Katherine Cordwell (ktcordwell@gmail.com) and George Wang* (georgeyw@usc.edu).

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)