

On Neutrosophic Z-algebras

Abstract

This study presents the notion of neutrosophic Z-algebra and neutrosophic pseudo Z-algebra explores some of its properties. Also studied are the neutrosophic Z-ideal, neutrosophic Z-sub algebra, and neutrosophic Z-filter. Several properties are discovered, and some findings from the study of homomorphism are discussed.

Keywords: neutrosophic Z-algebra , neutrosophic pseudo Z-algebra neutrosophic Z-sub algebra ,neutrosophic Z-ideal, ,neutrosophic Z-filter

1.Introduction:

Smrandche established the area of philosophy known as neutrosophy, which has a many implementations in the real world and in mathematics, particularly in algebra [1].also gave more information about neutrosophy see[2,3]. making use of neutrosophic theory Kandasamy and Smrandche [4] in 2004 suggested a set-based algebraic structure of neutrosophic numbers of the type $\mathcal{N} = \mathcal{Z} + \dagger\mathcal{J}$ that they dubbed \mathcal{J} -Neutrosophic Algebraic Structure. ,where $\mathcal{Z}, \dagger \in \mathbb{R}$ or \mathbb{C} , and \mathcal{J} which means indetermined or uncertain thus that $\mathcal{J}^2 = \mathcal{J}$,is referred to as literal indeterminacy, here \mathcal{Z} is referred to as the \mathcal{N} 's determinate portion, and $\dagger\mathcal{J}$ is referred to as its indeterminate portion on \mathcal{N} , with $g\mathcal{J} + h\mathcal{J} = (g + h)\mathcal{J}$, $0.\mathcal{J} = 0$. Where \mathcal{J} is separate from the imaginary $i^2 = -1$, where $\mathcal{J}^j = \mathcal{J}$ if $j > 0$, and is unknown for $j \leq 0$. In 2006, the idea of neutrosophic algebraic structures was also proposed [5].

In [6,7, 8 ,9], the idea of neutrosophic BCI/BCK –algebras, neutrosophic KU-algebras and neutrosophic B-algebras was presented.

Z-algebra is an unique algebraic structure based on logic that was first proposed in 2017 by Chandramouleeswaran et al. [10].

[11] and [12] They provided characteristics and further explanation of Z-algebra.

In this article, we explain the idea of neutrosophic Z-algebra, look at various relevant characteristics, examine a neutrosophic Z-homomorphism, and present some findings.

2. preliminaries:

Definition2.1: [1] A neutronsophic set $\mathcal{X}(\mathcal{J}) = \langle \mathcal{X}, \mathcal{J} \rangle = \{ \mathcal{Z} + \dagger\mathcal{J} : \mathcal{Z}, \dagger \in \mathcal{X} \}$, where

$\mathcal{X} \neq \phi$ and \mathcal{J} an indeterminate .

Definition2.2: [10] let $\mathcal{Z} \neq \phi$ and $*$ is a binary operation with constant 0 then the algebra $(\mathcal{Z}, *, 0)$ named Z-Algebra if satisfying the following axiom:

$$\mathcal{Z}_1: \mathcal{Z} * 0 = 0$$

$$\mathcal{Z}_2: 0 * \mathcal{Z} = \mathcal{Z}$$

$$\mathcal{Z}_3: \mathcal{Z} * \mathcal{Z} = \mathcal{Z}$$

$$\mathcal{Z}_4: \mathcal{Z} * \uparrow = \uparrow * \mathcal{Z} \text{ When } \mathcal{Z} \neq 0 \text{ and } \uparrow \neq 0, \forall \mathcal{Z}, \uparrow \in \mathcal{Z} .$$

Definition2.3: [10] Let $\delta \neq \phi$ and $\delta \subseteq \mathcal{Z}$ where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, δ is named Z-subalgebra if $\mathcal{Z} * \uparrow \in \delta, \forall \mathcal{Z}, \uparrow \in \delta$.

Definition2.4: [10] Let $\mathcal{J} \neq \phi$ and $\mathcal{J} \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, \mathcal{J} is named Z-ideal of \mathcal{Z} if satisfy (1) $0 \in \mathcal{J}$ (2) $\mathcal{Z} * \uparrow \in \mathcal{J}$, and $\uparrow \in \mathcal{J} \Rightarrow \mathcal{Z} \in \mathcal{J}$.

Definition2.5: [11] Let $\mathcal{J} \neq \phi$ and $\mathcal{J} \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, \mathcal{J} is named \mathcal{Z}_1 – ideal of \mathcal{Z} if satisfy

$$(1) 0 \in \mathcal{J} \quad (2) ((\mathcal{Z} * \lambda) * \mathcal{Z}) * \uparrow \in \mathcal{J}, \text{ and } \uparrow \in \mathcal{J} \Rightarrow \mathcal{Z} \in \mathcal{J}, \forall \mathcal{Z}, \uparrow, \lambda \in \mathcal{Z} .$$

Definition2.6: [11] Let $\mathcal{J} \neq \phi$ and $\mathcal{J} \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, \mathcal{J} is named \mathcal{Z}_2 –ideal of \mathcal{Z} if satisfy

$$(1) 0 \in \mathcal{J} \quad (2) (\mathcal{Z} * \lambda) * (\mathcal{Z} * \uparrow) \in \mathcal{J}, \text{ and } \uparrow \in \mathcal{J} \Rightarrow \mathcal{Z} \in \mathcal{J}, \forall \mathcal{Z}, \uparrow, \lambda \in \mathcal{Z}$$

Definition2.7: [12] Let $\mathcal{J} \neq \phi$ and $\mathcal{J} \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, \mathcal{J} is named \mathcal{Z}_p –ideal of \mathcal{Z} if satisfy

$$(1) 0 \in \mathcal{J} \quad (2) (\mathcal{Z} * \lambda) * (\uparrow * \lambda) \in \mathcal{J}, \text{ and } \uparrow \in \mathcal{J} \Rightarrow \mathcal{Z} \in \mathcal{J}, \forall \mathcal{Z}, \uparrow, \lambda \in \mathcal{Z} .$$

Definition2.8:[10] let $\mathcal{F} \neq \phi$ and $\mathcal{F} \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, 0)$ is a Z-Algebra, \mathcal{F} is named Z-filter of \mathcal{Z} if $\mathcal{Z}\mathcal{X}\uparrow = \mathcal{Z} * (\mathcal{Z} * \uparrow) \in \mathcal{F}, \forall \mathcal{Z}, \uparrow \in \mathcal{F}, (\mathcal{Z} \neq \uparrow)$.

