

# MATHEMATICA<sup>®</sup>5

*The Advanced Algorithms Release—  
Introducing hundreds of new features  
and major enhancements, including:*

- Record-breaking speed for numerical linear algebra
- Wide-ranging support for fast sparse matrix operations
- New-generation optimized numerical solvers for ordinary and partial differential equations
- Major new algorithms for solving equations and inequalities symbolically over complex numbers, reals, and integers
- Fully integrated solver for differential algebraic equations
- High-performance optimization and linear programming, including interior point method
- Extensive support for vector and array functions in numeric solvers
- Ground-breaking solver for recurrence equations
- Broader support for domain specifications in symbolic computation
- *.NET/Link™* for full integration with Microsoft .NET framework
- Flexible import and export of DICOM, PNG, SVG, and sparse matrix formats
- Optimized versions available for 64 bit hardware and operating systems
- New quick-start interactive tutorial



*Mathematica* 5 introduces important extensions to the *Mathematica* system, especially in scope and scalability of numeric and symbolic computation. Building on the core language and extensive algorithm knowledge base of *Mathematica*, Version 5 introduces a new generation of advanced algorithms for a wide range of numeric and symbolic operations.

## NUMERICAL COMPUTATION

Major optimization of dense numerical linear algebra  
 New optimized sparse numerical linear algebra  
 Support for optimized arbitrary-precision linear algebra  
 Generalized eigenvalues and singular value decomposition  
**LinearSolveFunction** for repeated linear-system solving  
 $p$  norms for vectors and matrices  
 Built-in **MatrixRank** for exact and approximate matrices  
 Support for large-scale linear programming, with interior point methods  
 New methods and array variable support in **FindRoot** and **FindMinimum**  
**FindFit** for full nonlinear curve fitting  
 Constrained global optimization with **NMinimize**  
 Support for  $n$ -dimensional PDEs in **NDSolve**  
 Support for differential-algebraic equations in **NDSolve**  
 Support for vector and array-valued functions in **NDSolve**  
 Highly extensive collection of automatically-accessible algorithms in **NDSolve**  
 Finer precision and accuracy control for arbitrary-precision numbers  
 Higher efficiency big number arithmetic, including processor-specific optimization  
 Enhanced algorithms for number theoretical operations including **GCD** and **FactorInteger**  
 Direct support for high-performance basic statistics functions

## SYMBOLIC COMPUTATION

Solutions to mixed systems of equations and inequalities in **Reduce**  
 Complete solving of polynomial systems over real or complex numbers  
 Solving large classes of Diophantine equations  
**ForAll** and **Exists** quantifiers and quantifier elimination  
 Representation of discrete and continuous algebraic and transcendental solution sets  
**FindInstance** for finding instances of solutions over different domains  
 Exact constrained minimization over real and integer domains  
 Integrated support for assumptions using **Assuming** and **Refine**  
**RSolve** for solving recurrence equations  
 Support for nonlinear, partial, and  $q$  difference equations and systems  
 Full solutions to systems of rational ordinary differential equations  
 Support for differential-algebraic equations  
**CoefficientArrays** for converting systems of equations to tensors

## PROGRAMMING AND CORE SYSTEM

Integrated language support for sparse arrays  
 New list programming with **Sow** and **Reap**  
**EvaluationMonitor** and **StepMonitor** for algorithm monitoring  
 Enhanced timing measurement, including **AbsoluteTiming**  
 Major performance enhancements for **MathLink**  
 Optimization for 64-bit operating systems and architectures  
 Support for computations in full 64-bit address spaces

## INTERFACES

Support for more than 50 import and export formats  
 High efficiency import and export of tabular data  
 PNG, SVG, and DICOM graphics and imaging formats  
 Import and export of sparse matrix formats  
 MPS linear programming format  
 Cascading style sheets and XHTML for notebook exporting  
 Preview version of **.NET/Link** for integration with **.NET**

## NOTEBOOK INTERFACE

Enhanced Help Browser design  
 Automatic copy/paste switching for Window  
 Enhanced support for slide show presentation  
**AuthorTools** support for notebook diffs

## STANDARD ADD-ON PACKAGES

Statistical plots and graphics  
 Algebraic number fields

## NEW IN VERSIONS 4.1 AND 4.2

Enhanced pattern matching of sequence objects  
 Enhanced optimizer for built-in *Mathematica* compiler  
 Enhanced continued fraction computation  
 Greatly enhanced **DSolve**  
 Additional **TraditionalForm** formats  
 Efficiency increases for multivariate polynomial operations  
 Support for import and export of DXF, STL, FITS, and STDS data formats  
 Full support for CSV format import and export  
 Support for UTF character encodings  
 Extensive support for XML, including **SymbolicXML** subsystem and **NotebookML**  
 Native support for evaluation and formatting of **Nand** and **Nor**  
 High-efficiency **CellularAutomaton** function  
**J/Link's MathLink**-based Java capabilities  
**MathMLForm** and extended **MathML** support  
 Extended simplification of **Floor**, **Erf**, **ProductLog**, and related functions  
 Integration over regions defined by inequalities  
 Integration of piecewise functions  
 Standard package for visualization of regions defined by inequalities  
**ANOVA** standard add-on package  
 Enhanced **Combinatorica** add-on package  
**AuthorTools** notebook authoring environment

**MATHEMATICA 5 IS AVAILABLE FOR:**  
 Windows, Mac OS X, Linux (x86, Alpha), Solaris,  
 HP Tru64 Unix, HP-UX, IBM AIX

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For complete specifications and technical requirements see  
[www.wolfram.com/mathematica](http://www.wolfram.com/mathematica)