1 Introduction

SINGULAR 2-2-0 is a further development of both actual 2-0-X release series and 2-1-X pre-release series. The new SINGULAR 2-2-0 offers a wide range of possibilities for modern researcher in the field of both commutative and noncommutative polynomial computation.

SINGULAR is a free service to the scientific community. Moreover, it has been proved to be a good development platform, featuring flexibility of different levels of user/system interaction.

The 2004 Richard D. Jenks Memorial Prize for Excellence in Software Engineering for Computer Algebra was awarded to the SINGULAR team at the yearly premier International Symposium on Symbolic and Algebraic Computation (ISSAC) in Santander (Spain).

2 Key Strengths of SINGULAR

- distributed under GPL (GNU Public License)
- available for most of hardware and software platforms
- the biggest choice of ground fields on the market
- the factorization over most of fields is provided
- one of the fastest implementations

3 Which Rings Can Be Handled with PLURAL?

Let \( R = \mathbb{k}[x_1, \ldots, x_n] \) be a commutative ring. Suppose there are elements \( c_{ij} \in R \setminus \{0\} \) and \( d_{ij} \in R, \forall 1 \leq i < j \leq n \).

Consider an algebra \( A = \mathbb{k}[x_1, \ldots, x_n] \setminus \{0\} \). It is called a \( G \)-algebra (in \( n \) variables) if the following conditions hold:

1. \( \text{a well–ordering on } R \text{ such that } \forall i < j \implies \ln(d_{ij}) < x_j - x_i \).  
2. Nondegeneracy conditions are fulfilled, that is \( \forall 1 \leq i < j < k \leq n, c_{ij}c_{jk} - c_{ik}c_{j} = 0 \).

Theorem. Let \( A \) be a \( G \)-algebra in \( n \) variables. Then:
- \( A \) has a PBW basis \( \{ x_1^{a_1}x_2^{a_2} \cdots x_n^{a_n} \mid a_i \in \mathbb{N} \setminus \{0\} \} \).
- \( A \) is left and right Noetherian.
- \( A \) is an integral domain with \( \text{gl. dim } A \leq n \).

A \( GR \)-algebra is a factor of \( G \)-algebra by a proper two–sided ideal. There are several comfortable ways to construct \( GR \)-algebras.

1. Generic Matrices: creating a \( G \)-algebra according to the definition.
2. Tensor Products: starting from two \( G \)-algebras \( A \) and \( B \), one can easily create a \( G \)-algebra \( A \otimes \mathbb{k} B \).
3. Library Products: many important algebras are predefined in libraries.

6 Contributors Are Welcome!
- Do you want to implement complicated algorithms in an efficient way?
- Have you even thought of doing this based on SINGULAR?
- Contact us and let us develop together!