Links to Projects. IMA workshop, Software for Algebraic Geometry, Oct 2006

This document is a collection of links and descriptions of projects related to IMA workshop, Software for Algebraic Geometry.

1. **APAtools**
   `http://`
   License: No public download

   A Maple/Matlab toolbox for approximate polynomial algebra. The toolbox includes software for computing the approximate GCD, approximate factorization, dual basis and multiplicity identification, as well as numerical elimination in solving polynomial systems.

2. **ATLAS**
   `http://math-atlas.sourceforge.net/`
   License: An original license. Partly LGPL for alpha processors

   ATLAS (automatically tuned linear algebra software) provides highly optimized linear algebra kernels for arbitrary cache-based architectures. (It is used by PHoM below.)

3. **Bertini**
   `http://www.nd.edu/~sommese/bertini`
   License: Original (No redistribution, only for education or research, ...)

   Bertini is a software package for computation in numerical algebraic geometry.

4. **CoCoA4**
   `http://cocoa.dima.unige.it/`
   License: The executables are free

   The interactive system CoCoA-4.6 offers facilities for COmputations in COmmutative Algebra: Gröbner bases and related operations on ideals and modules, Hilbert functions, factorization of polynomials, and some exact linear algebra. CoCoA-4.6 is well-suited to teaching with its simple and mathematically natural command language, and an extensive online help facility. It is free and runs on most common platforms.

5. **CoCoALib**
   http://cocoa.dima.unige.it/
   License: GPL, others

   The C++ library CoCoALib offers data structures and operations for COmputations in COmmuative Algebra, most particularly Gröbner bases. Ease of use through a clean design is paramount (with some concessions to guarantee good performance). The library comes with full documentation and numerous example programs. A "beta" release is anticipated in late 2006. A server and interactive system are planned.

6. **CRACK**
   http://lie.math.brocku.ca/crack/src/
   License: freely downloadable

   This is a package for solving systems of equations (algebraic and differential) interactively and automatically. It is especially suited for larger overdetermined systems. Crack needs REDUCE but can also be used online http://lie.math.brocku.ca/crack/demo/ . Running under Parallel-REDUCE on clusters (Intel, AMD64, Cray) it can perform parallel computations.

7. **diffalg**
   http://www-sop.inria.fr/cafe/Evelyne.Hubert/diffalg/
   License: Unknown. Downloading is free. Require Maple.

   The diffalg package is for systems of polynomial differential equations and inequations.

8. **D-modules for Macaulay2**
   http://www.ima.umn.edu/~leykin/Dmodules
   License: GPL. Require Macaulay2

   The package D-modules for Macaulay 2 implements the majority of the now classical algorithms in the computational D-module theory. Based on the ability of Macaulay 2 engine to compute Grobner bases in the Weyl algebra, the package provides, in particular, tools to work with holonomic D-modules such as the algorithms for b-functions, localized modules, restriction, etc. Amongst the applications there are computation of the local cohomology modules, polynomial and rational solutions, and A-hypergeometric systems.

9. **4ti2**
   http://www.4ti2.de
   License: GPL (from the next version 1.3)

   Computation of Hilbert bases, Graver bases, toric Groebner bases.

10. **Gambit**
    http://econweb.tamu.edu/gambit/
    License: GPL

Gambit is a library of game theory software and tools for the construction and analysis of finite extensive and strategic games.

11. **Gfan**
    `http://home.imf.au.dk/ajensen/software/gfan/gfan.html`
    License: GPL

    Gfan is a command line tool for enumerating the reduced Gröbner bases of a polynomial ideal in n variables. Hereby the Gröbner fan, an n-dimensional polyhedral complex, is computed. The tropical variety is a certain subcomplex which can also be computed by the software. Gfan uses Gmp and Cddlib for exact arithmetic and polyhedral computations, respectively.

12. **HOM4PS**
    `http://www.csulb.edu/~tgao/RESEARCH/Software.htm`
    License: GPL

    Solving equations by the polyhedral homotopy continuation method.

