

## Chapter 4: Lacunary Almost Convergence of Complex Uncertain Sequences

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**Abstract:** In this paper, we introduce and study the concept of lacunary almost convergence for complex uncertain sequences in the framework of uncertainty theory. By extending the classical notions of convergence in almost sure, mean, measure, distribution, and uniformly almost sure senses, we define the corresponding lacunary versions and investigate their interrelations. Several inclusion theorems are established, and counterexamples are provided to show that the converse results do not hold in general. Furthermore, we present the equivalence between lacunary almost convergence and lacunary almost Cauchy sequences of complex uncertain variables.

**Keywords:** Lacunary convergence, almost convergence, complex uncertain sequence.

**2020 Mathematical Subject Classification.** 40A05, 30B10, 42A75, 68T07.

### 1. Introduction

Convergence of sequences is a fundamental concepts in mathematical analysis. This idea was introduced by Lorentz [1] in 1948 based on summability, which is similar to the mean value used in almost periodic functions by Zygmund [2] but not the exact. Lorentz also studied this almost convergence for matrix transformation. Further, in the study of Freedman et al. [3] for summability he introduced the strong almost convergence for the spaces of bounded sequences. After that numerous mathematicians extended this convergence concept for matrix transformation in Banach spaces, for more detail work we refer this papers [4] [5] [6] [7].

The idea of difference sequence space was introduced by Kizmaz [8] for classical sequence spaces  $c, c_0, \ell_\infty$ . Further numerous mathematicians generalized this idea and also studied various topological properties, for more detail study for difference sequence spaces we refer the following papers [9] [10]. Moreover, statistical convergence idea was introduced by Fast [11] and Buck [12] independently. Further many researchers work on the statistical convergence idea and studied various properties for such sequences spaces, for detail work we refer the following articles [13] [14]. Beside of this Et et al. [15] introduced the almost statistical convergence idea for the difference sequences of fuzzy numbers. Further, Başar [16] introduced this almost convergence concept for generalized difference matrix and studied some topological properties by introducing duals.

A mathematical framework to study indeterminacy was introduced by Liu [17] in 2007, called it Uncertainty Theory. Liu introduced this framework which is based on classical measure theory. In his book he introduced uncertain measure, uncertain space, uncertain variables, uncertain distribution,