Example2.9: let $\mathcal{Z} = \{0, \mathcal{Z}, \uparrow, \lambda\}$ be set and $*$ is a binary operation defined on \mathcal{Z} by the table:

*	0	\mathcal{Z}	\uparrow	λ
0	0	\mathcal{Z}	\uparrow	λ
\mathcal{Z}	0	\mathcal{Z}	\uparrow	\uparrow
\uparrow	0	\uparrow	\uparrow	\uparrow
λ	0	\uparrow	\uparrow	λ

Then $(\mathcal{Z}, *, 0)$ is \mathcal{Z} -Algebra . $\delta = \{\mathcal{Z}, \uparrow, \Downarrow\}$ is \mathcal{Z} -subalgebra and $\mathcal{J} = \{0, \mathcal{Z}, \uparrow\}$ is a \mathcal{Z}_1 - ideal, $\mathcal{J}^\$ = \{0, \mathcal{Z}, \Downarrow\}$ is a $(\mathcal{Z}_2$ -ideal, \mathcal{Z}_p -ideal) \mathcal{Z} -ideal .and $\mathcal{F} = \{\mathcal{Z}, \uparrow\}$ is \mathcal{Z} -filter .

Note : every $(\mathcal{Z}_1$ - ideal, \mathcal{Z}_2 -ideal) is an ideal of \mathcal{Z} .

Definition2.10: [11] Let $\mathcal{Z} \neq \phi$ with two binary operations $*, \odot$ and constant 0 then the algebra $(\mathcal{Z}, *, \odot, 0)$ named pseudo \mathcal{Z} -Algebra (briefly, PZ) if satisfying the following axiom:

$$PZ_1: \mathcal{Z} * 0 = \mathcal{Z} \odot 0 = 0$$

$$PZ_2: 0 * \mathcal{Z} = 0 \odot \mathcal{Z} = \mathcal{Z}$$

$$PZ_3: \mathcal{Z} * \mathcal{Z} = \mathcal{Z} \odot \mathcal{Z} = \mathcal{Z}$$

$$PZ_4: \mathcal{Z} * \uparrow = \uparrow \odot \mathcal{Z} \text{ When } \mathcal{Z} \neq 0 \text{ and } \uparrow \neq 0, \forall \mathcal{Z}, \uparrow \in \mathcal{Z} .$$

Definition2.11: [11] Let $\delta \neq \phi$ and $\delta \subseteq \mathcal{Z}$, where $(\mathcal{Z}, *, \odot, 0)$ is PZ then δ is named a pseudo \mathcal{Z} -subalgebra if $\mathcal{Z} * \uparrow, \mathcal{Z} \odot \uparrow \in \delta, \forall \mathcal{Z}, \uparrow \in \delta$.

Example2.12: Let $\mathcal{Z} = \{0, \mathcal{Z}, \uparrow, \Downarrow\}$ be set and $*, \odot$ are a binary operations defined on \mathcal{Z} by the table as follows:

*	0	\mathcal{Z}	\uparrow	\Downarrow	\odot	0	\mathcal{Z}	\uparrow	\Downarrow
0	0	\mathcal{Z}	\uparrow	\Downarrow	0	0	\mathcal{Z}	\uparrow	\Downarrow
\mathcal{Z}	0	\mathcal{Z}	\mathcal{Z}	\uparrow	\mathcal{Z}	0	\mathcal{Z}	\uparrow	\mathcal{Z}
\uparrow	0	\uparrow	\uparrow	\mathcal{Z}	\uparrow	0	\mathcal{Z}	\uparrow	\mathcal{Z}
\Downarrow	0	\mathcal{Z}	\mathcal{Z}	\Downarrow	\Downarrow	0	\uparrow	\mathcal{Z}	\Downarrow

Then $(\mathcal{Z}, *, \odot, 0)$ is pseudo \mathcal{Z} -algebra , $\delta = \{\mathcal{Z}, \uparrow, \Downarrow\}$ is a pseudo \mathcal{Z} -sub algebra.

3. Neutrosophic \mathcal{Z} -algebra:

Definition 3.1: A neutrosophic \mathcal{Z} -algebra is the triple $(\mathcal{Z}(\mathcal{J}), *, (0, 0\mathcal{J}))$ (briefly, $\mathcal{N}\mathcal{Z}$) (where $(\mathcal{Z}, *, 0)$ be a \mathcal{Z} -algebra , $\mathcal{Z}(\mathcal{J}) = \langle \mathcal{Z}, \mathcal{J} \rangle$ a neutrosophic set)

if $(\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J})$ are any two elements of $\mathcal{Z}(\mathcal{J})$ with $\mathcal{Z}, \mathfrak{h}, \uparrow, \mathfrak{q} \in \mathcal{Z}$ satisfies

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J}) = (\mathcal{Z} * \uparrow, (\mathcal{Z} * \mathfrak{q} \wedge \mathfrak{h} * \uparrow \wedge \mathfrak{h} * \mathfrak{q})\mathcal{J})$$

An element $\mathcal{Z} \in \mathcal{Z}$ is represented by $(\mathcal{Z}, 0\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$,

$$(\mathcal{Z}, 0\mathcal{J}) * (\mathfrak{h}, 0\mathcal{J}) = (\mathcal{Z} * \mathfrak{h}, 0\mathcal{J}) = (\mathcal{Z} \wedge \sim \mathfrak{h}, 0) . \text{ where } \sim \mathfrak{h} \text{ is the negation of } \mathfrak{h} \text{ in } \mathcal{Z}$$

$$\text{And } (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\uparrow, \mathfrak{q}\mathcal{J}) \Leftrightarrow (\mathcal{Z} = \uparrow \text{ and } \mathfrak{h} = \mathfrak{q})$$