13. **HomLab**
    `http://www.nd.edu/~cwample1/HomLab/main.html`
    License: HomLab original license, downloading is free after a registration. Require MATLAB.

    Solving systems of algebraic equations by the homotopy continuation method.

14. **HybridRif**
    `http://`
    License: No public downloading

    Symbolic-Numeric completion of differential systems by homotopy continuation.

15. **KNOPPIX/math**
    `http://www.knoppix-math.org`
    License:

    KNOPPIX/Math is a project to archive free mathematical software and free mathematical documents and provide them on KNOPPIX.

16. **Kronecker**
    `http://www.math.uvsq.fr/~lecerf/software/kronecker`
    License: Unknown. Downloading is free. Require Magma

    System for solving systems of polynomial equations and inequations.

17. **Macaulay2**
    `http://www.math.uiuc.edu/Macaulay2`
    License: GPL

    Macaulay2 is a software system to support researches in algebraic geometry and commutative algebra.

18. **Magma**
    http://magma.maths.usyd.edu.au
    License: Commercial

    Magma is a large, well-supported software package designed to solve computationally hard problems in algebra, number theory, geometry and combinatorics. It provides a mathematically rigorous environment for computing with algebraic, number-theoretic, combinatoric and geometric objects.

19. **Maple**
    http://www.maplesoft.com
    License: Commercial

    Maple is a tool for solving mathematical problems and creating interactive technical applications.

20. **Mathematica**
    http://www.wolfram.com
    License: Commercial

    Mathematica is a system for doing mathematics. The cite also provides http://functions.wolfram.com (a data base for special functions) and http://library.wolfram.com (a collection of notebooks).

21. **math-polyglot**
    http://www.math.kobe-u.ac.jp/math-polyglot
    License: GFL, BSD

    This project is started for editing icms2006 — developer's meeting DVD's. It provides sample codes for mathematical software systems in knoppix/math DVD's. Samples are grouped with mathematical problems. This project also provides inputs for testing and checking if the installation is properly done to the knoppix-math.

22. **MATLAB**
    http://www.mathworks.com
    License: Commercial

    Matlab is a language for technical computing and an interactive environment.

23. **MixedVol**
    http://www.csulb.edu/~tgao/RESEARCH/Software.htm
    License: GPL

    Package to evaluate mixed volumes.

24. **Multroot**
    http://www.neiu.edu/~zzeng/multroot.htm
    License:

    Computing polynomial roots and multiplicities.

25. **Octave**
    http://www.octave.org
    License: GPL

    GNU Octave is a high-level language, primarily intended for numerical computations.

26. **ORMS**
    http://orms.mfo.de
    License:

    The Oberwolfach References on Mathematical Software (ORMS) project is a web-interfaced collection of information and links on mathematical software, see http://orms.mfo.de.

    It presents carefully selected software, including general purpose software systems, teaching software, and more specialized packages up to specific implementations on particular mathematical research problems. Each software package is presented by a short description of its mathematical features, information on basic properties like license type and distribution media are provided, and links to syntax examples, possible demo versions and manuals are given. The ORMS offers a choice of retrieval functions, for example, searching via browsing through a mathematical classification scheme, a structured key word search, and a full text search in the description of the software systems.

    The success of this project will rely on the co-operation of experienced users from different areas of mathematical software. We therefore encourage discussion (at orms@mfo.de) and we will be grateful to contributions (at contrib-orms@mfo.de).

27. **PHCpack**
    http://www.math.uic.edu/~jan/download.html
    License: GPL, free software

    PHCpack is a package for Polynomial Homotopy Continuation. Version 1 was archived by ACM TOMS as Algorithm 795. Currently it is a platform for "numerical algebraic geometry" providing algorithms developed jointly with Andrew Sommese and Charles Wampler. Contributions made by Anton Leykin, Yusong Wang, Ailing Zhao, and Yan Zhuang. (Jan Verschelde, UIC.)

