IMAGES OF MULTILINEAR POLYNOMIALS OF DEGREE
UP TO FOUR ON UPPER TRIANGULAR MATRICES

PEDRO S. FAGUNDES AND THIAGO C. DE MELLO

Abstract. We describe the images of multilinear polynomials of degree up to four on the upper triangular matrix algebra.

REFERENCES

[1] A. A. ALBERT AND B. MUCKENHOUPT, *On matrices of trace zero*, Michigan Math. J. **4** (1957), 1–3.
[2] S. A. AMITSUR AND L. ROWEN, *Elements of reduced trace 0*, Israel J. Math. **87** (1994), 161–179.
[3] D. BUZINSKI AND R. WINSTANLEY, *On multilinear polynomials in four variables evaluated on matrices*, Linear Algebra Appl. **439** (2013), 2712–2719.
[4] *Dniester notebook: unsolved problems in the theory of rings and modules*, Non-associative algebra and its applications, Lect. Notes Pure Appl. Math., vol. 246, Chapman & Hall/CRC, Boca Raton, FL, 2006, pp. 461–516. Translated from the 1993 Russian edition by Murray R. Bremnerand Mikhail V. Kochetov and edited by V. T. Filippov, V. K. Kharchenko and I. P. Shestakov.
[5] G. FALK, *Konstanzelemente in Ringen mit Differentiation*, Math. Ann. **124** (1952), 182–186.
[6] M. HALL, *A basis for free Lie rings and higher commutators in free groups*, Proc. Amer. Math. Soc. **1** (1950), 575–581.
[7] A. KANEL-BELOV, S. MALEV AND L. ROWEN, *The images of non-commutative polynomials evaluated on 2×2 matrices*, Proc. Amer. Math. Soc. **140** (2012), 465–478.
[8] Z. MESYAN, *Polynomials of small degree evaluated on matrices*, Linear Multilin. Alg. **61** (2013), 1487–1495.
[9] K. SHODA, *Einige Sätze über Matrizen*, Jap. J. Math. **13** (1936), 361–365.
[10] Š. ŠPENKO, *On the image of a noncommutative polynomial*, J. Algebra **377** (2013), 298–311.

ⓒ ELEMENT, Zagreb
Paper OaM-13-18

Operators and Matrices
www.ele-math.com
oam@ele-math.com