



mathsoft™
capturing imagination™

Calculation
Management.™





“

Mathcad allows engineers to accomplish five days worth of calculations in one day while leaving behind a historical footprint that can be used for years to come.”

Levi Hillmer [Transportation Project Engineer,
South Dakota Department of Transportation]



An opportunity ignored

For technology-based enterprises, engineering and scientific excellence is a competitive advantage. Shortening the time to market, continuously improving quality and investing in product innovation are all ways of winning an advantage over your competition. Your enterprise invests considerable sums in design, development and testing—your continued profitability depends on maximizing the return on this investment.

It is essential, then, to capture and manage the collective knowledge gained along the way to apply to future projects, reducing the risk of errors and ensuring a more productive, and ultimately more profitable, enterprise. Calculations are at the heart of this engineering knowledge.

Mathsoft recognizes how valuable calculations, and the knowledge behind them, are to any technical enterprise. Our concept of Calculation Management™ is about viewing calculations as a key engineering process rather than simply a routine task. Making the calculations and analyses that are at the heart of your design and development efforts visible and manageable can bring great rewards. Mathcad Enterprise is the only tool that captures these key engineering knowledge assets, multiplying their value to the enterprise.

Calculation Management is an opportunity to improve the quality of your engineering work, and the return on your engineering investment. Perhaps more importantly, failure to manage this critical process is a tremendous risk, as a single inaccuracy can bring down an entire multi-million dollar project.

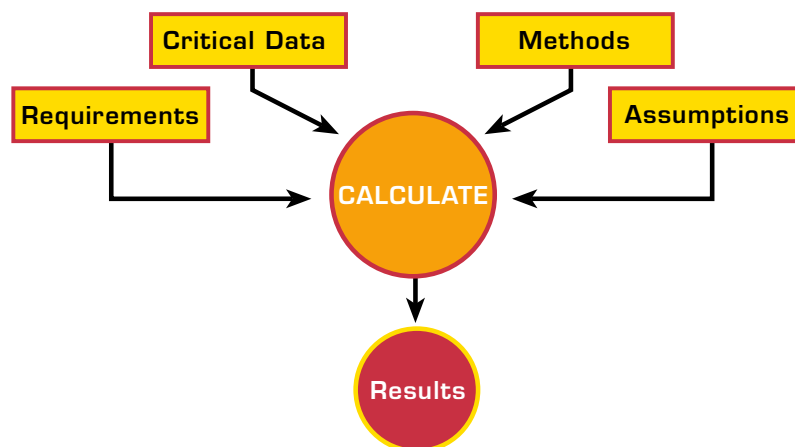




The importance of calculations

Conceptual design is at the heart of engineering and science-based enterprises, the part of the development cycle that has a big impact on your competitiveness. Innovation in your products, systems and services is what differentiates you from your competitors. It requires a large portion of your investment, and brings great rewards.

Calculations big and small are the key component of all engineering work, from designing new cell phones to building bridges. The results of these calculations are part of the design, but the thinking behind them, the factors and the constants used, the assumptions made and the methods employed, are often lost. All of this knowledge is crucial to verifying the validity of your results, improving your methods, and re-using this work later. If you are only capturing the results of the calculations, and not documenting and capturing the process, you are wasting money and opportunity every day.



With Mathcad as the cornerstone of a Calculation Management system, you go beyond improving the **task** of calculations to improving the **process** of calculation and design, and how you capture the knowledge created.

The return on your investment

A study by Nolan, Norton & Co. on the return on technology investments found that the return on investment depends on the degree to which the technology transforms core operations.

Improvements that focus on personal productivity at the task level bring a modest 10 to 20 percent return on your technology investment. A tactical business vision that focuses on improving business processes can return up to 300 percent.

Deploying Mathcad Enterprise for calculation management in your company will dramatically improve the process of calculation, design and knowledge capture. Mathcad will pay for itself many times over in a short period of time by encouraging re-use, reducing errors, and advancing engineering solutions and expertise for further verification and improvement.

From a time standpoint, it is easy to see the value of re-using calculation work, rather than doing the work over. But combined with Mathcad's clear documentation of the knowledge and process behind the calculations, this re-use also allows easy and frequent verification of results. An error corrected eliminates repeated errors further down the line. Methods are used consistently, continuous improvement becomes the norm, and the advancement in quality is considerable.

Mathcad saves time in other ways. With Mathcad, your engineers and R&D personnel can focus on the problem and its solution, rather than number crunching and programming. Their time is used more efficiently, more productively. The work they do is documented and validated quicker, and re-work is minimized. And compared to number crunching software or programming tools, less time is spent in training and getting up to speed. Because Mathcad speaks the language of engineering, mathematics, it is much easier to learn.

