Maple™ 12 What’s New

The Essential Tool for Mathematics and Modeling

Smart Document Environment
Maple’s smart document interface is easy to learn and easy to use. New features in Maple 12 include new plotting and visualization tools, and additional support for technical document creation.

Highlights:
- New interactive embedded components include dials, gauges, and radio buttons.
- The Exploration Assistant allows you to instantly create interactive mini-applications used to explore the parameters of expressions. Other improved “clickable” tools include palettes, task templates, and the drawing canvas.
- New plotting capabilities dramatically simplify the creation of complex engineering plots. New plot types include dual axis plots, polar plots, and specialized engineering plots such as frequency domain responses and root-locus plots.
- New code edit regions, including a start-up code region for initialization code, provide a convenient means of developing your programs directly inside the final application document.
- Command completion templates provide a fill-in-the-blank approach to common commands.
- More document layout templates, document headers and footers, and table enhancements make it even easier to create polished documents.
- A new Plotting Guide provides easy access to Maple’s plotting types and options, while the updated Getting Started Guide for new users includes many more examples using interactive, “clickable” methods as well as command-based solutions.

The World’s Richest Computational Environment
Maple supports sophisticated analyses combining high-performance numeric and symbolic computations. Maple 12 enriches the computational environment with new built-in functionality.

Highlights:
- The new Dynamic Systems package offers a large selection of analytic and graphing tools for linear time-invariant systems, which are essential in control systems development.
- Improvements to solvers for differential equations (ODEs), partial differential equations (PDEs), and differential algebraic equations (DAEs) continue to strengthen Maple’s world-leading position in numeric and symbolic differential equation solving. Enhancements include the ability to symbolically solve entire classes of ODEs for which no algorithms previously existed, and support for user-defined events in numeric solutions to DE and DAE initial value problems.
- Wavelet transforms have been added to the Discrete Transforms collection.
- Performance improvements include fast block copy for matrices and powerful multi-dimensional data interpolation functionality.
- Various programming improvements include improved syntax for entering and indexing arrays and matrices.
- Multi-threading enhancements make multi-threaded programs easier to write and more efficient.
- Numerous improvements and additions include the new ability to analyze and solve systems of parameterized polynomial equations and inequalities, and enhancements to equation solving, number theory, and linear algebra.

Fully Integrated in your Existing Workflow
Maple can be integrated into your existing workflow. Maple 12 offers connectivity to many new tools, as well as enhancements to existing functionality.

Highlights:
- CAD connectivity adds important analysis capabilities to CAD systems.
- MATLAB® to Maple code translation allows you to leverage existing work.
- Database connectivity gives you the ability to apply analysis and visualization tools to large datasets.
- Code generation and the Maple compiler now support complex arithmetic and elementary functions.
New Features

MATHMATICAL COMPUTATIONS

Differential Equations

New algorithms for solving entire classes of first and second order non-linear ODEs and third order linear ODEs.

New transformation techniques, included in DEtools, for converting equations into forms that Maple can solve, making it possible to find solutions to many equations for which there was previously no known solution.

Expansion of DEtools, including commands for working with Euler's operator, conserved currents, and generalized integrating factors, and for computing the general solution for some linear PDE families by using Laplace invariants.

Numeric Solutions - Differential Equations (DEs) and Differential Algebraic Equations (DAEs)

Numeric solutions to initial value problems with ordinary differential equations (ODE IVP) and differential algebraic equations (DAE IVP) have many new properties:

• The ability to handle user-defined events: when the event occurs, user-defined actions can be performed or a new event can be triggered.
• Parametric problem definition: a procedure can be formed for a whole class of ODEs or DAEs, then parameters can be adjusted and different solutions obtained interactively.
• Definition of discrete variables as part of the problem description: when combined with events, discrete variables can be used to handle stopping criteria, most conditions, zero-order holds, and most other events that occur in ODE and DAE system simulation.

New Packages

Dynamic Systems

• Commands for creating, analyzing, simulating, and plotting linear time-invariant systems, which are essential steps in control systems development.
• Model representations: transfer function, differential/equation, state space, zero/pole/gain models.
• Plotting tools: time and frequency domain responses, root-locus and root-contour plots, and plots of zeros and poles of a linear system.

Bits

• Ability to execute efficient bit-wise operations in Maple.
• Facilities for import and export type operations (splitting and joining), display, common queries, and bit-wise applied logic operations.

Enhanced Packages

Array Tools

• Improvements to the efficient interaction and manipulation of Arrays.
• Eleven new commands, including tools for performing block copies, extracting the upper and lower triangular regions, and searching for the location of non-zero elements.

Curve Fitting

• New ability to apply interpolation methods on n-dimensional data sets.
• Quick and efficient data resampling and table lookup.

Differential Geometry

• Enhancements to the Tensor subpackage include efficiency improvements and a new command for calculating sectional curvature.
• The LieAlgebra subpackage now supports calculations of Lie algebra commutator coefficients with a commutator in a representation.

Discrete Transforms

• New numerical waveform transforms.
• Waveform filters for the common families of wavelets, including Daubechies wavelets, Symlets, Coiflets, Battle-Lemarie (orthogonal spline) wavelets, and Biorthogonal spline wavelets.
• Wavelet plot tool for visualizing wavelets.
• Ability to define custom waveform filters.

Linear Algebra

• Contains a new routine for computing Kronecker tensor products.
• New command tests whether a polynomial is cyclic, and returns the order of the polynomial.

Physics

• The FeynmanDiagrams command now computes the tree level diagrams corresponding to the given interaction Lagrangian.
• The ChangeBasis command has been enhanced, and new vector formal conversion routines have been added.

Regular Chains

New ConstructibleSetTools subpackage offers a set of tools to compute with semialgebraic sets.

