

Weak Laws Of Large Numbers For Double Sums Of Independent Random Elements In Rademacher Type p And Stable Type p Banach Spaces

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Abstract

For a double array $\{V_{mn}, m \geq 1, n \geq 1\}$ of independent random elements in a real separable stable type p ($1 \leq p < 2$) Banach space \mathcal{X} and sequences of random positive integers $\{T_n, n \geq 1\}$ and $\{\tau_n, n \geq 1\}$, the main result provides necessary and sufficient conditions for a weak law of large numbers of the form $\sum_{i=1}^{T_m} \sum_{j=1}^{\tau_n} (V_{ij} - c(m, n, i, j)) / \beta(m, n) \xrightarrow{P} 0$ as $\max\{m, n\} \rightarrow \infty$ to hold where the $c(m, n, i, j)$ are suitable elements in \mathcal{X} and the $\beta(m, n)$ are suitable norming constants. The conditions are shown to completely characterize stable type p ($1 \leq p < 2$) Banach spaces. Illustrative examples are provided. Moreover, for a double array of independent random elements in a real separable Rademacher type p ($1 \leq p \leq 2$) Banach space, a weak law of large numbers is obtained for the double sums $\sum_{i=1}^m \sum_{j=1}^n V_{ij}, m \geq 1, n \geq 1$.