Definition 3.2: A neutrosophic pseudo \mathcal{Z} -algebra is $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ (briefly, \mathcal{NPZ}) (where $(\mathcal{Z}, *, \odot, 0)$ be a pseudo \mathcal{Z} -algebra

If $(\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J})$ are any two elements of $\mathcal{Z}(\mathcal{J})$ with $\mathfrak{x}, \mathfrak{h}, \dagger, \mathcal{V} \in \mathcal{Z}$ satisfies

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) = (\mathcal{Z} * \dagger, (\mathcal{Z} * \mathcal{V} \wedge \mathfrak{h} * \dagger \wedge \mathfrak{h} * \mathcal{V})\mathcal{J})$$

$$(\dagger, \mathcal{V}\mathcal{J}) \odot (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\dagger \odot \mathcal{Z}, (\mathcal{Z} \odot \mathcal{V} \wedge \mathfrak{h} \odot \dagger \wedge \mathfrak{h} \odot \mathcal{V})\mathcal{J})$$

Where $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\dagger, \mathcal{V}\mathcal{J})$ When $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (0, 0\mathcal{J})$ and $(\dagger, \mathcal{V}\mathcal{J}) \neq (0, 0\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

Theorem 3.3: Every $\mathcal{NZ} (\mathcal{Z}(\mathcal{J}), *, (0, 0\mathcal{J}))$ with condition $(0, 0\mathcal{J}) * (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J})$ is a \mathcal{Z} -algebra and conversely, not.

Proof: let $(\mathcal{X}(\mathcal{J}), *, (0, 0\mathcal{J}))$ is \mathcal{NZ}

Let $r = (\mathcal{Z}, \mathfrak{h}\mathcal{J})$ and $0 = (0, 0\mathcal{J})$

$$\mathcal{Z}_1: r * 0 = (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (0, 0\mathcal{J}) = (\mathcal{Z} * 0, (\mathcal{Z} * 0 \wedge \mathfrak{h} * 0)\mathcal{J}) = (0, (0 \wedge 0)\mathcal{J}) = (0, 0\mathcal{J})$$

$$\mathcal{Z}_2: 0 * r = (0, 0\mathcal{J}) * (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (0 * \mathcal{Z}, (0 * \mathfrak{h} \wedge 0 * \mathcal{Z})\mathcal{J}) = (\mathcal{Z}, (\mathfrak{h} \wedge \mathcal{Z})\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J})$$

$$\begin{aligned} \mathcal{Z}_3: r * r &= (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\mathcal{Z} * \mathcal{Z}, (\mathcal{Z} * \mathfrak{h} \wedge \mathfrak{h} * \mathcal{Z} \wedge \mathfrak{h} * \mathfrak{h})\mathcal{J}) \\ &= (\mathcal{Z}, (\mathcal{Z} \wedge \sim \mathfrak{h} \wedge \mathfrak{h} \wedge \sim \mathcal{Z} \wedge \mathfrak{h})\mathcal{J}) \\ &= (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \end{aligned}$$

\mathcal{Z}_4 : if $r * s = s * r$, when $r \neq 0$ & $s \neq 0, \forall r, s \in \mathcal{Z}(\mathcal{J})$

let $r = (\mathcal{Z}, \mathfrak{h}\mathcal{J}), s = (\dagger, \mathcal{V}\mathcal{J})$,

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) = (\dagger, \mathcal{V}\mathcal{J}) * (\mathcal{Z}, \mathfrak{h}\mathcal{J})$$

$$(\mathcal{Z} * \dagger, (\mathcal{Z} * \mathcal{V} \wedge \mathfrak{h} * \dagger \wedge \mathfrak{h} * \mathcal{V})\mathcal{J}) = (\dagger * \mathcal{Z}, (\dagger * \mathfrak{h} \wedge \mathcal{V} * \mathcal{Z} \wedge \mathcal{V} * \mathfrak{h})\mathcal{J})$$

Suppose $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (0, 0\mathcal{J})$ & $(\dagger, \mathcal{V}\mathcal{J}) \neq (0, 0\mathcal{J})$ we get

$$0 * \dagger = \dagger * 0 \Rightarrow \dagger = 0$$

$$\text{and } 0 * \mathcal{V} \wedge 0 * 0 = 0 * 0 \wedge \mathcal{V} * 0 \Rightarrow \mathcal{V} = 0$$

We get a contradiction.

Then $(\mathcal{Z}(\mathcal{J}), *, (0, 0\mathcal{J}))$ is a \mathcal{Z} -algebra.

Theorem 3.4: Every $\mathcal{NPZ} (\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ with condition $(0, 0\mathcal{J}) * (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (0, 0\mathcal{J}) \odot (\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J})$ is a pseudo \mathcal{Z} -algebra and conversely, not.

Proof: it is easy as above.

Definition 3.5: Let $\mathfrak{S}(\mathcal{J}) \neq \phi$ and $\mathfrak{S}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, (0, 0\mathcal{J}))$ is \mathcal{NZ} , $\mathfrak{S}(\mathcal{J})$ is named a neutrosophic \mathcal{Z} -subalgebra (briefly, \mathcal{NZ}^s) of $\mathcal{Z}(\mathcal{J})$ if

$$1) (0, 0\mathcal{J}) \in \mathfrak{S}(\mathcal{J})$$

- 2) $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) \in \mathfrak{S}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J}) \in \mathfrak{S}(\mathcal{J})$
- 3) $\mathfrak{S}(\mathcal{J})$ Contains a proper sub set which a Z-algebra.

Definition 3.6: Let $\mathfrak{S}(\mathcal{J}) \neq \phi$ and $\mathfrak{S}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NPZ} , $\mathfrak{S}(\mathcal{J})$ is called a neutrosophic pseudo Z-subalgebra (briefly, \mathcal{NPZ}^s) of $\mathcal{Z}(\mathcal{J})$ if

- 1) $(0, 0\mathcal{J}) \in \mathfrak{S}(\mathcal{J})$
- 2) $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) \in \mathfrak{S}(\mathcal{J}) \& (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\dagger, \mathcal{V}\mathcal{J}) \in \mathfrak{S}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J}) \in \mathfrak{S}(\mathcal{J})$
- 3) $\mathfrak{S}(\mathcal{J})$ Contains a proper sub set which a pseudo Z-algebra.

