Presentation OpenDreamKit

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Singular

SINGULAR

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Algorithmic and Experimental Methods

SINGULAR is a computer algebra system for polynomial computations, with special emphasis on commutative and non-commutative algebra, algebraic geometry, and singularity theory. It is free and open-source under the **GNU General Public Licence**.

SINGULAR provides

- highly efficient core algorithms,
- a multitude of advanced algorithms in the above fields,
- an intuitive, C-like programming language,
- easy ways to make it user-extendible through libraries, and
- a comprehensive **online manual** and help function.

Its main computational objects are ideals, modules and matrices over a large number of baserings. These include

- polynomial rings over various ground fields and some rings (including the integers),
- localizations of the above,
- a general class of non-commutative algebras (including the exterior algebra and the Weyl algebra),
- quotient rings of the above,
- tensor products of the above.

SINGULAR's core algorithms handle

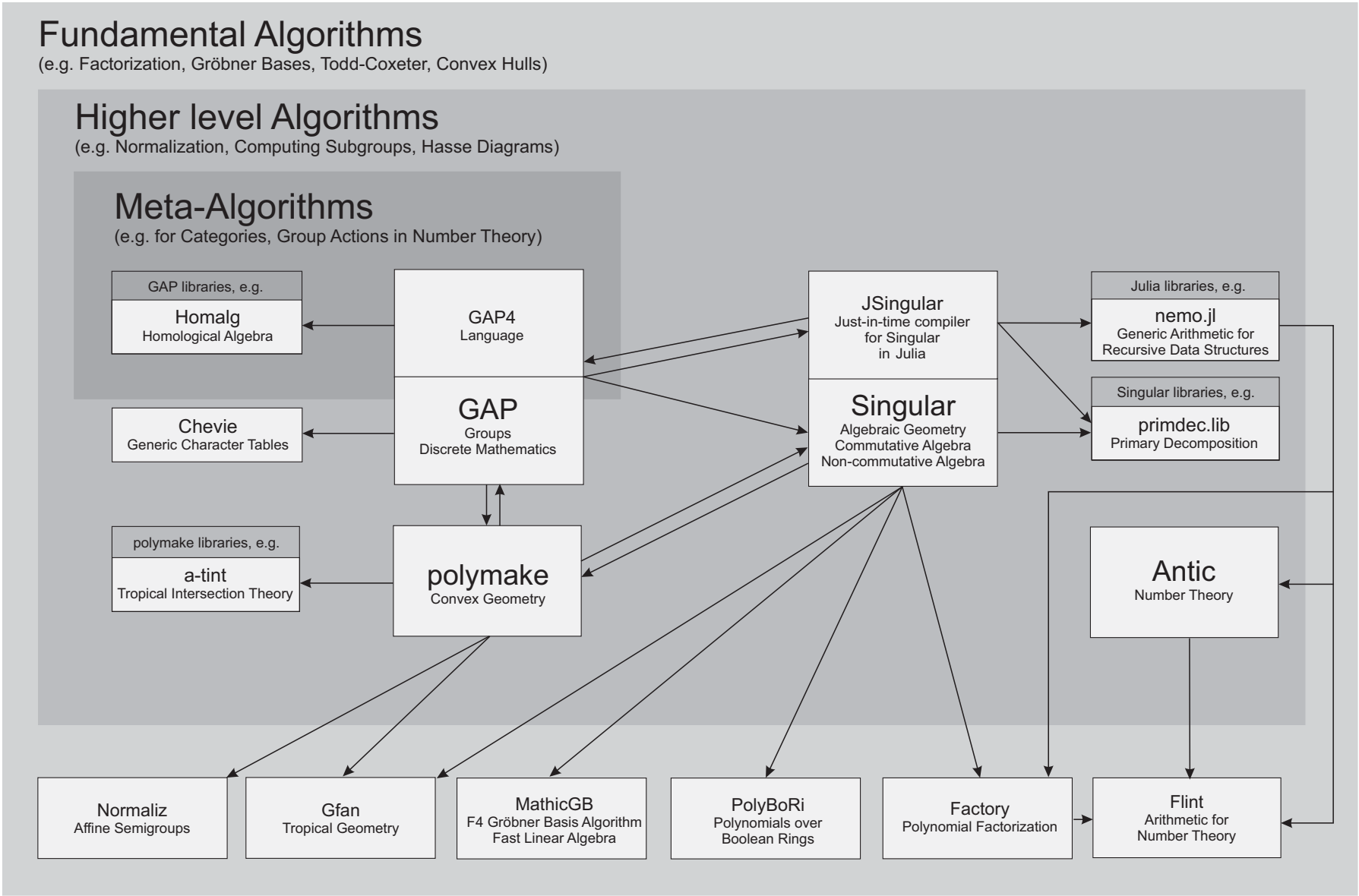
- Gröbner resp. standard bases and free resolutions,
- polynomial factorization,
- resultants, characteristic sets, and numerical root finding.

Its advanced algorithms, contained in currently **more than 90 libraries**, address topics such as **absolute factorization**, **algebraic D-modules**, **classification of singularities**, **deformation theory**, **Gauss-Manin systems**, **Hamburger-Noether (Puiseux) development**, **invariant theory**, **(non-) commutative homological algebra**, **normalization**, **primary decomposition**, **resolution of singularities**, and **sheaf cohomology**.

Further functionality is obtained by combining SINGULAR with **third-party software linked to SINGULAR**. This includes tools for **convex geometry**, **tropical geometry**, and **visualization**.

SINGULAR is developed under the direction of **Wolfram Decker**, **Gert-Martin Greuel**, **Gerhard Pfister**, and **Hans Schönemann** who head SINGULAR's core development team within the **Department of Mathematics** of the **University of Kaiserslautern**.

Software and Cooperation



Priority Programme

Algorithmic and Experimental Methods

in Algebra, Geometry, and Number Theory

DFG Priority Project SPP 1489

Deutsche Forschungsgemeinschaft DFG

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The field of computer algebra allows one to compute in and with a multitude of mathematical structures. It is interdisciplinary in nature, with links to quite a number of areas in mathematics, with applications in mathematics and other branches of science, and with constantly new and often surprising developments.

Particular fruitful interactions unfold between computer algebra and algebraic geometry, number theory, and group theory. Algebraic algorithms open up new ways of accessing subareas of these key disciplines of mathematics, and they are fundamental to practical applications of the disciplines. Conversely, challenges arising in algebraic geometry, number theory, and group theory quite often lead to algorithmic breakthroughs which, in turn, open the door for new theoretical and practical applications of computer algebra.

The goal of the DFG Priority Program SPP 1489 is to considerably further the algorithmic and experimental methods in the afore mentioned disciplines, to combine the different methods where needed, and to apply them to central questions in theory and praxis. Moreover, the programme is meant to support the further development of free computer algebra systems which are (co-)based in Germany, and which in the framework of different projects, may require crosslinking on different levels.

Of particular interest are interactions with application areas inside and outside of mathematics such as system- and control theory, coding theory, cryptography, CAD, algebraic combinatorics, and algebraic statistics as well as hybrid methods which combine numerical and symbolic approaches.