$$\leq \delta.\max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\}$$
$$= \max\{\delta.\upsilon_T(t_1 * t_2), \delta.\upsilon_T(t_2)\}$$
$$(\upsilon_T)^M_\delta(t_1) = \max\{(\upsilon_T)^M_\delta(t_1 * t_2), (\upsilon_T)^M_\delta(t_2)\}$$
$$(\upsilon_T)^M_\delta(t_1) \leq \max\{(\upsilon_T)^M_\delta(t_1 * t_2), (\upsilon_T)^M_\delta(t_2)\},$$

$$(\upsilon_I)^M_\delta(t_1) = \delta.\upsilon_I(t_1)$$
$$\leq \delta.\max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\}$$
$$= \max\{\delta.\upsilon_I(t_1 * t_2), \delta.\upsilon_I(t_2)\}$$
$$(\upsilon_I)^M_\delta(t_1) = \max\{(\upsilon_I)^M_\delta(t_1 * t_2), (\upsilon_I)^M_\delta(t_2)\}$$
$$(\upsilon_I)^M_\delta(t_1) \leq \max\{(\upsilon_I)^M_\delta(t_1 * t_2), (\upsilon_I)^M_\delta(t_2)\},$$

$(\upsilon_F)_\delta^M(t_1) = \delta.\upsilon_F(t_1)$

$\leq \delta.\max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\}$

$= \max\{\delta.\upsilon_F(t_1 * t_2), \delta.\upsilon_F(t_2)\}$

$(\upsilon_F)_\delta^M(t_1) = \max\{(\upsilon_F)_\delta^M(t_1 * t_2), (\upsilon_F)_\delta^M(t_2)\}$

$(\upsilon_F)_\delta^M(t_1) \leq \max\{(\upsilon_F)_\delta^M(t_1 * t_2), (\upsilon_F)_\delta^M(t_2)\}$.

Hence B_δ^M of B is a **NCID** of Y, for all $\delta \in (0,1]$.

Theorem 3.2.10 Let B be a **NCID** of Y and $\delta \in [0,1]$ then **NCM** B_δ^M of B is a **NCSU** of Y.

Proof. Suppose $t_1, t_2 \in Y$. Then

$(\kappa_T)_\delta^M(t_1 * t_2) = \delta.\kappa_T(t_1 * t_2)$

$\geq \delta.\mathrm{rmin}\{\kappa_T(t_2 * (t_1 * t_2)), \kappa_T(t_2)\}$

$= \delta.\mathrm{rmin}\{\kappa_T(0), \kappa_T(t_2)\}$

$\geq \delta.\mathrm{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_T(t_1), \delta.\kappa_T(t_2)\}$

$(\kappa_T)_\delta^M(t_1 * t_2) = \mathrm{rmin}\{(\kappa_T)_\delta^M(t_1), (\kappa_T)_\delta^M(t_2)\}$

$(\kappa_T)_\delta^M(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_T)_\delta^M(t_1), (\kappa_T)_\delta^M(t_2)\}$,

$(\kappa_I)_\delta^M(t_1 * t_2) = \delta.\kappa_I(t_1 * t_2)$

$\geq \delta.\mathrm{rmin}\{\kappa_I(t_2 * (t_1 * t_2)), \kappa_I(t_2)\}$

$= \delta.\mathrm{rmin}\{\kappa_I(0), \kappa_I(t_2)\}$

$\geq \delta.\mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_I(t_1), \delta.\kappa_I(t_2)\}$

$(\kappa_I)_\delta^M(t_1 * t_2) = \mathrm{rmin}\{(\kappa_I)_\delta^M(t_1), (\kappa_I)_\delta^M(t_2)\}$

$(\kappa_I)_\delta^M(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_I)_\delta^M(t_1), (\kappa_I)_\delta^M(t_2)\}$,

$(\kappa_F)_\delta^M(t_1 * t_2) = \delta.\kappa_F(t_1 * t_2)$

$\geq \delta.\mathrm{rmin}\{\kappa_F(t_2 * (t_1 * t_2)), \kappa_F(t_2)\}$

$= \delta.\mathrm{rmin}\{\kappa_F(0), \kappa_F(t_2)\}$

$\geq \delta.\mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_F(t_1), \delta.\kappa_F(t_2)\}$

$(\kappa_F)_\delta^M(t_1 * t_2) = \mathrm{rmin}\{(\kappa_F)_\delta^M(t_1), (\kappa_F)_\delta^M(t_2)\}$

$(\kappa_F)^M_\delta(t_1 * t_2) \geq \text{rmin}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_\delta(t_2)\}$

and

$(\upsilon_T)^M_\delta(t_1 * t_2) = \delta.\upsilon_T(t_1 * t_2)$

$\leq \delta.\max\{\upsilon_T(t_2 * (t_1 * t_2)), \upsilon_T(t_2)\}$

$= \delta.\max\{\upsilon_T(0), \upsilon_T(t_2)\}$

$\leq \delta.\max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$

$= \max\{\delta.\upsilon_T(t_1), \delta.\upsilon_T(t_2)\}$

$(\upsilon_T)^M_\delta(t_1 * t_2) = \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_\delta(t_2)\}$

$(\upsilon_T)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_\delta(t_2)\}$,

$(\upsilon_I)^M_\delta(t_1 * t_2) = \delta.\upsilon_I(t_1 * t_2)$

$\leq \delta.\max\{\upsilon_I(t_2 * (t_1 * t_2)), \upsilon_I(t_2)\}$

$= \delta.\max\{\upsilon_I(0), \upsilon_I(t_2)\}$

$\leq \delta.\max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$

$= \max\{\delta.\upsilon_I(t_1), \delta.\upsilon_I(t_2)\}$

$(\upsilon_I)^M_\delta(t_1 * t_2) = \max\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_\delta(t_2)\}$

$(\upsilon_I)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_\delta(t_2)\}$,

$(\upsilon_F)^M_\delta(t_1 * t_2) = \delta.\upsilon_F(t_1 * t_2)$

$\leq \delta.\max\{\upsilon_F(t_2 * (t_1 * t_2)), \upsilon_F(t_2)\}$

$= \delta.\max\{\upsilon_F(0), \upsilon_F(t_2)\}$

$\leq \delta.\max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$

$= \max\{\delta.\upsilon_F(t_1), \delta.\upsilon_F(t_2)\}$

$(\upsilon_F)^M_\delta(t_1 * t_2) = \max\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_\delta(t_2)\}$

$(\upsilon_F)^M_\delta(t_1 * t_2) \leq \max\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_\delta(t_2)\}$.

Hence B^M_δ is a **NCSU** of Y.

Theorem 3.2.11 If the **NCM** B^M_δ of B is a **NCID** of Y, for $\delta \in (0,1]$. Then B is a neutrosophic cubic BF-subalgebra of Y.