Theorem 3.7: If $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \neq \phi$ and $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$ for $\omega \neq 0$, $(\mathcal{Z}(\mathcal{J}), *, (0, 0\mathcal{J}))$ is \mathcal{NZ} , where $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) = \{(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{Z}(\mathcal{J}): (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\omega, \omega\mathcal{J}) = (\omega, \omega\mathcal{J})\}$

Then 1) $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$ is \mathcal{NZ}^s .

$$2) \mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \subseteq \mathcal{A}_{(0, 0\mathcal{J})}(\mathcal{J}).$$

Proof: 1) clearly $(0, 0\mathcal{J}) \in \mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$

$\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$ contain a proper sub set which a Z-algebra.

Let $(\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J}) \in \mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \Rightarrow$

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\omega, \omega\mathcal{J}) = (\omega, \omega\mathcal{J}), (\dagger, \mathcal{V}\mathcal{J}) * (\omega, \omega\mathcal{J}) = (\omega, \omega\mathcal{J}) \Rightarrow$$

$$\mathcal{Z} * \omega = \omega, \mathcal{Z} * \omega \wedge \mathfrak{h} * \omega = \omega \& \dagger * \omega = \omega, \dagger * \omega \wedge \mathcal{V} * \omega = \omega \text{ since } \omega \neq 0 \Rightarrow$$

$$\mathcal{Z} = \mathfrak{h} = \dagger = \mathcal{V} = \omega$$

$$\begin{aligned} [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J})] * (\omega, \omega\mathcal{J}) &= [\mathcal{Z} * \dagger, (\mathcal{Z} * \mathcal{V} \wedge \mathfrak{h} * \dagger)\mathcal{J}] * (\omega, \omega\mathcal{J}) \\ &= [(\mathcal{Z} * \dagger) * \omega, ((\mathcal{Z} * \dagger) * \omega \wedge (\mathcal{Z} * \mathcal{V} \wedge \mathfrak{h} * \dagger) * \omega)\mathcal{J}] \\ &= [\omega * \omega, (\omega * \omega \wedge \omega * \omega)\mathcal{J}] \\ &= (\omega, \omega\mathcal{J}) \end{aligned}$$

This shows that $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\dagger, \mathcal{V}\mathcal{J}) \in \mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$

Then $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$ is \mathcal{NZ}^s .

(2) it's easy.

Theorem 3.8: If $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \neq \phi$ and $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, for $\omega \neq 0$,

$(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NPZ} , where $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) = \{(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{Z}(\mathcal{J}): (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\omega, \omega\mathcal{J}) = (\omega, \omega\mathcal{J}) \& (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\omega, \omega\mathcal{J}) = (\omega, \omega\mathcal{J})\}$

Then 1) $\mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J})$ is \mathcal{NPZ}^s .

$$2) \mathcal{A}_{(\omega, \omega\mathcal{J})}(\mathcal{J}) \subseteq \mathcal{A}_{(0, 0\mathcal{J})}(\mathcal{J}).$$

Proof: it is easy as above.

Theorem 3.9: If $Z_\xi(\mathcal{J}) \neq \phi$ and $Z_\xi(\mathcal{J}) \subseteq Z(\mathcal{J})$, $(Z(\mathcal{J}), *, (0,0\mathcal{J}))$ is \mathcal{NZ} , where

$$Z_\xi(\mathcal{J}) = \{(z, z\mathcal{J}) : z \in Z\} \text{ Then } Z_\xi(\mathcal{J}) \text{ is a } \mathcal{NZ}^s \text{ of } Z(\mathcal{J}).$$

Proof: clearly $(0,0\mathcal{J}) \in Z_\xi(\mathcal{J})$ and the third condition is satisfied for $Z_\xi(\mathcal{J})$

Let $(\dagger, \dagger\mathcal{J}), (\mathfrak{b}, \mathfrak{b}\mathcal{J}) \in Z_\xi(\mathcal{J}), \dagger, \mathfrak{b} \in Z \Rightarrow$

$$(\dagger, \dagger\mathcal{J}) * (\mathfrak{b}, \mathfrak{b}\mathcal{J}) = (\dagger * \mathfrak{b}, (\dagger * \mathfrak{b})\mathcal{J})$$

This shows that $(\dagger, \dagger\mathcal{J}) * (\mathfrak{b}, \mathfrak{b}\mathcal{J}) \in Z_\xi(\mathcal{J})$

Then $Z_\xi(\mathcal{J})$ is a \mathcal{NZ}^s of $Z(\mathcal{J})$.

Theorem 3.10: If $Z_\xi(\mathcal{J}) \neq \phi$ and $Z_\xi(\mathcal{J}) \subseteq Z(\mathcal{J})$, $(Z(\mathcal{J}), *, \odot, (0,0\mathcal{J}))$ is \mathcal{NPZ} , where

$$Z_\xi(\mathcal{J}) = \{(z, z\mathcal{J}) : z \in Z\} \text{ Then } Z_\xi(\mathcal{J}) \text{ is a } \mathcal{NPZ}^s \text{ of } Z(\mathcal{J}).$$

Proof: it is easy as above.

Example 3.11: Let $*$ is a binary operation defined on

$Z_\xi(\mathcal{J}) = \{(0,0\mathcal{J}), (z, z\mathcal{J}), (\dagger, \dagger\mathcal{J}), (\mathfrak{a}, \mathfrak{a}\mathcal{J})\}$ as follows:

*	$(0,0\mathcal{J})$	$(z, z\mathcal{J})$	$(\dagger, \dagger\mathcal{J})$	$(\mathfrak{a}, \mathfrak{a}\mathcal{J})$
$(0,0\mathcal{J})$	$(0,0\mathcal{J})$	$(z, z\mathcal{J})$	$(\dagger, \dagger\mathcal{J})$	$(\mathfrak{a}, \mathfrak{a}\mathcal{J})$
$(z, z\mathcal{J})$	$(0,0\mathcal{J})$	$(z, z\mathcal{J})$	$(0,0\mathcal{J})$	$(z, z\mathcal{J})$
$(\dagger, \dagger\mathcal{J})$	$(0,0\mathcal{J})$	$(0,0\mathcal{J})$	$(\dagger, \dagger\mathcal{J})$	$(\dagger, \dagger\mathcal{J})$
$(\mathfrak{a}, \mathfrak{a}\mathcal{J})$	$(0,0\mathcal{J})$	$(z, z\mathcal{J})$	$(\dagger, \dagger\mathcal{J})$	$(\mathfrak{a}, \mathfrak{a}\mathcal{J})$

Then $(Z_\xi(\mathcal{J}), *, (0,0\mathcal{J}))$ is a \mathcal{NZ}^s of $Z(\mathcal{J})$.

