Al-Qadisiyah Journal of Pure Science

Volume 26 | Number 5 Article 6

10-7-2021

On The Quadruple Sequence Spaces Of Fuzzy Complex Numbers

Aqeel Mohammed Hussein
Department of Mathematics, College of Education, University of Al-Qadisiyah, Diwaniyah, Iraq,
aqeel.Hussein@qu.edu.iq

Recommended Citation

Hussein, Aqeel Mohammed (2021) "On The Quadruple Sequence Spaces Of Fuzzy Complex Numbers," *Al-Qadisiyah Journal of Pure Science*: Vol. 26: No. 5, Article 6.
DOI: 10.29350/qjps.2021.26.5.1459
Available at: https://qjps.researchcommons.org/home/vol26/iss5/6

Al-Qadisiyah Journal of Pure Science Vol.(26) Issue (5) (2021) pp. Math. 58–65

Al-Qadisiyah Journal of Pure Science

ISSN(Printed): 1997-2490 ISSN(Online): 2411-3514

DOI: /10.29350/jops.

http://qu.edu.iq/journalsc/index.php/JOPS

QJPS

Al-Qadisiyah Journal of Pure Science

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Authors Names

a. Aqeel Mohammed Hussein

Article History

Received on: 30/10/2021
Revised on: 3 /12/2021
Accepted on: 9/12/2021

Keywords:

Solidity, symmetry, monotonicity, quadric sequence, convergence-free, fuzzy complex number are all terms used

DOI: https://doi.org/10.29350/jops.2021.26. 5.1459

ABSTRACT

In this paper, we illustrate the quadruple sequence spaces of fuzzy complex numbers and we explain several features such as $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ aren't symmetric , where as the $\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}}$ be a symmetric, $\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}}$, $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$, and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ are solid , $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ aren't monotonous, $\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}}$, $\mathfrak{W}_{\mathbb{T}}^{4\mathbb{F}}$, and $\mathfrak{W}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ aren't convergent-free.

1. Introduction

The quadruple sequence can be defined as a function $\mathfrak{A}: \mathbb{N} \times \mathbb{N} \times \mathbb{N} \times \mathbb{N} \longrightarrow \mathbb{R}(\mathbb{C}) : \mathbb{N}$, $\mathbb{R}$ and $\mathbb{C}$ denote the set of natural numbers, real numbers and complex numbers, respectively in this study. Apostol (1978), Alzer, Karayannakis, and Srivastava (2006), Bor, Srivastava, and Sulaiman (2012), Choi and Srivastava (1991), Liu and Srivastava (2006), and Hardy (1917), Deepmala Subramanian, and Mishra (in press), Deepmala, Mishra, and Subramanian (2016), and many others have published early work on double sequence. Later work on triple sequence spaces can be found in Sahiner, Gurdal, and Duden (2007), Esi (2014), Esi and Necdet Catalbas (2014), Esi and Savas (2015), Subramanian and Esi (2015), and many other publications. The purpose of this paper is to introduce the $\mathfrak{M}^4$-fuzzy number, which is defined by an Orlicz function, and to investigate certain topological features, inclusion relations, and instances. Alzer et al. (2006), Bor et al. (2012), Choi and Srivastava (1991),

[a] Department of Mathematics, College of Education, University of Al-Qadisiyah, Diwaniyah, Iraq, E-mail: aqeel.Hussein@qu.edu.iq

Liu and Srivastava (2012) all have some intriguing outcomes (2006). If $\sup_{\ell\hbar g f}|\mathfrak{A}_{\ell\hbar g f}|^{\frac{1}{\ell+\hbar+g+f}} \prec \infty$, a sequence $\mathfrak{A} = (\mathfrak{A}_{\ell\hbar g f})$ is a quadruple analytic. $\mathfrak{T}^4$ is used to indicate the vector space of all quadruple analytic sequences . If $\sup_{\ell\hbar g f}|\mathfrak{A}_{\ell\hbar g f}|^{\frac{1}{\ell+\hbar+g+f}} \longrightarrow 0$ as $\ell,\hbar,g,f \longrightarrow \infty$, a sequence $\mathfrak{A} = (\mathfrak{A}_{\ell\hbar g f})$ is a quadruple entire sequence . If $\left((\ell+\hbar+g+f)!\,|\mathfrak{A}_{\ell\hbar g f}|\right)^{\frac{1}{\ell+\hbar+g+f}} \longrightarrow 0$ as $\ell,\hbar,g,f \longrightarrow \infty$, a sequence $\mathfrak{A} = (\mathfrak{A}_{\ell\hbar g f})$ is a quadruple chi sequence.