Proof. Assume B^M_δ of B is a **NCID** of Y. Then

$\delta.(\kappa_T)(t_1 * t_2) = (\kappa_T)^M_\delta(t_1 * t_2)$

$\geq \text{rmin}\{(\kappa_T)^M_\delta(t_2 * (t_1 * t_2)), (\kappa_T)^M_\delta(t_2)\}$

$= \text{rmin}\{(\kappa_T)^M_\delta(0), (\kappa_T)^M_\delta(t_2)\}$

$\geq \mathrm{rmin}\{(\kappa_T)^M_\delta(t_1), (\kappa_T)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_T(t_1), \delta.\kappa_T(t_2)\}$

$\delta.(\kappa_T)(t_1 * t_2) = \delta.\mathrm{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$

$\Rightarrow \kappa_T(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$,

$\delta.(\kappa_I)(t_1 * t_2) = (\kappa_I)^M_\delta(t_1 * t_2)$

$\geq \mathrm{rmin}\{(\kappa_I)^M_\delta(t_2 * (t_1 * t_2)), (\kappa_I)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{(\kappa_I)^M_\delta(0), (\kappa_I)^M_\delta(t_2)\}$

$\geq \mathrm{rmin}\{(\kappa_I)^M_\delta(t_1), (\kappa_I)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_I(t_1), \delta.\kappa_I(t_2)\}$

$\delta.(\kappa_I)(t_1 * t_2) = \delta.\mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$

$\Rightarrow \kappa_I(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$,

$\delta.(\kappa_F)(t_1 * t_2) = (\kappa_F)^M_\delta(t_1 * t_2)$

$\geq \mathrm{rmin}\{(\kappa_F)^M_\delta(t_2 * (t_1 * t_2)), (\kappa_F)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{(\kappa_F)^M_\delta(0), (\kappa_F)^M_\delta(t_2)\}$

$\geq \mathrm{rmin}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_\delta(t_2)\}$

$= \mathrm{rmin}\{\delta.\kappa_F(t_1), \delta.\kappa_F(t_2)\}$

$\delta.(\kappa_F)(t_1 * t_2) = \delta.\mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$

$\Rightarrow \kappa_F(t_1 * t_2) \geq \mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$

and

$\delta.(\upsilon_T)(t_1 * t_2) = (\upsilon_T)^M_\delta(t_1 * t_2)$

$\leq \max\{(\upsilon_T)^M_\delta(t_2 * (t_1 * t_2)), (\upsilon_T)^M_\delta(t_2)\}$

$= \max\{(\upsilon_T)^M_\delta(0), (\upsilon_T)^M_\delta(t_2)\}$

$\leq \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_\delta(t_2)\}$

$= \max\{\delta.\upsilon_T(t_1), \delta.\upsilon_T(t_2)\}$

$\delta.(\upsilon_T)(t_1 * t_2) = \delta.\max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$

$\Rightarrow \upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$,

$\delta.(\upsilon_I)(t_1 * t_2) = (\upsilon_I)^M_\delta(t_1 * t_2)$

$\leq \max\{(\upsilon_I)^M_\delta(t_2 * (t_1 * t_2)), (\upsilon_I)^M_\delta(t_2)\}$

$= \max\{(\upsilon_I)^M_\delta(0), (\upsilon_I)^M_\delta(t_2)\}$

$\leq \max\{(\upsilon_I)_\delta^M(t_1), (\upsilon_I)_\delta^M(t_2)\}$

$= \max\{\delta.\upsilon_I(t_1), \delta.\upsilon_I(t_2)\}$

$\delta.(\upsilon_I)(t_1 * t_2) = \delta.\max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$

$\Rightarrow \upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$,

$\delta.(\upsilon_F)(t_1 * t_2) = (\upsilon_F)_\delta^M(t_1 * t_2)$

$\leq \max\{(\upsilon_F)_\delta^M(t_2 * (t_1 * t_2)), (\upsilon_F)_\delta^M(t_2)\}$

$= \max\{(\upsilon_F)_\delta^M(0), (\upsilon_F)_\delta^M(t_2)\}$

$\leq \max\{(\upsilon_F)_\delta^M(t_1), (\upsilon_F)_\delta^M(t_2)\}$

$= \max\{\delta.\upsilon_F(t_1), \delta.\upsilon_F(t_2)\}$

$\delta.(\upsilon_F)(t_1 * t_2) = \delta.\max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$

$\Rightarrow \upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$.

Hence B is a **NCSU** of Y.

Theorem 3.2.12 Intersection of any two neutrosophic cubic multiplications of a **NCID** B of Y is a **NCID** of Y.

Proof. Suppose B_δ^M and $B_{\delta'}^M$ are neutrosophic cubic multiplications of **NCID** B of Y, where $\delta, \delta' \in (0,1]$ and $\delta \leq \delta'$, as we know that B_δ^M and $B_{\delta'}^M$ are **NCIDs** of Y. Then

$((\kappa_T)_\delta^M \cap (\kappa_T)_{\delta'}^M)(t_1) = \mathrm{rmin}\{(\kappa_T)_\delta^M(t_1), (\kappa_T)_{\delta'}^M(t_1)\}$

$= \mathrm{rmin}\{\kappa_T(t_1).\delta, \kappa_T(t_1).\delta'\}$

$= \kappa_T(t_1).\delta$

$((\kappa_T)_\delta^M \cap (\kappa_T)_{\delta'}^M)(t_1) = (\kappa_T)_\delta^M(t_1)$,

$((\kappa_I)_\delta^M \cap (\kappa_I)_{\delta'}^M)(t_1) = \mathrm{rmin}\{(\kappa_I)_\delta^M(t_1), (\kappa_I)_{\delta'}^M(t_1)\}$

$= \mathrm{rmin}\{\kappa_I(t_1).\delta, \kappa_I(t_1).\delta'\}$

$= \kappa_I(t_1).\delta$

$((\kappa_I)_\delta^M \cap (\kappa_I)_{\delta'}^M)(t_1) = (\kappa_I)_\delta^M(t_1)$,

$((\kappa_F)_\delta^M \cap (\kappa_F)_{\delta'}^M)(t_1) = \mathrm{rmin}\{(\kappa_F)_\delta^M(t_1), (\kappa_F)_{\delta'}^M(t_1)\}$

$= \mathrm{rmin}\{\kappa_F(t_1).\delta, \kappa_F(t_1).\delta'\}$

$= \kappa_F(t_1).\delta$

$((\kappa_F)_\delta^M \cap (\kappa_F)_{\delta'}^M)(t_1) = (\kappa_F)_\delta^M(t_1)$

and

$((\upsilon_T)^M_\delta \cap (\upsilon_T)^M_{\delta'})(t_1) = \max\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_{\delta'}(t_1)\}$

$= \max\{\upsilon_T(t_1).\delta, \upsilon_T(t_1).\delta'\}$

$= \upsilon_T(t_1).\delta'$

$((\upsilon_T)^M_\delta \cap (\upsilon_T)^M_{\delta'})(t_1) = (\upsilon_T)^M_{\delta'}(t_1),$

