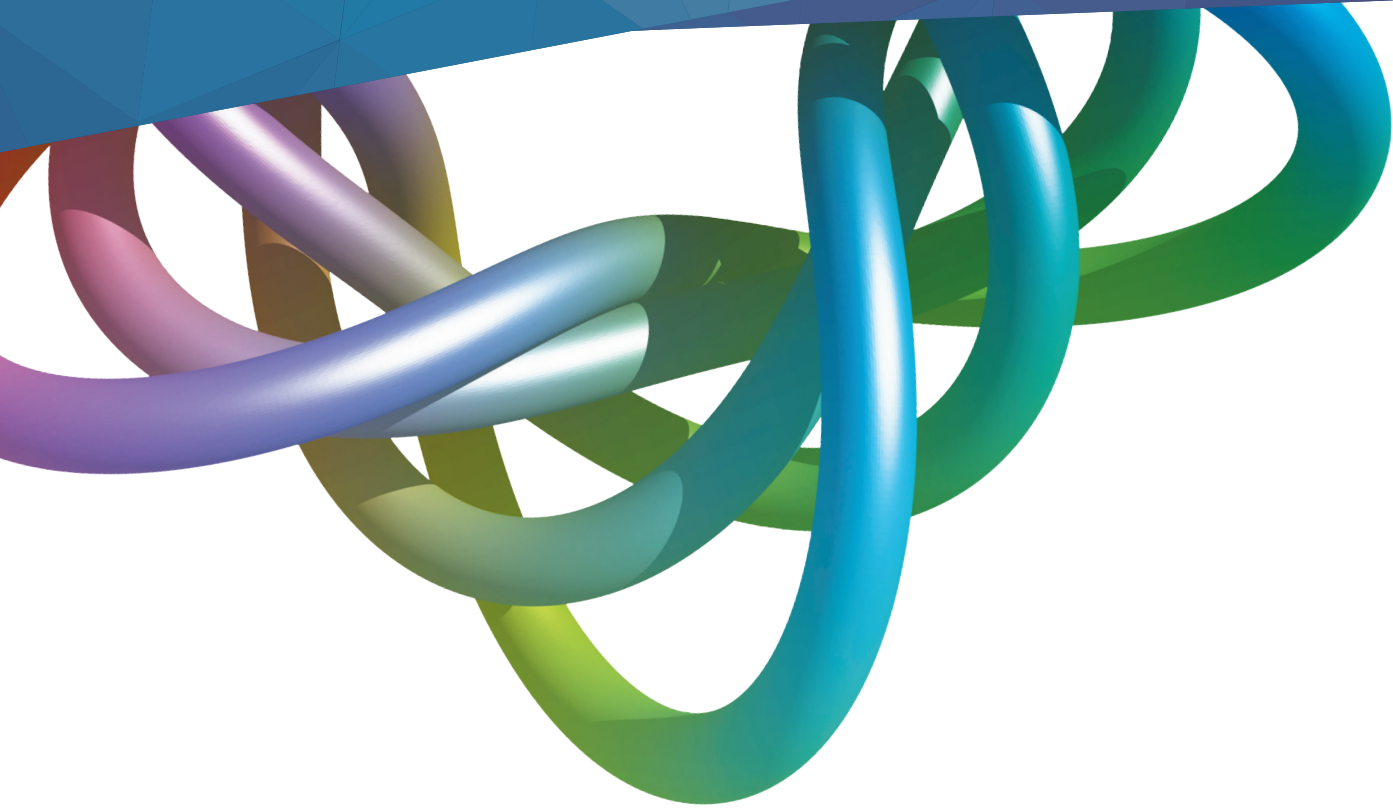


# Maximize the Value of Your Calculation Efforts



Maple™

# Calculation Management with Maple

Maple is a software tool that combines a powerful mathematics engine with an interface that makes it easy to manage your calculations, so you can treat them like the valuable assets they are.

## Powerful Mathematical Tool

Maple can handle all your mathematical needs, from performing simple calculations to advanced computations, visualizations, data analysis, and algorithm development.

## Calculation Management Environment

Maple provides an environment that helps you maximize the value of your calculation efforts. With Maple, you can easily validate, document, retain, reuse, and modify your calculations, reducing risk while saving time and effort in both current and future projects.

