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Alternative superalgebras on one odd generator

For every variety of algebras $\mathcal{V}$, one can consider the corresponding $\mathcal{V}$-Grassmann algebra, which is isomorphic as a vector space to the subspace of all skew-symmetric elements of the free $\mathcal{V}$-algebra. It seems interesting to construct a base for this subspace. Due to [3, 6], the problem is reduced to the free $\mathcal{V}$-superalgebra on one odd generator, which is easer to deal with.

In [4] we constructed a base of the free alternative superalgebra $\mathcal{A}$ on one odd generator. As a corollary we obtained a base of the alternative Grassmann algebra. We also described the nucleus and the center of $\mathcal{A}$ and found a new element of minimal degree in the radical of the free alternative algebra.

The knowledge of a base of the free alternative superalgebra $\mathcal{A}$ on one odd generator permits to investigate the structure of skew-symmetric identities and central elements in any given alternative algebra. In [5] we classified all super-identities and central functions of the free quadratic alternative superalgebra on one odd generator. We also proved that in characteristic 0 the skew-symmetric identities and central functions of octonion algebras coincides with those for the class of all quadratic alternative algebras.

In case of alternative algebras, the Dubnov-Ivanov-Nagata-Higman theorem is not true in general, but the Zhevlakov theorem establishes that every alternative nil-algebra is solvable. In [2] we constructed bases of free alternative nil-superalgebras of indices 2 and 3 on one odd generator and computed their indices of solvability. We considered also the corresponding Grassmann algebra and showed that the well known Dorofeev's example [1] of solvable non-nilpotent alternative algebra is its homomorphic image.

[1] G. V. Dorofeev: An example of a solvable but not nilpotent alternative ring, *Uspehi Mat. Nauk* **15** (1960), no. 3, 147-150 (in Russian).

[2] J. Scholtzová, N. Zhukavets: The free alternative nil-superalgebra of index 3 on one odd generator. Preprint.

[3] I. P. Shestakov: Alternative and Jordan superalgebras, *Siberian Adv. Math.*, **9**(2) (1999), 83–99.

[4] I. Shestakov, N. Zhukavets: The free alternative superalgebra on one odd generator, *Internat. J. Algebra Computations*, **17**(5/6) (2007), 1215-1247.

[5] I. Shestakov, N. Zhukavets: Skew-symmetric identities of octonions, *J. Pure Appl. Algebra*, **213**(2009) 479-492.

[6] M. Vaughan-Lee: Superalgebras and dimensions of algebras, *Int. J. Algebra and Computation*, **8**(1) (1998), 97–125.