# MATHEMATICA® 4

# Mathematica 4.1 adds more connectivity, high speed statistics, and new solvers to the world's leading technical computing and communications software.

*Mathematica* 4.1 extends the technologies and advances pioneered by Wolfram Research, Inc. in *Mathematica* 4.0. Enhanced solvers, functions, and an improved pattern matcher and compiler allow scientists and researchers to solve more complex problems more quickly. MathML and HTML integration helps academics and technical professionals to share their work over the Internet, while *J/Link* allows the design of innovative applications combining the strengths of *Mathematica* and Java.

## Key new features in *Mathematica* 4.1 include:

### *Greatly enhanced symbolic differential equation solvers*

The symbolic differential equation solvers in *Mathematica* 4.1 are completely redesigned, and now cover almost all classical methods. Some examples are: a new implementation of Kovacic's algorithm for solving second-order linear homogeneous differential equations with rational function coefficients; powerful new methods and symmetry techniques for solving first-order nonlinear differential equations; improved recognition of differential equations for special functions; and powerful integrating factor methods for second-order nonlinear ordinary differential equations. Also, the methods for finding solutions of partial differential equations are upgraded significantly.

### *Dramatic speed improvements in statistics functions*

Improvements in the statistical algorithms span a large variety of operations, from relatively simple ones like harmonic means to linear and nonlinear regression. For example, linear regression in *Mathematica* 4.1 is almost 100 times faster than the same operation in *Mathematica* 4.0. Overall, a test suite of 15 commonly used statistical functions shows 4.1 being seven times faster than 4.0 on average.

### *Improvements to the Mathematica pattern matcher and compiler*

*Mathematica* 4.0 introduced packed array technology, a much faster and more efficient way to operate on large data sets and matrices. *Mathematica* 4.1 adds new optimizations in the compiler and pattern matcher. This speeds up repetitive operations and calculations involving large arrays even further.

### *Full Java integration with J/Link 1.1*

Java and the Internet are having an enormous impact on the way corporations, researchers, and developers think about software, business, and communications. The complete and transparent integration of *Mathematica* and Java with *J/Link* opens up exciting new possibilities for our users by making all the functionality of Java applications available in *Mathematica*, while at the same time opening up all of *Mathematica* to Java programs.

### *Improved MathML integration, including copying and pasting of formulas to web browsers*

MathML import and export capabilities have been expanded to include direct conversion of typeset mathematical expressions to MathML and copy and paste between MathML and *Mathematica* syntax. This enables web designers and users of MathML-compatible web browsers or plug-ins to copy MathML code from their web browser, evaluate it in *Mathematica*, and paste the result back into XML or HTML pages.

### *New and faster import and export filters for Excel files, tabular data, compressed BMP, DXF, and STL*

In addition to the already strong import and export filters that make *Mathematica* one of the most interoperable software packages, *Mathematica* 4.1 now supports Excel spreadsheet format, comma separated text files, compressed Windows device-independent Bitmap (.bmp), AutoCAD drawing interchange format (.dxf), and STL stereolithography format (.stl), bringing the number of supported file formats to approximately 40.

### *New platforms: LinuxPPC and AlphaLinux*

*Mathematica* 4.1 brings the world's leading technical computation and communication software to these exciting and growing platforms. *Mathematica* 4.1 and *Parallel Computing Toolkit* provide an excellent platform for solving large-scale problems on AlphaLinux-based clusters that are increasingly popular in many academic institutions.

### *New standard packages*

*Mathematica* 4.1 includes new standard packages offering multiple integration over inequality defined regions and piecewise functions, visualizing logical combinations over the reals in two and three dimensions, discrete trigonometric transforms, and conversion between linear systems of equations and matrices.

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## *Principal Enhancements in Version 4.1*

### *Notebook and User Interface*
Enhanced error and help message system
Enhanced traditional typesetting formats
New functions:
- `CopyAs→MathML`
- `MathMLForm`

### *System and Program Interface*
Additional compiler enhancements include higher optimization levels
Enhanced pattern matching performance
Enhanced support for very long-running or very large computations
Additional import and export formats including: Excel spreadsheet format (CSV) and compressed Windows device-independent Bitmap (BMP)
New functions:
- `Ordering`
- `Nand`
- `Nor`

### *Numerical Computation*
Optimized algorithms for statistical computation
Numericalization of `Root` objects
`ContinuedFraction` improvements

### *Algebraic Computation*
Greatly enhanced symbolic differential equation solving
Support for multiple integration over inequality defined regions
Implementation of `GCD` by Chinese remainders
`Expand` improvements
Evaluation of `Roots` for polynomials with algebraic number coefficients
`Simplify` enhancements
Enhanced `Solve` for large linear systems
`InequalitySolve` improvements

### *Graphics and Sound*
Optimized import of tabular data
Support for import/export of DXF and STL
`InequalityGraphics` for plotting of logical combinations of inequalities in 2D and 3D
`RealTime3D` support under X
Sound support under X

### *Lists and Matrices*
New functions:
- `LinearExpressionToMatrix`
- `LinearExpressionToSparseMatrix`

### *Miscellaneous*
New standard package: `FourierTrig`
*MathLink* revision 8
*J/Link* 1.1


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