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M-Structures in Vector-Valued Polynomial Spaces

This paper is concerned with the study of M -structures in spaces of polynomials. More precisely, we discuss for E and F Banach spaces, whether the class of weakly continuous on bounded sets n -homogeneous polynomials, $\mathcal{P}_w(^n E, F)$, is an M -ideal in the space of continuous n -homogeneous polynomials $\mathcal{P}(^n E, F)$. We show that there is some hope for this to happen only for a finite range of values of n . We establish sufficient conditions under which the problem has positive and negative answers and use the obtained results to study the particular cases when $E = \ell_p$ and $F = \ell_q$ or F is a Lorentz sequence space $d(w, q)$. We extend to our setting the notion of property (M) introduced by Kalton which allows us to lift M -structures from the linear to the vector-valued polynomial context. Also, when $\mathcal{P}_w(^n E, F)$ is an M -ideal in $\mathcal{P}(^n E, F)$ we prove a Bishop-Phelps type result for vector-valued polynomials and relate norm-attaining polynomials with farthest points and remotal sets.

Keywords: M -ideals, homogeneous polynomials, weakly continuous polynomials on bounded sets

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