
io-port 05349037**Eick, Bettina; Nickel, Werner****Computing the Schur multiplier and the nonabelian tensor square of a polycyclic group.**

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The nonabelian tensor square $G \otimes H$, which came from homotopy theory, of the groups G and H is the group generated by the symbols $g \otimes h$ and the relations $gh \otimes k = ({}^g h \times {}^g k)(g \otimes k)$ and $g \otimes hk = (g \otimes h)({}^h g \times {}^h k)$. By the result of R. D. Blyth and R. F. Morse, if the group is polycyclic then so is the tensor square, and the present paper provides an effective algorithm for computing a consistent polycyclic presentation for the tensor square, with such a presentation for the group G given. The group $\nu(G)$ is important in the construction: to the generators g_i of the group G a set of new generators \bar{g}_i is added the same in number, subject to the same relations, and further suitable relations concerning the action of the generators on the commutators between elements of these two sets. The nonabelian tensor square embeds as a normal subgroup into the group $\nu(G)$ with factor the product $G \times G$. Another group $\tau(G)$ is constructed by means of a consistent polycyclic presentation, and the group $\nu(G)$ is a central extension of $\tau(G)$. Then a consistent polycyclic presentation of the group $\nu(G)$ may be computed by adding new central generators for every relation of the group $\tau(G)$ and modifying those relations in an appropriate way. Finally, the consistent polycyclic presentation of the tensor square may be obtained as the presentation of a subgroup of the group $\nu(G)$. Moreover, algorithms for computing presentations of certain related other group constructions and for checking whether a polycyclic group is isomorphic to the central factor of some group are also provided. The algorithms are implemented by the authors in the computer algebra system GAP. The tensor squares are computed for nonabelian groups of order at most 30 up to now, the new algorithms make the same computation for solvable groups of order at most 100 very fast. For the wreath product of the group of 4×4 upper triangular invertible matrices over the field of 7 elements and the cyclic group of order 3 (of order $2^{12}3^{13}7^{18}$) the computation of the group $\tau(G)$ (of order $2^{54}3^{56}7^{54}$) takes 6 minutes, the tensor square, however, is not computable.

János Kurdics (Nyíregyháza)

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