$((\upsilon_I)^M_\delta \cap (\upsilon_I)^M_{\delta'})(t_1) = \max\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_{\delta'}(t_1)\}$

$= \max\{\upsilon_I(t_1).\delta, \upsilon_I(t_1).\delta'\}$

$= \upsilon_I(t_1).\delta'$

$((\upsilon_I)^M_\delta \cap (\upsilon_I)^M_{\delta'})(t_1) = (\upsilon_I)^M_{\delta'}(t_1),$

$((\upsilon_F)^M_\delta \cap (\upsilon_F)^M_{\delta'})(t_1) = \max\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_{\delta'}(t_1)\}$

$= \max\{\upsilon_F(t_1).\delta, \upsilon_F(t_1).\delta'\}$

$= \upsilon_F(t_1).\delta'$

$((\upsilon_F)^M_\delta \cap (\upsilon_F)^M_{\delta'})(t_1) = (\upsilon_F)^M_{\delta'}(t_1).$

Hence $B^M_\delta \cap B^M_{\delta'}$ is **NCID** of Y.

Theorem 3.2.13 Union of any two neutrosophic cubic multiplications of a **NCID** B of Y is a **NCID** of Y.

Proof. Suppose B^M_δ and $B^M_{\delta'}$ are neutrosophic cubic multiplications of **NCID** B of Y, where $\delta, \delta' \in (0,1]$ and $\delta \le \delta'$, as we know that B^M_δ and $B^M_{\delta'}$ are **NCIDs** of Y. Then

$((\kappa_T)^M_\delta \cup (\kappa_T)^M_{\delta'})(t_1) = \mathrm{rmax}\{(\kappa_T)^M_\delta(t_1), (\kappa_T)^M_{\delta'}(t_1)\}$

$= \mathrm{rmax}\{\kappa_T(t_1).\delta, \kappa_T(t_1).\delta'\}$

$= \kappa_T(t_1).\delta'$

$((\kappa_T)^M_\delta \cup (\kappa_T)^M_{\delta'})(t_1) = (\kappa_T)^M_{\delta'}(t_1),$

$((\kappa_I)^M_\delta \cup (\kappa_I)^M_{\delta'})(t_1) = \mathrm{rmax}\{(\kappa_I)^M_\delta(t_1), (\kappa_I)^M_{\delta'}(t_1)\}$

$= \mathrm{rmax}\{\kappa_I(t_1).\delta, \kappa_I(t_1).\delta'\}$

$= \kappa_I(t_1).\delta'$

$((\kappa_I)^M_\delta \cup (\kappa_I)^M_{\delta'})(t_1) = (\kappa_I)^M_{\delta'}(t_1),$

$((\kappa_F)^M_\delta \cup (\kappa_F)^M_{\delta'})(t_1) = \mathrm{rmax}\{(\kappa_F)^M_\delta(t_1), (\kappa_F)^M_{\delta'}(t_1)\}$

$= \mathrm{rmax}\{\kappa_F(t_1).\delta, \kappa_F(t_1).\delta'\}$

$= \kappa_F(t_1).\delta'$

$((\kappa_F)^M_\delta \cup (\kappa_F)^M_{\delta'})(t_1) = (\kappa_F)^M_{\delta'}(t_1)$

and

$$((\upsilon_T)^M_\delta \cup (\upsilon_T)^M_{\delta'})(t_1) = \min\{(\upsilon_T)^M_\delta(t_1), (\upsilon_T)^M_{\delta'}(t_1)\}$$
$$= \min\{\upsilon_T(t_1).\delta, \upsilon_T(t_1).\delta'\}$$
$$= \upsilon_T(t_1).\delta$$
$$((\upsilon_T)^M_\delta \cup (\upsilon_T)^M_{\delta'})(t_1) = (\upsilon_T)^M_\delta(t_1),$$

$$((\upsilon_I)^M_\delta \cup (\upsilon_I)^M_{\delta'})(t_1) = \min\{(\upsilon_I)^M_\delta(t_1), (\upsilon_I)^M_{\delta'}(t_1)\}$$
$$= \min\{\upsilon_I(t_1).\delta, \upsilon_I(t_1).\delta'\}$$
$$= \upsilon_I(t_1).\delta$$
$$((\upsilon_I)^M_\delta \cup (\upsilon_I)^M_{\delta'})(t_1) = (\upsilon_I)^M_\delta(t_1),$$

$$((\upsilon_F)^M_\delta \cup (\upsilon_F)^M_{\delta'})(t_1) = \min\{(\upsilon_F)^M_\delta(t_1), (\upsilon_F)^M_{\delta'}(t_1)\}$$
$$= \min\{\upsilon_F(t_1).\delta, \upsilon_F(t_1).\delta'\}$$
$$= \upsilon_F(t_1).\delta$$
$$((\upsilon_F)^M_\delta \cup (\upsilon_F)^M_{\delta'})(t_1) = (\upsilon_F)^M_\delta(t_1).$$

Hence $B^M_\delta \cup B^M_{\delta'}$ is **NCID** of Y.

3.3 Magnified Translative Interpretation of Neutrosophic Cubic Subalgebra and Neutrosophic Cubic Ideal

In this section, we define the notion of neutrosophic cubic magnified translation **NCMT** and investigate some results.

Definition 3.3.1 Let $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ be a **NCS** of Y and for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], \daleth]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and for all $\delta \in [0,1]$. An object having the form $B^{M\,T}_{\delta\,\alpha,\beta,\gamma} = \{(\kappa_{T,I,F})^{M\,T}_{\delta\,\alpha,\beta,\gamma}, (\upsilon_{T,I,F})^{M\,T}_{\delta\,\alpha,\beta,\gamma}\}$ is said to be a **NCMT** of B, when $(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1) = \delta.\kappa_T(t_1) + \alpha$, $(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1) = \delta.\kappa_I(t_1) + \beta$, $(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1) = \delta.\kappa_F(t_1) - \gamma$ and $(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1) = \delta.\upsilon_T(t_1) + \alpha$, $(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1) = \delta.\upsilon_I(t_1) + \beta$, $(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1) = \delta.\upsilon_F(t_1) - \gamma$ for all $t_1 \in Y$.

