Vol. 28 No. 3

2022

MSC: 20G05 DOI: 10.21538/0134-4889-2022-28-3-155-165

ESTIMATES FOR THE NUMBER OF LARGE COMPOSITION FACTORS IN THE RESTRICTIONS OF REPRESENTATIONS OF SPECIAL LINEAR GROUPS ON SUBSYSTEM SUBGROUPS OF TYPE A_2

A. A. Osinovskaya

One of the main problems of representation theory is the description of the restrictions of irreducible representations of algebraic groups to subgroups, i.e., of the branching rules for representations. H. Weyl and I. Schur obtained the classical branching rules that describe the restrictions of representations of classical algebraic groups of rank r to a naturally embedded classical subgroup of rank r or r-1 in the characteristic 0. In a positive characteristic, obtaining such rules in explicit form in the nearest future is unlikely. Therefore it is reasonable to develop methods for studying the modular representations, which do not require the knowledge of the characters. One of the directions of such studies is finding asymptotic analogs of branching rules to subgroups of small rank. Earlier we described the restrictions of irreducible representations of algebraic groups to subgroups of type A_1 . In the present paper we study the restrictions of irreducible representations of the special linear group over an algebraically closed field of positive characteristic p to subgroups of type A_2 . An estimate is obtained for the number of factors that are large with respect to the subgroup for representations of groups of groups of rank 3 and 4.

Keywords: algebraic groups, special linear groups, modular representations, restrictions, composition factors.

REFERENCES

- 1. Andersen H.H., Jantzen J.C., Soergel W. Representations of quantum groups at a pth root of unity and of semisimple groups in characteristic p: independence of p. Paris: Société mathématique de France. Astérisque, no. 220. 1994, 321 p.
- Fiebig P. An upper bound on the exceptional characteristics for Lusztig's character formula. J. Reine Angew. Math., 2012, vol. 673, pp. 1–31. doi: 10.1515/CRELLE.2011.170.
- 3. Shchigolev V. Weyl submodules in restrictions of simple modules. J. Algebra, 2009, vol. 321, no. 5, pp. 1453–1462. doi: 10.1016/j.jalgebra.2008.11.034.
- 4. Osinovskaya A.A. Restrictions of irreducible representations of classical algebraic groups to root A₁-subgroups. Comm. Algebra, 2003, vol. 31, no. 5, pp. 2357–2379. doi: 10.1081/AGB-120019001.
- 5. Osinovskaya A.A. The restrictions of representations of the special linear group to subsystem subgroups of type A₂. J. Math. Sci., 2018, vol. 234, no. 2, pp. 203–218. doi: 10.1007/s10958-018-3997-4.
- Osinovskaya A., Suprunenko I. On the Jordan block structure of images of some unipotent elements in modular irreducible representations of the classical algebraic groups. J. Algebra, 2004, vol. 273, no. 2, pp. 586–600. doi: 10.1016/j.jalgebra.2003.06.001.
- 7. Osinovskaya A.A. On the restrictions of modular irreducible representations of algebraic groups of type A_n to naturally embedded subgroups of type A_2 . J. Group Theory, 2005, vol. 8, no. 1, pp. 43–92. doi: 10.1515/jgth.2005.8.1.43.
- Jantzen J.C. Representations of algebraic groups, Second edition. Providence: Americ. Math. Soc., 2003, Ser. Math. Surveys and Monogr., vol. 107, 576 p. ISBN: 978-0-8218-4377-2.
- Želobenko D.P. Compact Lie groups and their representations. Providence: Americ. Math. Soc., 1973, Ser. Trans. Math. Monogr., vol. 40, 448 p. doi: 10.1090/mmono/040. Original Russian text published in Zhelobenko D.P. Kompaktnye gruppy Li i ikh predstavleniya. Moscow: MTsNMO Publ., 2007, 552 p.

Accepted July 25, 2022

Funding Agency: This work was supported by the Belarusian Republican Foundation for Basic Research (project no. F21-054).

Anna Aleksandrovna Osinovskaya, Cand. Sci. (Phys.-Math.), Institute of Mathematics of the National Academy of Sciences of Belarus, Minsk, 220119 Belarus, e-mail: anna@im.bas-net.by.

Cite this article as: A. A. Osinovskaya. Estimates for the number of large composition factors in the restrictions of representations of special linear groups on subsystem subgroups of type A_2 . Trudy Instituta Matematiki i Mekhaniki UrO RAN, 2022, vol. 28, no. 3, pp. 155–165.