Theorem 3.12: Let $\{\mathcal{A}(\mathcal{J})_\gamma : \gamma \in \mathcal{S}\}$ and $\mathcal{A}(\mathcal{J})_\gamma \neq \phi$ be a collection of \mathcal{NZ}^s of $Z(\mathcal{J})$ if

$$\bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \neq \{(0,0\mathcal{J})\} \Rightarrow \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \text{ is a } \mathcal{NZ}^s \text{ of } Z(\mathcal{J}).$$

Proof: since $(0,0\mathcal{J}) \in \mathcal{A}(\mathcal{J})_\gamma, \forall \gamma \in \mathcal{S} \Rightarrow$

$$(0,0\mathcal{J}) \in \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \Rightarrow \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \neq \phi$$

And the third condition was achieved for $\mathcal{A}(\mathcal{J})_\gamma, \forall \gamma \in \mathcal{S} \Rightarrow$

The third condition was achieved for $\bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$

$$\bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \neq \{(0,0\mathcal{J})\} \Rightarrow \exists (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (0,0\mathcal{J}) \Rightarrow \{(0,0\mathcal{J})\} \subseteq \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma, \text{ which is a } \mathbb{Z} - \text{ algebra}$$

$$\text{Let } (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \mathcal{A}(\mathcal{J})_\gamma, \forall \gamma \in \mathcal{S}$$

Since $\mathcal{A}(\mathcal{J})_\gamma$ is a \mathcal{NZ}^s , $\forall \gamma \in \mathcal{S}$ of $\mathcal{Z}(\mathcal{J})$ then

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \mathcal{A}(\mathcal{J})_\gamma, \forall \gamma \in \mathcal{S}, \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$$

hence $\bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$ is a \mathcal{NZ}^s of $\mathcal{Z}(\mathcal{J})$.

Theorem 3.13: Let $\{\mathcal{A}(\mathcal{J})_\gamma : \gamma \in \mathcal{S}\}$ and $\mathcal{A}(\mathcal{J})_\gamma \neq \emptyset$ be a collection of \mathcal{NPZ}^s of $(\mathcal{Z}(\mathcal{J}), *, \oplus, (0,0\mathcal{J}))$ is \mathcal{NPZ} if

$$\bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \neq \{(0,0\mathcal{J})\} \Rightarrow \bigcap_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \text{ is a } \mathcal{NPZ}^s \text{ of } \mathcal{Z}(\mathcal{J}).$$

Proof: it is easy as above.

Theorem 3.14: Let $\{\mathcal{A}(\mathcal{J})_\gamma : \gamma \in \mathcal{S}\}$ and $\mathcal{A}(\mathcal{J})_\gamma \neq \emptyset$ be a collection of \mathcal{NZ}^s of $\mathcal{Z}(\mathcal{J})$ if $\mathcal{A}(\mathcal{J})_1 \subseteq \mathcal{A}(\mathcal{J})_2 \subseteq \dots$ then

$$\bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \text{ is a } \mathcal{NZ}^s \text{ of } \mathcal{Z}(\mathcal{J}).$$

$$\text{Proof: obviously } (0,0\mathcal{J}) \in \bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma \neq \emptyset \Rightarrow \exists (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$$

$$\Rightarrow \text{For some } \gamma \in \mathcal{S} \text{ } (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \mathcal{A}(\mathcal{J})_\gamma \text{ and } (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \mathcal{A}(\mathcal{J})_{\gamma \in \mathcal{S}}$$

$$\Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{t}, \mathfrak{q}\mathcal{J}) \in \bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$$

Let $\mathfrak{S}(\mathcal{J})_\gamma$ be a proper sub set of $\mathcal{A}(\mathcal{J})_\gamma$, for some $\gamma \in \mathcal{S}$ which a \mathbb{Z} - algebra,

then for any $\gamma \in \mathcal{S}$, $\mathfrak{S}(\mathcal{J})_\gamma \in \bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$ then

$$\bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_{\gamma \in \mathcal{S}} \text{ is } \mathcal{NZ}^s \text{ of } \mathcal{Z}(\mathcal{J}).$$

Theorem 3.15: Let $\{\mathcal{A}(\mathcal{J})_\gamma : \gamma \in \mathcal{S}\}$ and $\mathcal{A}(\mathcal{J})_\gamma \neq \phi$ be a collection of \mathcal{NPZ}^s of $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NPZ} if $\mathcal{A}(\mathcal{J})_1 \subseteq \mathcal{A}(\mathcal{J})_2 \subseteq \dots$ then

$\bigcup_{\gamma \in \mathcal{S}} \mathcal{A}(\mathcal{J})_\gamma$ is \mathcal{NPZ}^s of $\mathcal{Z}(\mathcal{J})$.

Proof: it is easy as above.

Definition 3.16: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic Z-ideal (briefly, \mathcal{NZ}^i) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0, 0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$

Remark 3.17: Let $\mathcal{D}(\mathcal{J})$ is a \mathcal{NZ}^i of $\mathcal{Z}(\mathcal{J})$ if

$(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$ and $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) = (0, 0\mathcal{J})$ then $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$.

Proof: let $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$ and $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) = (0, 0\mathcal{J}) \Rightarrow$

$(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$ and $(0, 0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$

Since $\mathcal{D}(\mathcal{J})$ is a $\mathcal{NZ}^i \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$.