## Calculations are a Vital Company Asset!

How much time has your company lost because a calculation was entered incorrectly, misplaced, misapplied, or had to be reconstructed because no one knew where it came from? Maple lets you treat your calculations as a vital company asset, so you can:

- Avoid errors with easy validation of calculations.
- Retain all the mathematics that went into your product in a single place, not scattered over notebooks, spreadsheets, napkins, and the project teams' brains.
- Always have a record of where "that" number came from, even long after the project is over.
- Record underlying assumptions so you can recognize when a parameter value should and should not be used in new situations.
- Retain vital project information long after the key engineer has left.
- Prevent redundant calculation work.
- Safely reuse and modify past calculations because you have a record of thinking behind the results.

The screenshot displays the Maple software interface with several windows open. On the left, a window titled "Adiabatic Mixing of Air in HVAC System" shows an introduction and thermophysical properties of input air streams. It includes a schematic of two air streams (1 and 2) mixing into stream 3. Below this is a psychrometric chart and a 3D visualization of a mixing process. In the center, a window titled "Impeller Design" shows a table of dimensions for a hub, shaft, impeller eye, inlet vane edge, and impeller diameter, along with a 3D model of the impeller and a circular diagram of the vane layout. On the right, a window titled "Analysis of Leakage Loss" provides the formula  $Q_L = C_L \sqrt{TD}^3$  and defines the variables C, A, and D. At the bottom, a window shows a frequency spectrum plot with Power (dB) on the y-axis and Frequency (kHz) on the x-axis.

## Powerful Mathematical Tool

Whether you want to perform quick calculations, create design sheets, or develop your own algorithms and interactive applications, Maple has all the mathematics you need in an environment that makes it easy to get the job done.

- **Over 5000 functions covering virtually every area of engineering**, including differential equations, data analysis, optimization, fluid and chemical properties, and control system design
- **Intuitive problem entry** and interactive environment for quick explorations
- **Sophisticated programming language** for efficient development of solutions and algorithms
- Both **symbolic and numeric algorithms** for flexible problem solving
- **World-leading algorithms** for finding solutions that are beyond the reach of any other software system
- Extensive collection of **customizable 2-D and 3-D plots and animations**
- Efficient algorithms and tools for **high performance computing and large-scale problem solving**
- **Built-in support for units** in your calculations
- **Numerous connectivity features**, including extensive import/export facilities, optimized code generation, connectivity to MATLAB® and Excel®, and more
- **Rich authoring environment** for creating technical documents and applications

It's time to treat your calculations as an essential company asset, and manage them with the attention they deserve.



## Calculation Management Environment

The mathematical foundation of many engineering projects is frequently done haphazardly on paper or in a spreadsheet, but such an informal approach comes with risks. Not only can calculation mistakes propagate throughout your entire project, but you also risk the loss of the assumptions, insights, and derivation details needed for future work. With Maple, you can treat your calculations like the valuable asset they are.

- **Mathematical expressions are displayed in standard notation**, so they are easy to interpret and any mistakes made when entering the problem are simple to spot and correct.
- You can combine math, text, images, plots and more in a single document, so you can **record your all your assumptions, reasoning, insights, and conclusions together with your calculations**, so they are always available when you need them.
- **All of your calculations, documentation, data, and analyses are stored as a single file** so nothing gets lost and it is easy to share your work with others.
- **Multiple deployment options** are available for making your Maple documents and interactive applications available to others, even if they do not have Maple.

## Key Features

### Mathematics

Maple includes over 5,000 computational functions covering virtually every area of mathematics, including:

- Abstract Algebra
- Algebra
- Algebraic Curves
- Calculus
- Combinatorial Functions
- Combinatorial Structures
- Complex Arithmetic and Functions
- Computational Geometry
- Curve Fitting
- Differential Algebra
- Differential Equations
- Differential Forms
- Differential Geometry
- Discrete and Integral Transforms
- Dynamic Systems
- Euclidean Geometry
- Financial Mathematics
- Fluid Properties
- Gaussian Integers
- Generating Functions
- Graph Theory
- Group Theory
- Lie Symmetries
- Linear Algebra
- Linear Functional Systems of Equations
- Linear Operators
- Linear Programming
- Linear Recurrence Equations
- Logic
- Numerical Approximations
- Number Theory
- Optimization
- Orthogonal Polynomials
- P-adic Numbers
- Physics
- Polynomials
- Polynomial Systems
- Q-Difference Equations
- Rational Normal Forms
- Real Domain Computations
- Series Expansions
- Scientific Constants
- Scientific Error Analysis
- Signal Processing
- Special Functions
- Statistics
- Statistical Process Control
- Symbolic-Numeric Algorithms for Polynomials
- Tensors
- Time Series Analysis
- Tolerances
- Units and Dimensions
- Variational Calculus
- Vector Calculus