Example 3.3.1 Let $Y = \{0,1,2\}$ be a BF-algebra as defined in Example 3.2.1. A **NCS** $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ of Y is defined as

$$\kappa_T(t_1) = \begin{cases} [0.1, 0.3] & \text{if } t_1 = 0 \\ [0.4, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_I(t_1) = \begin{cases} [0.2, 0.4] & \text{if } t_1 = 0 \\ [0.5, 0.7] & \text{if otherwise} \end{cases}$$

$$\kappa_F(t_1) = \begin{cases} [0.4, 0.6] & \text{if } t_1 = 0 \\ [0.5, 0.8] & \text{if otherwise} \end{cases}$$

and

$$\upsilon_T(t_1) = \begin{cases} 0.1 & \text{if } t_1 = 0 \\ 0.4 & \text{if otherwise} \end{cases}$$

$$\upsilon_I(t_1) = \begin{cases} 0.2 & \text{if } t_1 = 0 \\ 0.3 & \text{if otherwise} \end{cases}$$

$$\upsilon_F(t_1) = \begin{cases} 0.5 & \text{if } t_1 = 0 \\ 0.7 & \text{if otherwise.} \end{cases}$$

Then B is a neutrosophic cubic subalgebra, for $\upsilon_{T,I,F}$ choose $\delta = 0.1, \alpha = 0.02, \beta = 0.03, \gamma = 0.04$ and for $\kappa_{T,I,F}$ choose $\delta = [0.1,0.4], \alpha = [0.03,0.07], \beta = [0.04,0.08], \gamma = [0.02,0.06]$ then the mapping $B^{M\,T}_{(0.1)\,(\alpha,\beta,\gamma)}|Y \to [0,1]$ is given by

$$(\kappa_T)^{M}_{[0.1,0.4]\,[0.03,0.07]}(t_1) = \begin{cases} [0.04, 0.19] & \text{if } t_1 = 1 \\ [0.07, 0.35] & \text{if otherwise} \end{cases}$$

$$(\kappa_I)^{M\,T}_{[0.1,0.4]\,[0.04,0.08]}(t_1) = \begin{cases} [0.06, 0.24] & \text{if } t_1 = 1 \\ [0.09, 0.36] & \text{if otherwise} \end{cases}$$

$$(\kappa_F)^{M\,T}_{[0.1,0.4]\,[0.02,0.06]}(t_1) = \begin{cases} [0.02, 0.18] & \text{if } t_1 = 1 \\ [0.03, 0.26] & \text{if otherwise} \end{cases}$$

and

$$(\upsilon_T)^{M}_{0.1,0.02}(t_1) = \begin{cases} 0.03 & \text{if } t_1 = 1 \\ 0.06 & \text{if otherwise} \end{cases}$$

$$(\upsilon_I)^{M\,T}_{0.1,0.03}(t_1) = \begin{cases} 0.05 & \text{if } t_1 = 1 \\ 0.06 & \text{if otherwise} \end{cases}$$

$$(\upsilon_F)^{M\,T}_{0.1.0.04}(t_1) = \begin{cases} 0.01 & \text{if } t_1 = 1 \\ 0.03 & \text{if otherwise,} \end{cases}$$

which imply $(\kappa_T)^{M\,T}_{[0.1,0.4][0.03,0.07]}(t_1) = [0.1,0.4].\kappa_T(t_1) + [0.03,0.07]$, $(\kappa_I)^{M\,T}_{[0.1,0.4][0.04,0.08]}(t_1) = [0.1,0.4].\kappa_T(t_1) + [0.04,0.08]$, $(\kappa_F)^{M\,T}_{[0.1,0.4][0.02,0.06]}(t_1) = [0.1,0.4].\kappa_F(t_1) - [0.02,0.06]$ and $(\upsilon_T)^{M\,T}_{(0.1)(0.02)}(t_1) = (0.1).\upsilon_T(t_1) + 0.02$, $(\upsilon_I)^{M\,T}_{(0.1)(0.03)}(t_1) = (0.1).\upsilon_T(t_1) + 0.03$, $(\nu_F)^{M\,T}_{(0.1)\,(0.04)}(t_1) = (0.1).\nu_F(t_1) - 0.04$ for all $t_1 \in Y$. Hence $B^{M\,T}$ is a neutrosophic cubic magnified translation.

Theorem 3.3.1 Let B be a neutrosophic cubic subset of Y such that for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in [0,1]$ and a mapping $B^{M\,T,I,F}_{\delta\,\alpha,\beta,\gamma}|Y \to [0,1]$ be a **NCMT** of B. If B is **NCSU** of Y, then $B^{M\,T,I,F}_{\delta\,\alpha,\beta,\gamma}$ is a **NCSU** of Y.

Proof. Let B be a neutrosophic cubic subset of Y such that for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in [0,1]$ and a mapping $B^{M\,T,I,F}_{\delta\,\alpha,\beta,\gamma}|Y \to [0,1]$ be a **NCMT** of B. Suppose B is a **NCSU** of Y. Then $\kappa_T(t_1 * t_2) \geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}, \kappa_I(t_1 * t_2) \geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}, \kappa_F(t_1 * t_2) \geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$ and $\upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}, \upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}, \upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$. Now

$$(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) = \delta.\kappa_T(t_1 * t_2) + \alpha$$

$$\geq \delta.\text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\} + \alpha$$

$= \mathrm{rmin}\{\delta.\kappa_T(t_1) + \alpha, \delta.\kappa_T(t_2) + \alpha\}$

$(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) = \mathrm{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1), (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$

$(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1), (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_2)\},$

$(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) = \delta.\kappa_I(t_1 * t_2) + \beta$

$\geq \delta.\mathrm{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\} + \beta$

$= \mathrm{rmin}\{\delta.\kappa_I(t_1) + \beta, \delta.\kappa_I(t_2) + \beta\}$

$(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) = \mathrm{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1), (\kappa_I)^{M\,T}_{\delta\,\beta}(t_2)\}$

$(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1), (\kappa_I)^{M\,T}_{\delta\,\beta}(t_2)\},$

$(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) = \delta.\kappa_F(t_1 * t_2) - \gamma$

$\geq \delta.\mathrm{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\} - \gamma$

$= \mathrm{rmin}\{\delta.\kappa_F(t_1) - \gamma, \delta.\kappa_F(t_2) - \gamma\}$

$(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) = \mathrm{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1), (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$

$(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) \geq \mathrm{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1), (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$

and

$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) = \delta.\upsilon_T(t_1 * t_2) + \alpha$

$\leq \delta.\max\{\upsilon_T(t_1), \upsilon_T(t_2)\} + \alpha$

$= \max\{\delta.\upsilon_T(t_1) + \alpha, \delta.\upsilon_T(t_2) + \alpha\}$

$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) = \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1), (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$

$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2) \leq \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1), (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_2)\},$

$(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) = \delta.\upsilon_I(t_1 * t_2) + \beta$

$\leq \delta.\max\{\upsilon_I(t_1), \upsilon_I(t_2)\} + \beta$

$= \max\{\delta.\upsilon_I(t_1) + \beta, \delta.\upsilon_I(t_2) + \beta\}$

$(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) = \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1), (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_2)\}$

$(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2) \leq \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1), (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_2)\},$

$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) = \delta.\upsilon_F(t_1 * t_2) - \gamma$

$\leq \delta.\max\{\upsilon_F(t_1), \upsilon_F(t_2)\} - \gamma$

$= \max\{\delta.\upsilon_F(t_1) - \gamma, \delta.\upsilon_F(t_2) - \gamma\}$

$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) = \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$

$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2) \leq \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\}.$

Hence **NCMT** $B^{MT}_{\delta\,\alpha,\beta,\gamma}$ is a **NCSU** of Y.

