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Abstract

In this paper, we introduce the double Taylor sequence space $\mathcal{T}_p^{r,s}$ consisting of all sequences whose doubly Taylor transforms of orders r, s are in the space \mathcal{L}_p of non-absolute type which is a Banach space including the space \mathcal{L}_p . Further, some inclusion relations concerning the space $\mathcal{T}_p^{r,s}$ are given. Then, we focus on the evaluation of the exact values of the operator norm and lower bound of four-dimensional Hausdorff matrices as operators mapping the double sequence space \mathcal{L}_p into the double Taylor sequence spaces $\mathcal{T}_p^{r,s}$. Some estimates are obtained. In particular, we apply our results to some special cases of four-dimensional Hausdorff matrices, such as Cesàro, Euler, Hölder and Gamma matrices.

Keywords: Double sequences, Matrix domain, Four-dimensional Hausdorff matrices, Operator norm and lower bound.

2000 MSC: 46A45, 26D15.

1. Introduction

By Ω , we denote the space of all real or complex valued double sequences which is the vector space with coordinatewise addition and scalar multiplication. Any vector subspace of Ω are called as the double sequence space. The space of bounded double sequences is denoted by \mathcal{L}_∞ , which is a Banach space with the norm $\|x\|_{\mathcal{L}_\infty} = \sup_{n,m} |x_{n,m}|$. Also the space \mathcal{L}_p of double sequences [7] is defined by

$$\mathcal{L}_p = \left\{ (x_{n,m}) \in \Omega : \sum_{n=0}^{\infty} \sum_{m=0}^{\infty} |x_{n,m}|^p < \infty \right\}, \quad (0 < p < \infty).$$

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