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Hilbert functions and the Buchberger algorithm. (English) Zbl 0922.13019

J. Symb. Comput. 22, No. 4, 355-376 (1996).

From the paper: In the computation of Gröbner bases of zero-dimensional ideals, linear algebra has been proved to be an useful tool, provided that the zero-dimensionality is explicitly known [see *J. C. Faugère*, *P. Gianni*, *D. Lazard* and *T. Mora*, J. Symb. Comput. 16, No. 4, 329-344 (1993; Zbl 0805.13007) and *M. G. Marinari*, *H. M. Moeller* and *T. Mora*, Appl. Algebra Eng. Commun. Comput. 4, No. 2, 103-145 (1993; Zbl 0785.13009)]. For most of the related algorithms the vector space dimension of the quotient ring has to be known.

In higher dimensional cases the Hilbert function can be used instead of the vector-space dimension to obtain results of the same type. In this paper we show how to use the knowledge of the Hilbert-Poincaré series of an ideal I to speed up the Buchberger algorithm for the computation of a Gröbner basis.

The algorithm is useful in the change of ordering and in the validation of modular computations, also with tangent cone orderings; speeds the direct computation of a Gröbner basis if the ideal is a complete intersection, e.g. in the computation of cartesian from parametric equations, can validate or disprove a conjecture that an ideal is a complete intersection, and is marginally useful also when the conjecture is false.

A large set of experiments is reported.

MSC:

13P10	Gröbner bases; other bases for ideals and modules (e.g., Janet and border bases)
13D40	Hilbert-Samuel and Hilbert-Kunz functions; Poincaré series
68W30	Symbolic computation and algebraic computation
13-04	Software, source code, etc. for problems pertaining to commutative algebra

Keywords:

Hilbert-Poincaré series; Buchberger algorithm; Gröbner basis

Software:

SINGULAR

Full Text: DOI