Theorem 3.3.2 Let B be a **NCS** of Y such that and for $\kappa_{T,I,F}$, $\alpha,\beta \in [[0,0],7]$ and $\gamma \in [[0,0],¥]$, where for $\upsilon_{T,I,F}$, $\alpha,\beta \in [0,\Gamma]$ and $\gamma \in [0,£]$ and $\delta \in [0,1]$ and a mapping $B^{MT}_{\delta\,\alpha,\beta,\gamma}: Y \to [0,1]$ be a **NCMT** of B. If $B^{MT}_{\delta\,\alpha,\beta,\gamma}$ is **NCSU** of Y. Then B is a **NCSU** of Y.

Proof. Let B be a neutrosophic cubic subset of Y, where $\alpha,\beta,\gamma \in [0,¥]$, $\delta \in [0,1]$ and a mapping $B^{MT}_{\delta\,\alpha,\beta,\gamma}: Y \to [0,1]$ be a **NCMT** of B. Suppose $B^{MT}_{\delta\,\alpha,\beta,\gamma} = \{(\kappa_B)^{MT,I,F}_{\delta\,\alpha,\beta,\gamma}, (\upsilon_B)^{MT,I,F}_{\delta\,\alpha,\beta,\gamma}\}$ is a **NCSU** of Y, then

$$\delta.\kappa_T(t_1 * t_2) + \alpha = (\kappa_T)^{MT}_{\delta\,\alpha}(t_1 * t_2)$$

$$\geq \text{rmin}\{(\kappa_T)^{MT}_{\delta\,\alpha}(t_1), (\kappa_T)^{MT}_{\delta\,\alpha}(t_2)\}$$

$$= \text{rmin}\{\delta.\kappa_T(t_1) + \alpha, \delta.\kappa_T(t_2) + \alpha\}$$

$$\delta.\kappa_T(t_1 * t_2) + \alpha = \delta.\text{rmin}\{\kappa_T(t_2), \kappa_T(t_1)\} + \alpha,$$

$$\delta.\kappa_I(t_1 * t_2) + \beta = (\kappa_I)^{MT}_{\delta\,\beta}(t_1 * t_2)$$

$$\geq \text{rmin}\{(\kappa_I)^{MT}_{\delta\,\beta}(t_1), (\kappa_I)^{MT}_{\delta\,\beta}(t_2)\}$$

$$= \text{rmin}\{\delta.\kappa_I(t_1) + \beta, \delta.\kappa_I(t_2) + \beta\}$$

$$\delta.\kappa_I(t_1 * t_2) + \beta = \delta.\text{rmin}\{\kappa_I(t_2), \kappa_I(t_1)\} + \beta,$$

$$\delta.\kappa_F(t_1 * t_2) - \gamma = (\kappa_F)^{MT}_{\delta\,\gamma}(t_1 * t_2)$$

$$\geq \text{rmin}\{(\kappa_F)^{MT}_{\delta\,\gamma}(t_1), (\kappa_F)^{MT}_{\delta\,\gamma}(t_2)\}$$

$$= \text{rmin}\{\delta.\kappa_F(t_1) - \gamma, \delta.\kappa_F(t_2) - \gamma\}$$

$$\delta.\kappa_F(t_1 * t_2) - \gamma = \delta.\text{rmin}\{\kappa_F(t_2), \kappa_F(t_1)\} - \gamma,$$

and

$$\delta.\upsilon_T(t_1 * t_2) + \alpha = (\upsilon_T)^{MT}_{\delta\,\alpha}(t_1 * t_2)$$

$$\leq \max\{(\upsilon_T)^{MT}_{\delta\,\alpha}(t_1), (\upsilon_T)^{MT}_{\delta\,\alpha}(t_2)\}$$

$$= \max\{\delta.\upsilon_T(t_1) + \alpha, \delta.\upsilon_T(t_2) + \alpha\}$$

$$\delta.\upsilon_T(t_1 * t_2) + \alpha = \delta.\max\{\upsilon_T(t_2), \upsilon_T(t_1)\} + \alpha,$$

$$\delta.\upsilon_I(t_1 * t_2) + \beta = (\upsilon_I)^{MT}_{\delta\,\beta}(t_1 * t_2)$$

$$\leq \max\{(\upsilon_I)^{MT}_{\delta\,\beta}(t_1), (\upsilon_I)^{MT}_{\delta\,\beta}(t_2)\}$$

$$= \max\{\delta.\upsilon_I(t_1) + \beta, \delta.\upsilon_I(t_2) + \beta\}$$

$$\delta.\upsilon_I(t_1 * t_2) + \beta = \delta.\max\{\upsilon_I(t_2), \upsilon_I(t_1)\} + \beta,$$

$$\delta.\upsilon_F(t_1 * t_2) - \gamma = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2)$$
$$\leq \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$
$$= \max\{\delta.\upsilon_F(t_1) - \gamma, \delta.\upsilon_F(t_2) - \gamma\}$$
$$\delta.\upsilon_F(t_1 * t_2) - \gamma = \delta.\max\{\upsilon_F(t_2), \upsilon_F(t_1)\} - \gamma,$$

which imply $\kappa_T(t_1 * t_2) \geq \text{rmin}\{\kappa_T(t_1), \kappa_T(t_2)\}$, $\kappa_I(t_1 * t_2) \geq \text{rmin}\{\kappa_I(t_1), \kappa_I(t_2)\}$, $\kappa_F(t_1 * t_2) \geq \text{rmin}\{\kappa_F(t_1), \kappa_F(t_2)\}$ and $\upsilon_T(t_1 * t_2) \leq \max\{\upsilon_T(t_1), \upsilon_T(t_2)\}$,$\upsilon_I(t_1 * t_2) \leq \max\{\upsilon_I(t_1), \upsilon_I(t_2)\}$,$\upsilon_F(t_1 * t_2) \leq \max\{\upsilon_F(t_1), \upsilon_F(t_2)\}$ for all $t_1, t_2 \in Y$. Hence B is a **NCSU** of Y.

Theorem 3.3.3 If B is a **NCID** of Y. Then **NCMT** $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ of B is a **NCID** of Y for all $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ד]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in (0,1]$.