New ParametricSystemTools subpackage offers new tools to study the solutions of polynomial systems with parameters in their coefficients.

Root Finding

• New subpackage supplies tools for analyzing and solving systems of polynomial equations and inequalities depending on parameters.
• Provides the ability to ask questions such as “For which parameter values does the system of equations have at least one solution?”

Sum Tools

• The SumDecomposition command has been enhanced to allow more control over the type of minimization performed for rational function inputs.

Statistics

• Enhanced plotting facilities include the ability to create a visual representation of the symmetry of a one-dimensional data set about its median, and to create plots that simplify viewing large quantities of data in one, two, and three dimensions.
• New command removes data in large data sets based on the density of point clustering.

Student Vector Calculus

• The Student/VectorCalculus package has been updated to take advantage of recent enhancements in vector calculus support in Maple.

General

• Sets now have a deterministic ordering that is not based on runtime properties. The order of elements will remain the same between sessions no matter when the set was created and what operating system is used.
• A new version of Zeilberger’s algorithm for definite hypergeometric summation, based on universal denominators, has been added to the SumTools/Hypergeometric package, while its analog has been added to DEtools.
• A version of Zeilberger’s summation algorithm has been added to the QDifferenceEquations package.

Numerical

• The solve command has been enhanced to handle systems of procedures of more than one argument.
• The VectorTools command now provides several new options, which add the Multiple Polynomial Quadratic Sieve (MPQS) method and provide enhanced access to existing methods.
• The numeric:code and routine support library have been enhanced to support complete arithmetic and calls to arbitrary functions of a complete argument.

Efficiency

• The solve command takes further advantage of the FGb library, the worlds most efficient Groebner bases engine. It also uses a new, faster sparse exact linear system solver for systems with rational coefficients.
• Several enhancements have been made to the zip command, resulting in speed-ups of over 100 times in some cases.

• New block copy mechanism for matrices is much more efficient, since intermediate objects are no longer created.
• Expansion of large polynomials through the expand command has been made faster.
• The multi-threaded/parallel kernel is more efficient.

USER INTERFACE

Usability

• The Exploration Assistant allows you to instantly create interactive mini-applications useful for exploring the parameters of expressions, using sliders to control your variables.
• More than a dozen new task templates have been added.
• Command completion has been extended to include templates for calling sequences.
• The Getting Started Guide for new users includes many more examples using interactive, “clickable” methods as well as command-based solutions.
• The Maple Portal for Students acts as a guide for hundreds of common tasks from mathematics courses.
• The toolbar items for changing the background and foreground color of text have been enhanced with a new color picker.
• The Examples section of help pages can be displayed in 1-0 or 2-D math.
• The Maple command-line interface optionally stores command history between Maple sessions.
• Worksheet magnification options have been expanded to support 125% magnification.
• The Student Help Center, Teacher Resource Center, and other web-based resources can be accessed directly from Maple.

Document Creation

• Add running headers and footers to your printed documents by using predefined or custom formats.
• New pre-defined document templates include design sheets, interactive application, and technical report layouts.
• The start-up code region provides a convenient place to put any initialization code for your document, which will be automatically executed upon opening the document.
• The Code Edit Region allows the entry of Maple procedures within a region that can be optionally hidden in your document.
• Tables now support the ability to set the background color of individual cells.
• New interactive embedded components include dials, gauges, and radio buttons.
• The embedded plot component now supports actions, which can be performed when a 2-D plot is clicked, dragged, or when a drag ends.
• Sliders support floating-point tickmark values and spacing.
• Toggle button images are now customizable.

Visualization

• Dual axis and polar axis plots are available through both interactive tools and commands.
• New engineering plots, including time and frequency domain responses and root-locus and root-contour plots, are available from the new Dynamic Systems package.
• Plot attributes changed interactively are remembered on re-execution of the original command.
• The plotcompare command has a new option to plot the real and imaginary parts of an expression, typically involving special functions, in less 3-0 boxes.
• A new Plotting Guide makes the available plot types easier to navigate.

CONNECTIVITY

CAD

• New CAD system connectivity allows you to retrieve parameters from a CAD drawing and send new values back to be automatically incorporated in the design.
• Includes the CAD Link Assistant, an interactive tool for viewing and modifying the scalar properties of a CAD model.
• Links to SolidWorks® and Autodesk Inventor® software.

Database

• New package allows you to query, update, and create databases from within Maple.
• Easy-to-use Maplet® assistant for managing connections and building queries makes detailed knowledge of SQL unnecessary.
• Works with JDBC-compliant databases, such as Microsoft® SQL Server®, Microsoft Access®, Sybase®, Oracle® BMS ORG®, and MySQL®.

MATLAB® Link

• New MATLAB to Maple code translator.
• Converts and automatically executes MATLAB commands by using the Maple equivalents.
• Works with single commands or MATLAB m-files.
• Supports basic operations, matrix indexing, and matrix construction, and over 100 MATLAB commands that are automatically mapped to their Maple equivalents.

Code Generation

• The Fortran and MATLAB® code-generators now support complex numeric data types.

PROGRAMMING

• Improved syntax for entering and including arrays, vectors, and matrices combines convenient notation with efficient operation.
• New, simple notation provides the ability to grow arrays past their endpoints in a memory-efficient way.
• Implicit range endpoints are now supported for arrays, lists, sets, sequences, and strings.
• Many more examples using interactive, “clickable” templates for calling sequences.

• The standard Maple kernel now supports multi-threaded operations; there is no need to launch a separate kernel.
• The new Security package provides a set of user-level routines for modifying and testing security settings in the Maple engine.

For more details on new and improved features in Maple 12, visit www.maplesoft.com.