Definition 3.18: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NPZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic pseudo Z-ideal (briefly, \mathcal{NPZ}^i) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0, 0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$.
- 2) If $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$

And $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$.

Definition 3.19: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic Z_1 -ideal (briefly, \mathcal{NZ}^{i1}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0, 0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $[((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{a}, \mathfrak{w}\mathcal{J})) * (\mathcal{Z}, \mathfrak{h}\mathcal{J})] * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{a}, \mathfrak{w}\mathcal{J}), (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

Definition 3.20: : Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0, 0\mathcal{J}))$ is \mathcal{NPZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic pseudo Z_1 -ideal (briefly, \mathcal{NPZ}^{i1}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0, 0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) $[((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{a}, \mathfrak{w}\mathcal{J})) * (\mathcal{Z}, \mathfrak{h}\mathcal{J})] * (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{a}, \mathfrak{w}\mathcal{J}), (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

And $[((\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\mathfrak{a}, \mathfrak{w}\mathcal{J})) \odot (\mathcal{Z}, \mathfrak{h}\mathcal{J})] \odot (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, and $(\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J})$, $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\mathfrak{a}, \mathfrak{w}\mathcal{J}), (\mathfrak{f}, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

Definition 3.21: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, (0,0\mathcal{J}))$ is \mathcal{NZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic Z_2 -ideal (briefly, \mathcal{NZ}^{i2}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\lambda, \omega\mathcal{J})] * [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$.

Definition 3.22: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0,0\mathcal{J}))$ is \mathcal{NPZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic pseudo Z_2 -ideal (briefly, \mathcal{NPZ}^{i2}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\lambda, \omega\mathcal{J})] * [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

And $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\lambda, \omega\mathcal{J})] \odot [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$.

Definition 3.23: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, (0,0\mathcal{J}))$ is \mathcal{NZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic Z_q -ideal (briefly, \mathcal{NZ}^{iq}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\lambda, \omega\mathcal{J})] * [(\uparrow, \mathfrak{q}\mathcal{J}) * (\lambda, \omega\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

Definition 3.24: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0,0\mathcal{J}))$ is \mathcal{NPZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic pseudo Z_q ideal (briefly, \mathcal{NPZ}^{iq}) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \in \mathcal{D}(\mathcal{J})$
- 2) If $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\lambda, \omega\mathcal{J})] * [(\uparrow, \mathfrak{q}\mathcal{J}) * (\lambda, \omega\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

And $[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\lambda, \omega\mathcal{J})] \odot [(\uparrow, \mathfrak{q}\mathcal{J}) \odot (\lambda, \omega\mathcal{J})] \in \mathcal{D}(\mathcal{J})$, and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{D}(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\lambda, \omega\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$

Definition 3.25: Let $\mathcal{D}_\xi(\mathcal{J}) \neq \phi$ and $\mathcal{D}_\xi(\mathcal{J}) \subseteq \mathcal{Z}_\xi(\mathcal{J})$, $\mathcal{D}_\xi(\mathcal{J})$ is named a neutrosophic Z -ideal (briefly, $\mathcal{NZ}^{\xi i}$) of $\mathcal{Z}_\xi(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \in \mathcal{D}_\xi(\mathcal{J})$
- 2) If $(\mathcal{Z}, \mathfrak{Z}\mathcal{J}) * [(\uparrow, \uparrow\mathcal{J}) * (\lambda, \lambda\mathcal{J})] \in \mathcal{D}_\xi(\mathcal{J})$, and $(\uparrow, \uparrow\mathcal{J}) \in \mathcal{D}_\xi(\mathcal{J}) \Rightarrow (\mathcal{Z}, \mathfrak{Z}\mathcal{J}) * (\lambda, \lambda\mathcal{J}) \in \mathcal{D}_\xi(\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{Z}\mathcal{J}), (\uparrow, \uparrow\mathcal{J}), (\lambda, \lambda\mathcal{J}) \in \mathcal{D}_\xi(\mathcal{J})$

Theorem 3.26: Every $\mathcal{NZ}^{\xi i}$ of $\mathcal{X}_\xi(\mathcal{J})$ is a \mathcal{NZ}^i of $\mathcal{X}_\xi(\mathcal{J})$.

Proof: suppose that $(\mathcal{Z}, \mathfrak{Z}\mathcal{J}) = (0,0\mathcal{J})$ in 2 \Rightarrow it's proofed. .

Definition 3.27: Let $\mathcal{D}(\mathcal{J}) \neq \phi$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, (0,0\mathcal{J}))$ is \mathcal{NZ} , $\mathcal{D}(\mathcal{J})$ is named a neutrosophic Z -filter (briefly, \mathcal{NZ}^f) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \notin \mathcal{D}(\mathcal{J})$
- 2) $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \text{ and } (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (\uparrow, \mathfrak{q}\mathcal{J}) \Rightarrow$
 $(\mathcal{Z}, \mathfrak{h}\mathcal{J})\mathfrak{X}(\uparrow, \mathfrak{q}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$

Definition 3.28: Let $\mathcal{D}(\mathcal{J}) \neq \emptyset$ and $\mathcal{D}(\mathcal{J}) \subseteq \mathcal{Z}(\mathcal{J})$, $(\mathcal{Z}(\mathcal{J}), *, \odot, (0,0\mathcal{J}))$ is $\mathcal{NPZ}, \mathcal{D}(\mathcal{J})$ is named a neutrosophic pseudo Z-filter (briefly, \mathcal{NPZ}^f) of $\mathcal{Z}(\mathcal{J})$ if :

- 1) $(0,0\mathcal{J}) \notin \mathcal{D}(\mathcal{J})$
- 2) $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \text{ and } (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (\uparrow, \mathfrak{q}\mathcal{J}) \Rightarrow$
 $(\mathcal{Z}, \mathfrak{h}\mathcal{J})\mathfrak{X}(\uparrow, \mathfrak{q}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$

And $\forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{D}(\mathcal{J}) \text{ and } (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \neq (\uparrow, \mathfrak{q}\mathcal{J}) \Rightarrow$