Proof. Suppose $B = (\kappa_{T,I,F}, \upsilon_{T,I,F})$ is a **NCID** of Y. Then

$$(\kappa_T)^{M\,T}_{\delta\,\alpha}(0) = \delta.\kappa_T(0) + \alpha$$
$$\geq \delta.\kappa_T(t_1) + \alpha$$
$$(\kappa_T)^{M\,T}_{\delta\,\alpha}(0) = (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1),$$

$$(\kappa_I)^{M\,T}_{\delta\,\beta}(0) = \delta.\kappa_I(0) + \beta$$
$$\geq \delta.\kappa_I(t_1) + \beta$$
$$(\kappa_I)^{M\,T}_{\delta\,\beta}(0) = (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1),$$

$$(\kappa_F)^{M\,T}_{\delta\,\gamma}(0) = \delta.\kappa_F(0) - \gamma$$
$$\geq \delta.\kappa_F(t_1) - \gamma$$
$$(\kappa_F)^{M\,T}_{\delta\,\gamma}(0) = (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1)$$

and

$$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(0) = \delta.\upsilon_T(0) + \alpha$$
$$\leq \delta.\upsilon_T(t_1) + \alpha$$
$$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(0) = (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1),$$

$$(\upsilon_I)^{M\,T}_{\delta\,\beta}(0) = \delta.\upsilon_I(0) + \beta$$
$$\leq \delta.\upsilon_I(t_1) + \beta$$
$$(\upsilon_I)^{M\,T}_{\delta\,\beta}(0) = (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1),$$

$$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(0) = \delta.\upsilon_F(0) - \gamma$$
$$\leq \delta.\upsilon_F(t_1) - \gamma$$
$$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(0) = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1)$$

Now

$$(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1) = \delta.\kappa_T(t_1) + \alpha$$

$$\geq \delta.\,\mathrm{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\} + \alpha$$

$$= \mathrm{rmin}\{\delta.\kappa_T(t_1 * t_2) + \alpha, \delta.\kappa_T(t_2) + \alpha\}$$

$$(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1) = \mathrm{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$$

$$\Rightarrow (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1) \geq \mathrm{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_2)\},$$

$$(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1) = \delta.\kappa_I(t_1) + \beta$$

$$\geq \delta.\,\mathrm{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\} + \beta$$

$$= \mathrm{rmin}\{\delta.\kappa_I(t_1 * t_2) + \beta, \delta.\kappa_I(t_2) + \beta\}$$

$$(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1) = \mathrm{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\kappa_I)^{M\,T}_{\delta\,\beta}(t_2)\}$$

$$\Rightarrow (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1) \geq \mathrm{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\kappa_I)^{M\,T}_{\delta\,\beta}(t_2)\},$$

$$(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1) = \delta.\kappa_F(t_1) - \gamma$$

$$\geq \delta.\,\mathrm{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\} - \gamma$$

$$= \mathrm{rmin}\{\delta.\kappa_F(t_1 * t_2) - \gamma, \delta.\kappa_F(t_2) - \gamma\}$$

$$(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1) = \mathrm{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$

$$\Rightarrow (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1) \geq \mathrm{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$

and

$$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1) = \delta.\upsilon_T(t_1) + \alpha$$

$$\leq \delta.\max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\} + \alpha$$

$$= \max\{\delta.\upsilon_T(t_1 * t_2) + \alpha, \delta.\upsilon_T(t_2) + \alpha\}$$

$$(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1) = \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$$

$$\Rightarrow (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1) \leq \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_2)\},$$

$$(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1) = \delta.\upsilon_I(t_1) + \beta$$

$$\leq \delta.\max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\} + \beta$$

$$= \max\{\delta.\upsilon_I(t_1 * t_2) + \beta, \delta.\upsilon_I(t_2) + \beta\}$$

$$(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1) = \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_2)\}$$

$$\Rightarrow (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1) \le \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_2)\},$$

$$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1) = \delta.\upsilon_F(t_1) - \gamma$$

$$\le \delta.\max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\} - \gamma$$

$$= \max\{\delta.\upsilon_F(t_1 * t_2) - \gamma, \delta.\upsilon_F(t_2) - \gamma\}$$

$$(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1) = \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$

$$\Rightarrow (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1) \le \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\},$$

for all $t_1, t_2 \in Y$ and all for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in (0,1]$. Hence $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ of B is a **NCID** of Y.

Theorem 3.3.3 If B is a neutrosophic cubic set of Y such that **NCMT** $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ of B is a **NCID** of Y for all for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in (0,1]$, then B is a **NCID** of Y.

Proof. Suppose **NCMT** $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ is a **NCID** of Y for some $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$ and $\gamma \in [[0,0], ¥]$, where for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$ and $\gamma \in [0, £]$ and $\delta \in (0,1]$ and $t_1, t_2 \in Y$. Then

$$\delta.\kappa_T(0) + \alpha = (\kappa_T)^{M\,T}_{\delta\,\alpha}(0)$$

$$\ge (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1)$$

$$\delta.\kappa_T(0) + \alpha = \delta.\kappa_T(t_1) + \alpha,$$

$$\delta.\kappa_I(0) + \beta = (\kappa_I)^{M\,T}_{\delta\,\beta}(0)$$

$$\ge (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1)$$

$$\delta.\kappa_I(0) + \beta = \delta.\kappa_I(t_1) + \beta,$$

$$\delta.\kappa_F(0) - \gamma = (\kappa_F)^{M\,T}_{\delta\,\gamma}(0)$$

$$\ge (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1)$$

$$\delta.\kappa_F(0) - \gamma = \delta.\kappa_F(t_1) - \gamma,$$

and

$$\delta.\upsilon_T(0) + \alpha = (\upsilon_T)^{M\,T}_{\delta\,\alpha}(0)$$

$$\le (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1)$$

$$\delta.\upsilon_T(0) + \alpha = \delta.\upsilon_T(t_1) + \alpha,$$

$$\delta.\upsilon_I(0) + \beta = (\upsilon_I)^{M\,T}_{\delta\,\beta}(0)$$

$$\le (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1)$$

$$\delta.\upsilon_I(0) + \beta = \delta.\upsilon_I(t_1) + \beta,$$

$$\delta.\upsilon_F(0) - \gamma = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(0)$$
$$\leq (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1)$$
$$\delta.\upsilon_F(0) - \gamma = \delta.\upsilon_F(t_1) - \gamma,$$

which imply $\kappa_T(0) \geq \kappa_T(t_1)$, $\kappa_I(0) \geq \kappa_I(t_1)$, $\kappa_F(0) \geq \kappa_F(t_1)$ and $\upsilon_T(0) \leq \upsilon_T(t_1)$, $\upsilon_I(0) \leq \upsilon_I(t_1)$, $\upsilon_F(0) \leq \upsilon_F(t_1)$. Now, we have

$$\delta.\kappa_T(t_1) + \alpha = (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1)$$
$$\geq \text{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$$
$$= \text{rmin}\{\delta.\kappa_T(t_1 * t_2) + \alpha, \delta.\kappa_T(t_2) + \alpha\}$$
$$\delta.\kappa_T(t_1) + \alpha = \delta.\text{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\} + \alpha,$$

$$\delta.\kappa_I(t_1) + \beta = (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1)$$
$$\geq \text{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\kappa_I)^{M\,T}_{\delta\,\beta}(t_2)\}$$
$$= \text{rmin}\{\delta.\kappa_I(t_1 * t_2) + \beta, \delta.\kappa_I(t_2) + \beta\}$$
$$\delta.\kappa_I(t_1) + \beta = \delta.\text{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\} + \beta,$$

