

Simplification of tensor expressions in computer algebra

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Abstract

Computer algebra are widely used in various fields of mathematics, physics and other sciences. One of the important cases is the simplification of tensor expressions.

The work considers the reduction of tensor polynomials to the canonical form taking into account symmetry properties of permutations of indices, the symmetries associated with the renaming of the summation indices, and also the linear relations between tensors of a general form.

We give a definition of the canonical representation for polynomial (multiplicative) expressions of variables with abstract indices, which is the result of averaging the original expression by the action of some finite group (the signature stabilizer).

In practical cases, for expressions from the Riemann curvature tensors, the proposed algorithms demonstrate high efficiency.

Keywords: tensor, abstract indexed object, computer algebra, permutation group, canonical form, symmetry, multiterm linear identity