Han, Kangjin; Moon, Hyunsuk
A new bound for the Waring rank of monomials. (English)

A Waring decomposition of a polynomial is an expression of the polynomial as a sum of powers of linear forms. In this paper they study the rank of monomials over the reals and the rationals and we give an improved upper bound for it.

Earlier studies of Waring decomposition and Waring rank, initiated by works of Sylvester and others, go back to the 19th century. But, despite their long history, the Waring ranks for general forms over the complex numbers, a long-standing conjecture in this field, were determined only in the 1990s, as well as the complex Waring rank of monomials.

In general, it is known that it is very difficult to compute the rank of a form except some known cases, even though some algorithms have been proposed. The Waring rank over the real numbers is even more difficult to compute.

In this paper they consider the Waring rank of monomials over the real and the rational numbers. They give a new upper bound for it by establishing a way in which one can take a structured apolar set for any given monomial. This bound is also lower than any other known general bounds for the real Waring rank. Since all of the constructions are still valid over the rational numbers, this provides a new result for the rational Waring rank of any monomial as well. Some examples and computational implementation for potential use are given in the end.

Reviewer: Cenap Özel (İzmir)

MSC:
14P99 Real algebraic and real-analytic geometry
12D05 Polynomials in real and complex fields: factorization

Keywords:
real Waring rank; rational Waring rank; Waring decomposition; monomial; real hyperbolic polynomial

Full Text: DOI arXiv

References:


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