2.Definitons and Preliminaries

Definition 2.1[19] :

$\mathbb{E}^{4\mathbb{F}}$ be a solid if $(\mathfrak{U}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}$ whenever $(\mathfrak{A}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}$ and $|\mathfrak{U}_{\ell\hbar g f}| \preccurlyeq |\mathfrak{A}_{\ell\hbar g f}|$ for everybody $\ell,\hbar,g,f \in \mathbb{N}$.

Definition 2.2[19] :

Let's $\mathbb{K} = \{(\ell_i , \hbar_i , g_i, f_i)\ i \in \mathbb{N}, \ell_1 \prec \ell_2 \prec \ell_3 \prec \ldots, \hbar_1 \prec \hbar_2 \prec \hbar_3, g_1 \prec g_2 \prec g_3$, and $f_1 \prec f_2 \prec f_3 \prec \ldots\} \subseteq \mathbb{N} \times \mathbb{N} \times \mathbb{N} \times \mathbb{N}$. A $\mathbb{K}$-step space of $\mathbb{E}^{4\mathbb{F}}$ be a quadruple sequence space $\xi_{\mathbb{K}}^{\mathbb{E}^{4\mathbb{F}}}$ be a equals to the set $\{(\mathfrak{A}_{\ell\hbar g f}) \in \mathbb{W}^{4\mathbb{E}}: (\mathfrak{A}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}\}$, in which $\mathbb{W}^4 = \{(\mathfrak{A}_{\ell\hbar g f}): \mathfrak{A}_{\ell\hbar g f} \in \mathbb{C}\}$.

Definition 2.3[19] :

A canonical pre-image of any quadric sequence $(\mathfrak{A}_{\ell\hbar g f})$ in $\mathbb{E}^{4\mathbb{F}}$ be a quadruple sequence $(\mathfrak{U}_{\ell\hbar g f})$ be characterized by:

$$\mathfrak{U}_{\ell\hbar g f} = \begin{cases} \mathfrak{A}_{\ell\hbar g f} & \text{if} \quad (\ell,\hbar,g,f) \in \mathbb{K} \\ \bar{0} & \text{otherwise} \end{cases}.$$

Definition 2.4[19] :

A canonical pre-image of a step space $\zeta_{\mathbb{K}}^{\mathbb{E}^{4\mathbb{F}}}$ be a set of canonical pre-image of all elements in $\zeta_{\mathbb{K}}^{\mathbb{E}^{4\mathbb{F}}}$.

Definition 2.5[19] :

$\mathbb{E}^{4\mathbb{F}}$ be a monotone if $\mathbb{E}^{4\mathbb{F}}$ contains the canonical pre-image of all its step spaces.

Definition 2.6[19] :

$\mathbb{E}^{4\mathbb{F}}$ be a symmetric if $(\mathfrak{A}_{\pi(\ell),\pi(\hbar),\pi(g),\pi(f)}) \in \mathbb{E}^{4\mathbb{F}}$ whenever $(\mathfrak{A}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}$.

Definition 2.7[19] :

$\mathbb{E}^{4\mathbb{F}}$ be a convergent-free if $(\mathfrak{U}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}$ whenever $(\mathfrak{A}_{\ell\hbar g f}) \in \mathbb{E}^{4\mathbb{F}}$ and $\mathfrak{A}_{\ell\hbar g f} = 0$ implies $\mathfrak{U}_{\ell\hbar g f} = 0$

The classes of Quadruple sequence mentioned below have been defined:

$$\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}} = \left\{(\mathfrak{A}_{\ell\hbar g f}) : \sup_{\ell\hbar g f} \mathbb{T}(\bar{d}(\mathfrak{A}_{\ell\hbar g f}^{\frac{1}{\ell+\hbar+g+f}}, \bar{0})) \prec \infty, \mathfrak{A}_{\ell\hbar g f} \in \mathbb{L}(\mathbb{C})\right\}.$$

$$\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}} = \left\{(\mathfrak{A}_{\ell\hbar g f}) : \lim_{\ell,\hbar,g,f\to\infty} \mathbb{T}(\bar{d}\left(\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}}, \bar{0}\right)\right) = 0\right\}.$$

Moreover, we define the classes of quadruple sequence $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ as follows :

$(\mathfrak{A}_{\ell\hbar g f}) \in \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ if $(\mathfrak{A}_{\ell\hbar g f}) \in \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and the following limits hold

$$\lim_{\ell\to\infty} \mathbb{T}(\bar{d}\left(\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}}, \bar{0}\right)\right) = 0 \text{ each and every } \ell \in \mathbb{N}.$$

$$\lim_{\hbar\to\infty} \mathbb{T}(\bar{d}\left(\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\mathrm{n+m+i+j}}}, \bar{0}\right)\right) = 0 \text{ each and every } \hbar \in \mathbb{N}.$$

$$\lim_{g\to\infty} \mathbb{T}(\bar{d}\left(\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}}, \bar{0}\right)\right) = 0 \text{ each and every } g \in \mathbb{N}.$$

$$\lim_{f\to\infty} \mathbb{T}(\bar{d}\left(\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}}, \bar{0}\right)\right) = 0 \text{ each and every } f \in \mathbb{N}.$$

3.Main results :

Proposition 3.1 :

$\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ aren't symmetric , where as the $\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}}$ be a symmetric .