28. **PHCmaple**
    http://www.ima.umn.edu/~leykin/PHCmaple
    License: GPL

    This Maple package provides a convenient interface to the functions of PHCpack, a collection of numerical algorithms for solving polynomial systems using polynomial homotopy continuation.

29. **PHoM**
    http://www.is.titech.ac.jp/~kojima/PHoM/index.html
    License: GPL

    A software package for a polyhedral homotopy continuation method of finding all isolated solutions of a system of n polynomial equations f(x) = 0.

30. **Rifsimp**
    http://www.cecm.sfu.ca/~wittkopf/rif.html
    License: Unknown. Downloading is free and is also a Maple package. Require Maple.

    Simplification package for overdetermined polynomially nonlinear PDE or ODE systems

31. **Risa/Asir**
    http://www.math.kobe-u.ac.jp/Asir
    License: Other(FFL, BSD)

    Risa/Asir is a computer algebra system. Here is a list of some commands: fctr (factorization), gr, nd_gr_trace (Groebner basis), primadec (primary ideal decomposition), af (factorization over algebraic numbers), ifplot (plot of implicit functions), ox_* (OpenXM communication functions), generic_bfct (b-function).

32. **SAGE: Software for Algebra and Geometry Experimentation**
    http://sage.scipy.org/sage
    License: GPL

    The mathematics software system SAGE comes with GAP, PARI, Singular, and Maxima, and provides interfaces to KASH/KANT, Macaulay2, Gnuplot, Octave, Magma, Mathematica, and Maple. It uses Python for the interactive interpreted language. It includes functions for algebraic number theory, basic algebraic geometry, elliptic curves, modular forms, linear algebra and Z-modules, and inherits functionality from the systems it includes.

33. **SALSA**
    http://fgbrs.lip6.fr/salsa/Software/
    License: Unknown. Downloading is free.

    SALSA Software contains recent algorithms for computing certified solutions of systems of polynomial equalities, inequalities and inequations. It consists of FGb, RS, RAGlib, DV.

34. **SDPT3**
    http://www.math.nus.edu.sg/~mattohkc/sdpt3.html
    License: Unknown. Downloading is free. Require MATLAB

    A software for semidefinite-quadratic-linear programming. (It is used by SOStools.)

35. **SeDuMi**
    `http://sedumi.mcmaster.ca/`
    License: GPL. Require Matlab.

    Software for optimization over symmetric cones. (It is used by SOStools.)

36. **Singular**
    `http://www.singular.uni-kl.de`
    License: GPL, others

    SINGULAR is a Computer Algebra System for polynomial computations with emphasis on the special needs of commutative algebra, algebraic geometry, and singularity theory. SINGULAR's main computational objects are ideals and modules over a large variety of rings, including local rings and non-commutative G-algebras (in the subsystem PLURAL). Large variety of algorithms, including those based on Gröbner and standard bases, have powerful implementations in SINGULAR.

37. **SOSTOOLS**
    `http://www.cds.caltech.edu/sostools/`
    License: GPL. Require MATLAB and (SeDuMi or SDPT3) package

    It solves sums of squares (SOS) optimization programs.

38. **SparsePOP**
    `http://www.is.titech.ac.jp/~kojima/SparsePOP`
    License: Unknown. Downloading is free. Require Matlab and SeDuMi.

    SparesPOP is an implementation of a sparse semidefinite programming (SDP) relaxation method.

39. **SYNAPS**
    `http://www-sop.inria.fr/galaad/logiciels/synaps`
    License: GPL

    SYNAPS (SYmbolic Numeric APplications) is a C++ library devoted to symbolic and numeric computations. It provides data-structures for the manipulation of basic algebraic objects, such as vectors, matrices (dense, sparse, structured), univariate and multivariate polynomials. It contains solvers for univariate and multivariate polynomials, including generalized normal form or subdivision solvers, tools for the manipulatiion of algebraic numbers, for the construction of resultants, ...

About this document

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