$$\delta.\kappa_F(t_1) - \gamma = (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1)$$
$$\geq \text{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\kappa_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$
$$= \text{rmin}\{\delta.\kappa_F(t_1 * t_2) - \gamma, \delta.\kappa_F(t_2) - \gamma\}$$
$$\delta.\kappa_F(t_1) - \gamma = \delta.\text{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\} - \gamma$$

and

$$\delta.\upsilon_T(t_1) + \alpha = (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1)$$
$$\leq \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1 * t_2), (\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_2)\}$$
$$= \max\{\delta.\upsilon_T(t_1 * t_2) + \alpha, \delta.\upsilon_T(t_2) + \alpha\}$$
$$\delta.\upsilon_T(t_1) + \alpha = \delta.\max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\} + \alpha,$$

$$\delta.\upsilon_I(t_1) + \beta = (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1)$$
$$\leq \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1 * t_2), (\upsilon_I)^{M\,T}_{\delta\,\beta}(t_2)\}$$
$$= \max\{\delta.\upsilon_I(t_1 * t_2) + \beta, \delta.\upsilon_I(t_2) + \beta\}$$
$$\delta.\upsilon_I(t_1) + \beta = \delta.\max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\} + \beta,$$

$$\delta.\upsilon_F(t_1) - \gamma = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1)$$
$$\leq \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1 * t_2), (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_2)\}$$
$$= \max\{\delta.\upsilon_F(t_1 * t_2) - \gamma, \delta.\upsilon_F(t_2) - \gamma\}$$

$$\delta.\upsilon_F(t_1) - \gamma = \delta.\max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\} - \gamma$$

which imply $\kappa_T(t_1) \geq \text{rmin}\{\kappa_T(t_1 * t_2), \kappa_T(t_2)\}$, $\kappa_I(t_1) \geq \text{rmin}\{\kappa_I(t_1 * t_2), \kappa_I(t_2)\}$, $\kappa_F(t_1) \geq \text{rmin}\{\kappa_F(t_1 * t_2), \kappa_F(t_2)\}$ and $\upsilon_T(t_1) \leq \max\{\upsilon_T(t_1 * t_2), \upsilon_T(t_2)\}$,$\upsilon_I(t_1) \leq \max\{\upsilon_I(t_1 * t_2), \upsilon_I(t_2)\}$,$\upsilon_F(t_1) \leq \max\{\upsilon_F(t_1 * t_2), \upsilon_F(t_2)\}$ for all $t_1, t_2 \in Y$. Hence B is a **NCID** of Y.

Theorem 3.3.4 Intersection of any two **NCMT** of a **NCID** B of Y is a **NCID** of Y.

Proof. Suppose $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ and $B^{M\,T}_{\delta'\alpha',\beta',\gamma'}$ are two **NCMTs** of **NCID** B ofY, where for $B^{M\,T}_{\alpha,\beta,\gamma}$, for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$, $\gamma \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$, $\gamma \in [0, £]$ and for $B^{T}_{\alpha',\beta',\gamma'}$, for $\kappa_{T,I,F}$ $\alpha', \beta' \in [[0,0], ℸ]$, $\gamma' \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha', \beta' \in [0, \Gamma]$, $\gamma' \in [0, £]$. Assume $\alpha \leq \alpha', \beta \leq \beta', \gamma \leq \gamma'$ and $\delta = \delta'$. Then by Theorem 3.3.3, $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ and $B^{M\,T}_{\delta'\,\alpha',\beta',\gamma'}$ are **NCIDs** of Y. So

$$((\kappa_T)^{M\,T}_{\delta\,\alpha} \cap (\kappa_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = \text{rmin}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1), (\kappa_T)^{M\,T}_{\delta'\,\alpha'}(t_1)\}$$
$$= \text{rmin}\{\delta.\kappa_T(t_1) + \alpha, \delta'.\kappa_T(t_1) + \alpha'\}$$
$$= \delta.\kappa_T(t_1) + \alpha$$
$$((\kappa_T)^{M\,T}_{\delta\,\alpha} \cap (\kappa_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1),$$

$$((\kappa_I)^{M\,T}_{\delta\,\beta} \cap (\kappa_I)^{M\,T}_{\delta'\,\beta'})(t_1) = \text{rmin}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1), (\kappa_I)^{M\,T}_{\delta'\,\beta'}(t_1)\}$$
$$= \text{rmin}\{\delta.\kappa_I(t_1) + \beta, \delta'.\kappa_I(t_1) + \beta'\}$$
$$= \delta.\kappa_I(t_1) + \beta$$
$$((\kappa_I)^{M\,T}_{\delta\,\beta} \cap (\kappa_I)^{M\,T}_{\delta'\,\beta'})(t_1) = (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1),$$

$$((\kappa_F)^{M\,T}_{\delta\,\gamma} \cap (\kappa_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = \text{rmin}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1), (\kappa_F)^{M\,T}_{\delta'\,\gamma'}(t_1)\}$$
$$= \text{rmin}\{\delta.\kappa_F(t_1) - \gamma, \delta'.\kappa_F(t_1) - \gamma'\}$$
$$= \delta'.\kappa_F(t_1) - \gamma'$$
$$((\kappa_F)^{M\,T}_{\delta\,\gamma} \cap (\kappa_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = (\kappa_F)^{M\,T}_{,\delta'\,\gamma'}(t_1)$$

and

$$((\upsilon_T)^{M\,T}_{\delta\,\alpha} \cap (\upsilon_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = \max\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1), (\upsilon_T)^{M\,T}_{\delta'\,\alpha'}(t_1)\}$$
$$= \max\{\delta.\upsilon_T(t_1) + \alpha, \delta'.\upsilon_T(t_1) + \alpha'\}$$
$$= \delta'.\upsilon_T(t_1) + \alpha'$$
$$((\upsilon_T)^{M\,T}_{\delta\,\alpha} \cap (\upsilon_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = (\upsilon_T)^{M\,T}_{\delta'\alpha'}(t_1),$$

$$((\upsilon_I)^{M\,T}_{\delta\,\beta} \cap (\upsilon_I)^{M\,T}_{\delta'\,\beta'})(t_1) = \max\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1), (\upsilon_I)^{M\,T}_{\delta'\,\beta'}(t_1)\}$$
$$= \max\{\delta.\upsilon_I(t_1) + \beta, \delta'.\upsilon_I(t_1) + \beta'\}$$
$$= \delta'.\upsilon_I(t_1) + \beta'$$
$$((\upsilon_I)^{M\,T}_{\delta\,\beta} \cap (\upsilon_I)^{M\,T}_{\delta'\beta'})(t_1) = (\upsilon_I)^{M\,T}_{\delta'\,\beta'}(t_1),$$

$$((\upsilon_F)^{M\,T}_{\delta\,\gamma} \cap (\upsilon_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = \max\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1), (\upsilon_F)^{M\,T}_{\delta'\,\gamma'}(t_1)\}$$
$$= \max\{\delta.\upsilon_F(t_1) - \gamma, \delta'.\upsilon_F(t_1) - \gamma'\}$$
$$= \delta.\upsilon_F(t_1) - \gamma$$
$$((\upsilon_F)^{M\,T}_{\delta\,\gamma} \cap (\upsilon_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1).$$

Hence $B^{M\,T}_{\delta\,\alpha,\beta,\gamma} \cap B^{M\,T}_{\delta'\alpha',\beta',\gamma'}$ is **NCID** of Y.