Proof :

This proposition can be explained by the following example:

Example :

Consider the following $\mathfrak{W}_{\mathbb{T}}^{4\mathbb{F}}$. Assume that $j(\mathfrak{A})$ equals $\mathfrak{A}$ and that the quadruple sequence $(\mathfrak{A}_{\ell\hbar g f})$ has the description given below:

$$\mathfrak{A}_{1\hbar g f}(\mathfrak{x}) = \begin{cases} \frac{(-\mathfrak{x}+1)^{1+\hbar+g+f}}{(1+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = -1, \\ \frac{(\mathfrak{x}-1)^{1+\hbar+g+f}}{(1+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = 1, \\ 0 & \text{in any case.} \end{cases}$$

for $\ell \succ 1$,

$$\mathfrak{A}_{\ell\hbar g f}(\mathfrak{x}) = \begin{cases} \frac{(\mathfrak{x}+2)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = -2, \\ \frac{(-\mathfrak{x}-1)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = -1, \\ 0, & \text{in any case.} \end{cases}$$

let's assume $(\mathfrak{U}_{\ell\hbar g f})$ be reorganization of $(\mathfrak{A}_{\ell\hbar g f})$ is characterized with :

$$\mathfrak{U}_{\ell\ell\ell\ell}(\mathfrak{x}) = \begin{cases} \frac{(-\mathfrak{x}+1)^{4\ell}}{(4\ell)!}, & \text{in order to} \quad \mathfrak{x} = -1, \\ \frac{(\mathfrak{x}-1)^{4\ell}}{(4\ell)!}, & \text{in order to} \quad \mathfrak{x} = 1, \\ 0, & \text{in any case.} \end{cases}$$

For $\ell \neq \hbar \neq g \neq f$,

$$\mathfrak{U}_{\ell\hbar g f}(\mathfrak{x}) = \begin{cases} \frac{(\mathfrak{x}+2)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = -2, \\ \frac{(-\mathfrak{x}-1)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad \mathfrak{x} = -1, \\ 0, & \text{in any case.} \end{cases}$$

Then it's $(\mathfrak{A}_{\ell\hbar g f}) \in \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ but $(\mathfrak{U}_{\ell\hbar g f}) \notin \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$. As a result, $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ isn't symmetric.

Proposition 3.2 :

$\mathfrak{T}_{\mathbb{T}}^{4\mathbb{F}}$, $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$, and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ are solid.

Proof :

Consider the following $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$. Assume the following $(\mathfrak{A}_{\ell\hbar g f})$ and $(\mathfrak{U}_{\ell\hbar g f}) \in \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ to the extent that.

$$\bar{d}\left(\left((\ell+\hbar+g+f)!\,\mathfrak{U}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}},0\right) \preccurlyeq \bar{d}\left(\left((\ell+\hbar+g+f)!\,\mathfrak{A}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}},0\right).$$

As $\mathbb{T}$ that isn't decreasing, we've got,

$$\lim_{\ell,\hbar,g,f\to\infty} \mathbb{T}(\bar{d}\left(\left((\ell+\hbar+g+f)!\,\mathfrak{U}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}},0\right)) \preccurlyeq \lim_{\ell,\hbar,g,f\to\infty} \mathbb{T}(\bar{d}\left(\left((\ell+\hbar+g+f)!\,\mathfrak{U}_{\ell\hbar g f}\right)^{\frac{1}{\ell+\hbar+g+f}},0\right)$$

As a result, $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ be a solid.

Proposition 3.3 :

$\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}^{\mathcal{R}}}$ aren't monotonous, and aren't solid.

Proof :

This theorem can be explained by following example.

Example :

Consider the following $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ and $\mathbb{T}(\mathfrak{A})$ equals $\mathfrak{A}$.