### Symbolic and Numeric Computations

- Work with exact quantities such as fractions, radicals, and symbols, eliminating accumulated round-off errors
- Choose from a variety of exact and approximate techniques, as best suits your needs
- Approximations can be computed at any precision that is required, and are not restricted by hardware limitations
- Solvers use a combination of symbolic and numeric techniques, allowing them to solve problems for which either approach alone would be insufficient

### Visualization

- 2-D and 3-D graphs and animations, created through menus, commands, and interactive assistants
- Over 200 plot types and options, including implicit, contour, complex, polar, vector field, conformal, density, ODE, PDE, engineering, and statistical plots

- Smart plot view automatically focuses on the region of a 2-D plot that is most meaningful
- Light modeling, legends, axis control, titles, glossiness, gridlines, and transparency
- Display typeset text and mathematical expressions in plot titles, labels, legends, tickmark labels, pop-up annotations, and axis labels
- International (non-English) characters in titles, legends, and labels
- Plot annotations for 2-D and 3-D plots include arrows, shapes, and drawing tools
- Zoom and pan 2-D and 3-D plots and animations
- Real-time rotation of 3-D plots
- Fly-through animations of 3-D plots using user-defined camera paths
- Interactive control of parameters through sliders
- Live Data Plots for creating and customizing statistical plots such as area charts, histograms, and pie charts
- Standard geometric objects, regular solids, and polyhedra
- Layering of graphics and animations of different types
- Wide variety of coordinate systems
- Create and manipulate many kinds of data structures, including sets, strings, lists, arrays, stacks, queues, records, and modules
- Tools for manipulating mathematical objects, including polynomials, integrals, and sums
- Powerful type system, including ability to extend existing types
- Generate and manipulate Maple worksheets through their XML representation
- User-level routines for multi-threaded and multiprocess programming on multi-core computers
- Compiler package, CUDA™ support, parallel algorithms, and optimization tools promote highly efficient user code for numeric computations
- External function interface for transparent access to dynamic libraries
- Interactive embedded components include buttons, sliders, plots, check boxes, list boxes, toggle buttons, radio buttons, dials, gauges, data tables, videos, microphone, speaker, and mathematical expression boxes for entering and displaying 2-D math
- Customizable context-sensitive menus
- Tools for building interactive applications

### User Interface

- Technical document environment with comprehensive word processing tools
- Easy problem entry with Clickable Math™ features, including a math equation editor, palettes, and context-sensitive, self-documenting operations
- Hundreds of task templates for fill-in-the-blank problem solving
- Interactive assistants for many tasks, including equation manipulation, analyzing ODEs and ODE systems, creating plots and matrices, converting units, and exploring parameters in expressions
- Command completion and code editor
- Tables, symbolic spreadsheets, code regions, drawing canvas, and interactive components such as buttons, sliders, and dials
- MapleCloud™ for easy exchange of documents, applications, and packages with colleagues

### Programming

- Full featured programming language for scripts, programs, and full applications
- Interpreted language supports easy exploration and fast prototyping
- Procedural, functional, and object oriented programming
- Advanced features include operator overloading, assumptions on variables, and exception handling
- Debugging, profiling, security, and library management tools
- Source code of most routines available for viewing
- Code generation for C, C#, Fortran, Java, JavaScript®, Julia, MATLAB®, Perl, Python®, R, Swift, and Visual Basic
- Internet connectivity
- MATLAB connectivity includes two way integration and code translation
- Mathematica® Notebook conversion and command translation tools
- OpenMaple™ API for C, C#, Java, and Visual Basic programs
- External calling to Java, C, C#, Fortran, and Python™
- Connect with Microsoft® Excel®, databases, and CAD systems
- MathML 2.0 presentation and content support
- Access millions of online time series data sets
- Import and export of XML documents
- Export documents to HTML, XML, MathML, LaTeX, RTF, PDF, and ePUB
- Export plots to BMP, DAE, DXF, EPS, GIF, HPGL, JPEG, PCX, PLY, POV, STL, TEK, WMF, X3D, and more
- Import, manipulate, and export data from WAV, JPEG, and TIFF files
- Import data from ASCII, CSV, DIF, JSON, MATLAB, Matrix Market, Microsoft Excel, ODS, and more
- Deploy solutions through the Maple Player™, MapleCloud, or MapleNet™

### Connectivity