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Multilinear polynomials of small degree evaluated on matrices over a unital algebra.

Our work branches from a famous result by Kenjiro Shoda that over any field K of characteristic 0, any traceless matrix can be expressed as a commutator. This is equivalent to showing that all traceless matrices are contained in the image of the degree 2 multilinear polynomial $f(x_1, x_2) = x_1x_2 - x_2x_1$.

We consider instead a unital associative algebra R over a field K of characteristic zero. Let f be a multilinear polynomial of degree 3 or 4 over K . Applying methods of combinatorial algebra, we prove that all traceless matrices can be written as the sum of two values of f evaluated over $M_n(R)$, $n > 2$. We conjecture that this result holds for higher values of m , provided that $n \geq m - 1$. Our results extend recent works due to Zachary Mesyan, Dinesh Khurana and Tsit-Yuen Lam. (Received August 04, 2015)