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Some examples of division symbol algebras of degree 3 and 5

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ABSTRACT.

In this paper we provide an algorithm to compute the product between two elements in a symbol algebra of degree n and we find an octonion algebra (in general, without division) in a symbol algebra of degree three. Moreover, using MAGMA software, we will provide some examples of division symbol algebras of degree 3 and of degree 5.

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REFERENCES

[1] Albu, T. and Ion, I. D., *Chapters of the algebraic Number Theory* (in Romanian), Ed. Academiei, Bucharest, 1984
[2] Bales, J. W., *A Tree for Computing the Cayley-Dickson Twist*, Missouri J. Math. Sci., **21** (2009), No. 2, 83–93
[3] Bosma, W., Cannon, J., Playoust, C. and Steel, A., *Solving Problems with Magma*, School of Mathematics and Statistics, University of Sydney, NSW 2006, Australia (http://magma.maths.usyd.edu.au/magma/documentation/)
[4] Faulkner, J. R., *Finding octonion algebras in associative algebras*, Proc. Amer. Math. Soc. **104** (1988), No. 4, 1027–1030
[5] Flatley, R., *Trace forms of Symbol Algebras*, Alg. Colloquium, **19** (2012), 1117–1124
[6] Flaut, C. and Savin, D., *Some properties of the symbol algebras of degree*, 3 Math. Reports, **16(3)(66)** (2014), 443–463
[7] Gille, P. and Szamuely, T., *Central Simple Algebras and Galois Cohomology*, Cambridge University Press, 2006
[8] Hazewinkel, M., *Handbook of Algebra*, Vol. **2**, North Holland, Amsterdam, 2000
[9] Ireland, K. and Rosen, M. *A Classical Introduction to Modern Number Theory*, Springer Verlag, 1992
[10] Jacobson, N., *Structure theory of Jordan algebras*, Lecture Notes in Mathematics, Vol. **5**, The University of Arkansas, Fayetteville, 1981
[11] Jafari, M. and Yayli, Y.,*Rotation in four dimensions via Generalized Hamilton operators*, Kuwait J. Sci., **40** (2013), No. 1, 67–79
[12] Kaplansky, I., *Infinite-dimensional quadratic forms admitting composition*, Proc. Amer. Math. Soc., **4** (1953), 956–960
[13] Ledet, A., *Brauer Type Embedding Problems*, AMS, 2005
[14] Lemmermeyer, F., *Reciprocity laws, from Euler to Eisenstein*, Springer-Verlag, Heidelberg, 2000
[15] http://magma.maths.usyd.edu.au/magma/handbook/
[16] Milne, J. S., *Class Field Theory*, http://www.math.lsa.umich.edu/ jmilne

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[17] Milnor, J., textitIntroduction to Algebraic K-Theory, Annals of Mathematics Studies, Princeton Univ. Press, 1971
[18] Olteanu, G., *Baer-Galois connections and applications*, Carpathian J. Math., **30** (2014), No. 2, 225–229
[19] Savin, D., Flaut, C. and Ciobanu, C., *Some properties of the symbol algebras*, Carpathian J. Math., **25** (2009), No. 2, 239–245
[20] Schafer, R. D., *An Introduction to Nonassociative Algebras*, Academic Press, New-York, 1966
[21] Schafer, R. D., *On the algebras formed by the Cayley-Dickson process*, Amer. J. Math., **76** (1954), 435–446
[22] Tarnauceanu, M., *A characterization of the quaternion group*, An. St. Univ. Ovidius Constanta, **21** (2013), No. 1, 209–214

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