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J})\mathfrak{X}(\uparrow, \mathfrak{q}\mathcal{J}) = (\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot [(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\uparrow, \mathfrak{q}\mathcal{J})] \in \mathcal{D}(\mathcal{J})$$

Definition 3.29: If $(\mathcal{Z}(\mathcal{J}), *, (0,0\mathcal{J}))$ & $(\mathcal{Z}'(\mathcal{J}), \acute{*}, (\acute{0}, \acute{0}\mathcal{J}))$ be two \mathcal{NZ} , a mapping

$f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}'(\mathcal{J})$ is named a neutrosophic Z- homomorphism (briefly, \mathcal{NZ}^h) if satisfied

- 1) $f[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] = f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \acute{*} f(\uparrow, \mathfrak{q}\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$
- 2) $f(0,0\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J})$
- 3) If f is 1-1 $\Rightarrow f$ is named "a neutrosophic Z- monomorphism".
- 4) If f is onto $\Rightarrow f$ is named "a neutrosophic Z- epimorphism".
- 5) If f is 1-1 and onto $\Rightarrow f$ is named a neutrosophic Z-isomorphism.

Definition 3.30: If $(\mathcal{Z}(\mathcal{J}), *, \odot, (0,0\mathcal{J}))$ & $(\mathcal{Z}'(\mathcal{J}), \acute{*}, \acute{\odot}, (\acute{0}, \acute{0}\mathcal{J}))$ be two \mathcal{NPZ} , a mapping

$f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}'(\mathcal{J})$ is named a neutrosophic pseudo Z- homomorphism (briefly, \mathcal{NPZ}^h) if satisfied

- 1) $f[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})] = f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \acute{*} f(\uparrow, \mathfrak{q}\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$
- 2) $f[(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \odot (\uparrow, \mathfrak{q}\mathcal{J})] = f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \acute{\odot} f(\uparrow, \mathfrak{q}\mathcal{J}), \forall (\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in \mathcal{Z}(\mathcal{J})$
- 3) $f(0,0\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J})$
- 4) If f is 1-1 $\Rightarrow f$ is named "a neutrosophic pseudo Z- monomorphism".
- 5) If f is onto $\Rightarrow f$ is named "a neutrosophic pseudo Z- epimorphism".
- 6) If f is 1-1 and onto $\Rightarrow f$ is named a neutrosophic pseudo Z-isomorphism.

Theorem 3.31: Let $\mathcal{Z}(\mathcal{J})$ & $\mathcal{Z}'(\mathcal{J})$ be two \mathcal{NZ} , $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}'(\mathcal{J})$ be a neutrosophic Z-epimorphism .If $\mathcal{D}(\mathcal{J})$ is a \mathcal{NZ}^f of $\mathcal{Z}(\mathcal{J}) \Rightarrow f(\mathcal{D}(\mathcal{J}))$ is a \mathcal{NZ}^f of $\mathcal{Z}'(\mathcal{J})$.

Proof: let $(\mathcal{Z}, \mathfrak{h}\mathcal{J}), (\uparrow, \mathfrak{q}\mathcal{J}) \in f(\mathcal{D}(\mathcal{J})) \Rightarrow$

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J}) = f(\lambda, \omega\mathcal{J}) \quad , \quad (\uparrow, \mathfrak{q}\mathcal{J}) = f(\rho, \epsilon\mathcal{J}) \quad \text{where } (\lambda, \omega\mathcal{J}), (\rho, \epsilon\mathcal{J}) \in \mathcal{D}(\mathcal{J})$$

Since $\mathcal{D}(\mathcal{J})$ is a \mathcal{NZ}^f of $\mathcal{Z}(\mathcal{J})$, \Rightarrow

$$(\lambda, \omega\mathcal{J})\mathfrak{X}(\rho, \epsilon\mathcal{J}) = (\lambda, \omega\mathcal{J}) * [(\lambda, \omega\mathcal{J}) * (\rho, \epsilon\mathcal{J})] \in \mathcal{D}(\mathcal{J})$$

$$\text{Also } f((\lambda, \omega\mathcal{J})\mathfrak{X}(\rho, \epsilon\mathcal{J})) \in f(\mathcal{D}(\mathcal{J}))$$

$$\begin{aligned}
(\mathcal{Z}, \mathfrak{h}\mathcal{J})\mathfrak{X}(\uparrow, \mathfrak{q}\mathcal{J}) &= (\mathcal{Z}, \mathfrak{h}\mathcal{J}) * ((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\uparrow, \mathfrak{q}\mathcal{J})) \\
&= f(\lambda, \omega\mathcal{J}) * (f(\lambda, \omega\mathcal{J}) * f(\varphi, \epsilon\mathcal{J})) \\
&= f[(\lambda, \omega\mathcal{J}) * ((\lambda, \omega\mathcal{J}) * (\varphi, \epsilon\mathcal{J}))] \\
&= f[(\lambda, \omega\mathcal{J})\Delta(\varphi, \epsilon\mathcal{J})]
\end{aligned}$$

$$(\mathcal{Z}, \mathfrak{h}\mathcal{J})\mathfrak{X}(\uparrow, \mathfrak{q}\mathcal{J}) \in f(\mathcal{D}(\mathcal{J})) \Rightarrow$$

$f(\mathcal{D}(\mathcal{J}))$ is a \mathcal{NZ}^f of $\mathcal{Z}(\mathcal{J})$.

Theorem 3.32: Let $\mathcal{Z}(\mathcal{J})$ & $\mathcal{Z}(\hat{\mathcal{J}})$ be two \mathcal{NPZ} , $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ be a neutrosophic pseudo \mathcal{Z} -epimorphism. If $\mathcal{D}(\mathcal{J})$ is a \mathcal{NPZ}^f of $\mathcal{Z}(\mathcal{J}) \Rightarrow f(\mathcal{D}(\mathcal{J}))$ is a \mathcal{NPZ}^f of $\mathcal{Z}(\hat{\mathcal{J}})$.

Proof: it is easy as above.

Definition 3.33: Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ be a \mathcal{NZ}^h then

$\ker(f) = \{(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{Z}(\mathcal{J}) : f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J})\}$ is named the kernel of f .

