

TOPOLOGY OF THE CONVERGENCE IN PROBABILITY ON A LINEAR
SPAN OF A SEQUENCE OF INDEPENDENT RANDOM VARIABLES

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Abstract: Let X_1, X_2, \dots be a sequence of independent symmetric Hilbert space valued non-degenerated random variables and let L_x denote the closed linear span of $\{X_n\}$ in $L_0(\Omega, \mathcal{F}, P; H)$. If L_x is a locally convex subspace of L_0 , then L_x is Banach iff L_x does not contain an isomorphic copy of R^∞ iff

$$\sup_n P(X_n = 0) < 1.$$

If, moreover, X_n are equidistributed and $P(X_n = 0) = 0$, then

$$\left\{ Y \in L_x : P\left(\|Y\| > \frac{1}{201}\right) < \frac{1}{210} \right\}$$

is a bounded neighbourhood of zero.

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