Theorem 3.3.5 Union of any two **NCMT** $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ of a **NCID** B of Y is a **NCID** of Y.

Proof. Suppose $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ and $B^{M\,T}_{\delta'\alpha',\beta',\gamma'}$ are two NCMTs of NCID B of Y , where for $B^{M\,T}_{\alpha,\beta,\gamma}$, for $\kappa_{T,I,F}$, $\alpha, \beta \in [[0,0], ℸ]$, $\gamma \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha, \beta \in [0, \Gamma]$, $\gamma \in [0, £]$ and for $B^{T}_{\alpha',\beta',\gamma'}$, for $\kappa_{T,I,F}$ $\alpha', \beta' \in [[0,0], ℸ]$, $\gamma' \in [[0,0], ¥]$, for $\upsilon_{T,I,F}$, $\alpha', \beta' \in [0, \Gamma]$, $\gamma' \in [0, £]$. Assume $\alpha \geq \alpha', \beta \geq \beta', \gamma \geq \gamma'$ and $\delta = \delta'$. Then by Theorem 3.3.3, $B^{M\,T}_{\delta\,\alpha,\beta,\gamma}$ and $B^{M\,T}_{\delta'\,\alpha',\beta',\gamma'}$ are NCIDs of Y. So

$$((\kappa_T)^{M\,T}_{\delta\,\alpha} \cup (\kappa_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = \text{rmax}\{(\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1), (\kappa_T)^{M\,T}_{\delta'\alpha'}(t_1)\}$$
$$= \text{rmax}\{\delta.\kappa_T(t_1) + \alpha, \delta'.\kappa_T(t_1) + \alpha'\}$$
$$= \delta.\kappa_T(t_1) + \alpha$$
$$((\kappa_T)^{M\,T}_{\delta\,\alpha} \cup (\kappa_T)^{M\,T}_{\delta'\alpha'})(t_1) = (\kappa_T)^{M\,T}_{\delta\,\alpha}(t_1),$$

$$((\kappa_I)^{M\,T}_{\delta\,\beta} \cup (\kappa_I)^{M\,T}_{\delta'\beta'})(t_1) = \text{rmax}\{(\kappa_I)^{M\,T}_{\delta\,\beta}(t_1), (\kappa_I)^{M\,T}_{\delta'\beta'}(t_1)\}$$
$$= \text{rmax}\{\delta.\kappa_I(t_1) + \beta, \delta'.\kappa_I(t_1) + \beta'\}$$
$$= \delta.\kappa_I(t_1) + \beta$$
$$((\kappa_I)^{M\,T}_{\delta\,\beta} \cup (\kappa_I)^{M\,T}_{\delta'\,\beta'})(t_1) = (\kappa_I)^{M\,T}_{\delta\,\beta}(t_1),$$

$$((\kappa_F)^{M\,T}_{\delta\,\gamma} \cup (\kappa_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = \text{rmax}\{(\kappa_F)^{M\,T}_{\delta\,\gamma}(t_1), (\kappa_F)^{M\,T}_{\delta'\,\gamma'}(t_1)\}$$
$$= \text{rmax}\{\delta.\kappa_F(t_1) - \gamma, \delta'.\kappa_F(t_1) - \gamma'\}$$
$$= \delta'.\kappa_F(t_1) - \gamma'\}$$
$$((\kappa_F)^{M\,T}_{\delta\,\gamma} \cup (\kappa_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = (\kappa_F)^{M\,T}_{\delta'\,\gamma'}(t_1)$$

and

$$((\upsilon_T)^{M\,T}_{\delta\,\alpha} \cup (\upsilon_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = \min\{(\upsilon_T)^{M\,T}_{\delta\,\alpha}(t_1), (\upsilon_T)^{M\,T}_{\delta'\,\alpha'}(t_1)\}$$
$$= \min\{\delta.\upsilon_T(t_1) + \alpha, \delta'.\upsilon_T(t_1) + \alpha'\}$$
$$= \delta'.\upsilon_T(t_1) + \alpha'$$
$$((\upsilon_T)^{M\,T}_{\delta\,\alpha} \cup (\upsilon_T)^{M\,T}_{\delta'\,\alpha'})(t_1) = (\upsilon_T)^{M\,T}_{\delta'\alpha'}(t_1),$$

$$((\upsilon_I)^{M\,T}_{\delta\,\beta} \cup (\upsilon_I)^{M\,T}_{\delta'\,\beta'})(t_1) = \min\{(\upsilon_I)^{M\,T}_{\delta\,\beta}(t_1), (\upsilon_I)^{M\,T}_{\delta'\,\beta'}(t_1)\}$$
$$= \min\{\delta.\upsilon_I(t_1) + \beta, \delta'.\upsilon_I(t_1) + \beta'\}$$
$$= \delta'.\upsilon_I(t_1) + \beta'$$

$$((\upsilon_I)^{M\,T}_{\delta\,\beta} \cup (\upsilon_I)^{M\,T}_{\delta'\,\beta'})(t_1) = (\upsilon_I)^{M\,T}_{\delta'\beta'}(t_1),$$

$$((\upsilon_F)^{M\,T}_{\delta\,\gamma} \cup (\upsilon_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = \min\{(\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1), (\upsilon_F)^{M\,T}_{\delta'\,\gamma'}(t_1)\}$$
$$= \min\{\delta.\upsilon_F(t_1) - \gamma, \delta'.\upsilon_F(t_1) - \gamma'\}$$
$$= \delta.\upsilon_F(t_1) - \gamma$$
$$((\upsilon_F)^{M\,T}_{\delta\,\gamma} \cup (\upsilon_F)^{M\,T}_{\delta'\,\gamma'})(t_1) = (\upsilon_F)^{M\,T}_{\delta\,\gamma}(t_1).$$

Hence $B^{M\,T}_{\delta\,\alpha,\beta,\gamma} \cup B^{M\,T}_{\delta'\,\alpha',\beta',\gamma'}$ is **NCID** of Y.

4. Conclusion

In this paper, we defined neutrosophic cubic translation,, neutrosophic cubic multiplication and neutrosophic cubic magnified translation for neutrosophic cubic set on BF-algebra. We provided the new sort of different conditions for neutrosophic cubic translation, neutrosophic cubic multiplication and neutrosophic cubic magnified translation and proved with examples. Moreover, for better understanding we investigated many results for NCT, NCM and NCMT using the subalgebra and ideals. For future work, translation and multiplication can be applied on neutrosophic cubic soft set and T-neutrosophic cubic set.

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