Definition 3.34: Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ be a \mathcal{NPZ}^h then

$\ker(f) = \{(\mathcal{Z}, \mathfrak{h}\mathcal{J}) \in \mathcal{Z}(\mathcal{J}) : f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J})\}$ is named the kernel of f .

Remark 3.35: (1) Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ is a \mathcal{NZ}^h , then $\ker(f)$ is not a \mathcal{NZ}^f of $\mathcal{Z}(\mathcal{J})$.

(2) \mathcal{NZ}^f is not \mathcal{NZ}^i and conversely.

(3) \mathcal{NZ}^f is not \mathcal{NZ}^s and conversely.

Remark 3.36: (1) Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ is a \mathcal{NPZ}^h , then $\ker(f)$ is not a \mathcal{NPZ}^f of $\mathcal{Z}(\mathcal{J})$.

(2) \mathcal{NPZ}^f is not \mathcal{NPZ}^i and conversely.

(3) \mathcal{NPZ}^f is not \mathcal{NPZ}^s and conversely.

Theorem 3.37: Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ be a \mathcal{NZ}^h then

- 1) If the identity of $\mathcal{Z}(\mathcal{J})$ is $(0, 0\mathcal{J}) \Rightarrow$ the identity of $\mathcal{Z}(\hat{\mathcal{J}})$ is $f(0, 0\mathcal{J})$.
- 2) If \mathcal{U} is a \mathcal{NZ}^s of $\mathcal{Z}(\mathcal{J})$, then $f(\mathcal{U})$ is a \mathcal{NZ}^s of $\mathcal{Z}(\hat{\mathcal{J}})$.
- 3) If \mathcal{U} is a \mathcal{NZ}^s of $\mathcal{Z}(\hat{\mathcal{J}})$, then $f^{-1}(\mathcal{U})$ is a \mathcal{NZ}^s of $\mathcal{Z}(\mathcal{J})$.

Proof: it's clear.

Theorem 3.38: Let $f: \mathcal{Z}(\mathcal{J}) \rightarrow \mathcal{Z}(\hat{\mathcal{J}})$ be a \mathcal{NPZ}^h then

- 1) If the identity of $\mathcal{Z}(\mathcal{J})$ is $(0, 0\mathcal{J}) \Rightarrow$ the identity of $\mathcal{Z}(\hat{\mathcal{J}})$ is $f(0, 0\mathcal{J})$.
- 2) If \mathcal{U} is a \mathcal{NPZ}^s of $\mathcal{Z}(\mathcal{J})$, then $f(\mathcal{U})$ is a \mathcal{NPZ}^s of $\mathcal{Z}(\hat{\mathcal{J}})$.
- 3) If \mathcal{U} is a \mathcal{NPZ}^s of $\mathcal{Z}(\hat{\mathcal{J}})$, then $f^{-1}(\mathcal{U})$ is a \mathcal{NPZ}^s of $\mathcal{Z}(\mathcal{J})$.

Proof: it's clear.

Theorem 3.39: Let $f: Z(\mathcal{J}) \rightarrow Z(\mathcal{J})$ is a \mathcal{NZ}^h then f is a neutrosophic Z -monomorphism $\Leftrightarrow \ker(f) = \{(0,0I)\}$

Proof: it's clear.

Theorem 3.40: Let $f: Z(\mathcal{J}) \rightarrow Z(\mathcal{J})$ is a \mathcal{NPZ}^h then f is a neutrosophic Z -monomorphism $\Leftrightarrow \ker(f) = \{(0,0I)\}$

Proof: it's clear.

Theorem 3.41: Let $f: Z(\mathcal{J}) \rightarrow Z(\mathcal{J})$ is a \mathcal{NZ}^h then $\ker(f)$ is a \mathcal{NZ}^i of $Z(\mathcal{J})$.

Proof: $f(0,0\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J}) \Rightarrow (0,0\mathcal{J}) \in \ker(f)$

Let $(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\uparrow, \mathfrak{q}\mathcal{J}) * (\mathfrak{r}, \mathfrak{w}\mathcal{J})] \in \ker(f)$ and $(\uparrow, \mathfrak{q}\mathcal{J}) \in \ker(f) \Rightarrow$

$$f((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\uparrow, \mathfrak{q}\mathcal{J}) * (\mathfrak{r}, \mathfrak{w}\mathcal{J})]) = (\acute{0}, \acute{0}\mathcal{J}) \text{ and } f(\uparrow, \mathfrak{q}\mathcal{J}) = (\acute{0}, \acute{0}\mathcal{J})$$

$$(\acute{0}, \acute{0}\mathcal{J}) = f((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\uparrow, \mathfrak{q}\mathcal{J}) * (\mathfrak{r}, \mathfrak{w}\mathcal{J})])$$

$$= f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [f(\uparrow, \mathfrak{q}\mathcal{J}) * f(\mathfrak{r}, \mathfrak{w}\mathcal{J})]$$

$$= f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * [(\acute{0}, \acute{0}\mathcal{J}) * f(\mathfrak{r}, \mathfrak{w}\mathcal{J})]$$

$$= f(\mathcal{Z}, \mathfrak{h}\mathcal{J}) * f(\mathfrak{r}, \mathfrak{w}\mathcal{J})$$

$$= f((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{r}, \mathfrak{w}\mathcal{J}))$$

We get $((\mathcal{Z}, \mathfrak{h}\mathcal{J}) * (\mathfrak{r}, \mathfrak{w}\mathcal{J})) \in \ker(f)$. then $\ker(f)$ is a \mathcal{NZ}^i of $Z(\mathcal{J})$.

Theorem 3.42: Let $f: Z(\mathcal{J}) \rightarrow Z(\mathcal{J})$ is a \mathcal{NPZ}^h then $\ker(f)$ is a \mathcal{NPZ}^i of $Z(\mathcal{J})$.

Proof: it is easy as above.

CONCLUSION:

We discussed the idea of a neutrosophic Z -algebra and neutrosophic pseudo Z – algebra looked into some of its properties, and the concept of neutrosophic Z -ideal, neutrosophic Z -sub algebra , neutrosophic Z -filter and neutrosophic Z - homomorphism are studied and a few properties are obtained.

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