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FULLY AND STRONGLY ALMOST SUMMING MULTILINEAR MAPPINGS

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ABSTRACT. In this paper we generalize a theorem of Kwapień which asserts that a linear operator T is absolutely $(1;1)$-summing whenever T^* is absolutely $(q;q)$-summing for some $q \geq 1$. We also introduce the classes of strongly and fully almost summing multilinear mappings and investigate structural properties such as a Dvoretzky-Rogers type theorem and connections with other classes of absolutely summing mappings.

1. Introduction. The success of the theory of absolutely summing linear operators has motivated the investigation of new classes of multilinear mappings and polynomials between Banach spaces. The first possible directions of a multilinear theory of absolutely summing multilinear mappings were outlined by Pietsch [**15**] and several related concepts have been exhaustively studied by several authors. Recently a question of Pietsch about Hilbert-Schmidt multilinear mappings was answered by Matos in [**8**] and this work motivated the study of a new class of multilinear mappings, called the space of fully absolutely summing multilinear mappings, see [**9, 16, 17**].

The concept of almost summing operators was first considered for the multilinear and polynomial cases by Botelho [**3**] and Botelho-Braunss-Junek [**4**]. In [**12**] and [**13**] it is proved that whenever $n \geq 2$ and $E_1, \dots, E_n$ are $\mathcal{L}_\infty$-spaces, every continuous n-linear mapping from $E_1 \times \cdots \times E_n$ into any Banach space F is almost 2-summing, showing that coincidence results for almost summing mappings are much more common than was known. These coincidental results motivate the study of other natural directions for extending the concepts of almost summing linear operators to polynomial and multilinear mappings. Our first definition leads us to the space of strongly almost summing

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