Lacunary $\mathcal{I}_2$-Invariant convergence of double sequences in random 2-normed spaces

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Abstract

In this study, we introduce the concept of lacunary $\mathcal{I}_2$-invariant convergence, lacunary $\mathcal{I}_2^*$-invariant convergence and lacunary $\mathcal{I}_2$-invariant Cauchy for double sequences in the topology introduced by random 2-normed spaces. We give the relationships among these concepts and prove some important results.

Keywords: $\mathcal{I}_2$-invariant convergence,lacunary convergence, 2-norm, 2-normed space.

1 Introduction

The notion of statistical convergence of sequences of numbers was introduced by Fast [2]. Later on, statistical convergence turned out to be one of the most active areas of research in summability theory after the works of Fridy [3] and Salat [4].

The notion of convergence of real double sequences was first introduced by Pringsheim [9]. A lot of useful developments of double sequences in summability methods can be found in Limayea and Zeltser, Altay and Başar [1]. This notion of convergence of real double sequences has been extended to statistical convergence by Mursaleen and Edely, [5]. Also, they established some relationships between statistical convergence and strongly Cesàro summable double sequences.

The concept of lacunary statistical convergence was defined by Fridy and Orhan [7]. Also, Fridy and Orhan gave the relationships between the lacunary statistical convergence and the Cesàro summability. Freedman and Sember established the connection between the strongly Cesàro summable sequences space $|\sigma_1|$ and the strongly lacunary summable sequences space N_θ in their work [10] published in 1978. This notion was extended to the double sequences by Savaş and Patterson [32].

Kostyrko, Salát and Wilezyński [11] introduced the concept of $\mathcal{I}$-convergence of sequences in a metric space and studied some properties of this convergence.

Tripathy, Hazarika and Choudhary [28] introduced the concepts of $\mathcal{I}$-lacunary convergent sequences.

Recently in [12] we used ideals to introduce the concepts of $\mathcal{I}$-statistical convergence and $\mathcal{I}$-lacunary statistical convergence which naturally extend the notions of the above mentioned convergence.

Quite recently, $\mathcal{I}$-double statistical convergence has been established as a better tool than double statistical convergence. It is found very interesting that some results on sequences, series and summability can be proved by replacing the double statistical convergence by $\mathcal{I}$-double statistical convergence.

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