Let's assume $\mathbb{J}$ equals to the set of values $\{(\ell,\hbar,g,f)\colon \ell \succcurlyeq \hbar \succcurlyeq g \succcurlyeq f\} \subseteq \mathbb{N}\times\mathbb{N}\times\mathbb{N}\times\mathbb{N}$. Let's assume $(\mathfrak{A}_{\ell\hbar g f})$ be characterized with

$$\mathfrak{A}_{\ell\hbar g f}(\mathfrak{x}) = \begin{cases} \frac{(\mathfrak{x}+3)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad -3 \prec \mathfrak{x} \preccurlyeq -2, \\ \frac{(\mathfrak{n}\mathfrak{x})^{\ell+\hbar+g+f}}{(3\ell-1)^{\ell+\hbar+g+f}(\ell+\hbar+g+f)!} + \frac{(3\mathfrak{n})^{\ell+\hbar+g+f}}{(3\ell-1)^{\ell+\hbar+g+f}(\ell+\hbar+g+f)!}, & \text{in order to} \quad -2 \prec \mathfrak{x} \preccurlyeq -1+\frac{1}{\mathfrak{n}}, \\ 0, & \text{in any case.} \end{cases}$$

Then it's $(\mathfrak{A}_{\ell\hbar g f}) \in \mathfrak{W}_{\mathbb{T}}^{4\mathbb{F}}$. Let's assume $(\mathfrak{U}_{\ell\hbar g f})$ be the canonical pre-image of $\left(\mathfrak{A}_{\ell\hbar g f}\right)_{\mathbb{J}}$ for the $\mathbb{J}$ of the sequence of $\mathbb{N}\times\mathbb{N}\times\mathbb{N}\times\mathbb{N}$. Then ,

$$(\mathfrak{U}_{\ell\hbar g f}) = \begin{cases} \mathfrak{A}_{\ell\hbar g f}, & \text{in order to} \quad (\ell,\hbar,g,f) \in \mathbb{J} \\ \bar{0}, & \text{in any case} \end{cases},$$

Then it's $(\mathfrak{U}_{\ell\hbar g f}) \notin \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$. As a result $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ isn't monotonous .

Proposition 3.4 :

$\mathfrak{T}_{\mathbb{T}}^{2\mathbb{F}}$, $\mathfrak{W}_{\mathbb{T}}^{2\mathbb{F}}$, and $\mathfrak{W}_{\mathbb{T}}^{2\mathbb{F}^{\mathcal{R}}}$ aren't convergent-free.

Proof :

This theorem can be explained by following example.

Example :

Consider the following $\mathfrak{W}_{\mathbb{T}}^{4\mathbb{F}}$. Assume that $\mathbb{T}(\mathfrak{A})$ equals $\mathfrak{A}$ and $(\mathfrak{A}_{\ell\hbar g f})$ for is the symbol for

$\left((1+\hbar+g+f)!\,\mathfrak{A}_{1\hbar g f}\right)^{\frac{1}{1+\hbar+g+f}} = 0$. Other values include :

$$\mathfrak{A}_{\ell\hbar g f}(\mathfrak{x}) = \begin{cases} \frac{(1)^{\ell+\hbar+g+f}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad 0 \preccurlyeq \mathfrak{x} \preccurlyeq 1 \\ \frac{(-\ell\mathfrak{x})^{\ell+\hbar+g+f}(\ell+1)^{-(\ell+\hbar+g+f)}+(2\ell+1)^{\ell+\hbar+g+f}(1+\ell)^{-(\ell+\hbar+g+f)}}{(\ell+\hbar+g+f)!}, & \text{in order t} \quad 1 \preccurlyeq \mathfrak{x} \preccurlyeq 2+\frac{1}{\mathfrak{n}} \\ 0, & \text{in any case.} \end{cases}$$

Let's assume $(\mathfrak{U}_{\ell\hbar g f})$ be characterized by $\left((1+\hbar+g+f)!\,\mathfrak{U}_{1\hbar g f}\right)^{\frac{1}{1+\hbar+g+f}} = \bar{0}$, and for other values

,

$$\mathfrak{U}_{\ell\hbar g f}(\mathfrak{x}) = \begin{cases} \dfrac{(1)^{\ell+\hbar+g+f}}{(\mathfrak{n}+\mathfrak{m}+\mathfrak{i}+\mathfrak{j})!}, & \text{in order to} \quad 0 \preccurlyeq \mathfrak{x} \preccurlyeq 1 \\ \dfrac{(\ell-\mathfrak{x})^{\ell+\hbar+g+f}(\ell-1)^{-(\ell+\hbar+g+f)}}{(\ell+\hbar+g+f)!}, & \text{in order to} \quad 1 \preccurlyeq \mathfrak{x} \preccurlyeq \mathfrak{n}\,. \\ 0, & \text{in any case.} \end{cases}$$

Then it's $(\mathfrak{A}_{\ell\hbar g f}) \in \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ but $(\mathfrak{U}_{\ell\hbar g f}) \notin \mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$. As a consequence, $\mathfrak{M}_{\mathbb{T}}^{4\mathbb{F}}$ aren't convergent-free.

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