As your engineers develop their projects in Mathcad, they automatically document the process and knowledge behind it. A design produced in Mathcad shows all the underlying calculations and equations in clear view, though confidential regions of the worksheet can be hidden behind industrial-strength password protection to secure your intellectual property. The fully documented design can be shared on paper, as a PDF file, or over the Web. Concepts and ideas are distributed, and preserved for later reference and re-use. Your investment in design becomes a permanent corporate asset.



Mathcad is a great tool within Honeywell because it facilitates communication between the hundreds of engineers here. For technical presentations, I don't mess around with Office-type software. Mathcad's all I need."

Kevin Barr [Principal Engineer, Honeywell]



— ■ Mathcad vs. other calculation tools

Some organizations use spreadsheets or programming languages to perform calculations. While both serve the task of performing calculations, both fall far short when it comes to the process of managing those calculations.

Spreadsheets were designed for use in accounting, not as an engineering tool. With a spreadsheet, not everything is visible: equations are hidden in cells and there is no easy way to document the process. This makes the work very difficult to troubleshoot and validate. It also makes spreadsheets difficult to understand and be re-used by others in the organization.

Programming languages are more flexible and more powerful than spreadsheets, but are hard to use and take the longest time to learn. Because the user interface is tricky, it is easy to make mistakes, which forces testing and debugging rounds. Programming is neither visual nor interactive. You cannot change a few lines in your program and automatically see the results without recompiling and re-running the program. It is also difficult to share work and have others understand the process and solutions. Non-programmers certainly cannot re-use the work. Even if you are a programmer, re-using the work requires extensive reverse engineering to understand the process behind the result.

With Mathcad, calculations appear on your screen just as you would write them on paper, with as much text as you need to explain the method and assumptions. Mathcad worksheets can be verified easily, and their clear documentation is widely understandable. Mathcad's intelligent technology ensures your worksheets are free of dimensional errors, inconsistent units and other common sources of error in engineering analyses.

Calculation procedures and critical design parameters can be shared centrally, so it's easy to determine which calculations in a project are affected by a change in a procedure or parameter. Overall, Mathcad worksheets give engineering analyses and methods visibility, presenting information that is easily quality-assured, and easily shared among engineers, management, customers, suppliers and regulators.

MATHCAD

Flow coefficient

$$\Delta \omega := \frac{\left(1 - \alpha \cdot \beta^2\right)}{\left(1 + \alpha \cdot \beta^2\right)} \cdot \Delta p$$

Diameter ratio

$$\Delta \omega = 1.279 \times 10^4 \text{ Pa}$$

Mean axial velocity of the fluid

SPREADSHEET

$$\begin{aligned} & 1 - (0.41 + 0.35 \cdot B65) \cdot B74 / B78 / 1.4 \\ & \frac{0.5959 + 0.0312 \cdot B64^2 \cdot 1 - 0.184 \cdot B65^2 + B67 + B68}{B10 / B11 \cdot B64^4} \cdot \frac{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}}{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}} \cdot B74 / B78 \\ & \frac{1 / \text{SQRT}(1 - B65)}{B64^4} \cdot \frac{B64^4}{1 / \text{SQRT}(1 - B65)} \\ & \frac{(1 - B25 \cdot B64^2) / (1 - B25 \cdot B64^2)}{0.039 \cdot B12 \cdot B65 / (1 - B65) - 0.0337 \cdot B13 \cdot B64^3} \cdot \frac{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}}{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}} \\ & 1 - (0.41 + 0.35 \cdot B65) \cdot B74 / B78 / 1.4 \cdot \frac{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}}{0.0029 \cdot B64^2 \cdot 5(1000000 / B14)^{0.75}} \\ & \frac{0.5959 + 0.0312 \cdot B64^2 \cdot 1 - 0.184 \cdot B65^2 + B67 + B68}{B74 / B78} \cdot \frac{0.039 \cdot B12 \cdot B65 / (1 - B65) - 0.0337 \cdot B13 \cdot B64^3}{0.5959 + 0.0312 \cdot B64^2 \cdot 1 - 0.184 \cdot B65^2 + B67 + B68} \end{aligned}$$

ARE YOUR CALCULATIONS A DISASTER WAITING TO HAPPEN?

Hundreds of times a day, your engineers use calculators, spreadsheets or programming languages to get answers that affect the products and services you provide. A quick look at a Mathcad worksheet and spreadsheet side-by-side shows you all you need to know about how each serves your needs in the areas of documentation, knowledge capture, traceability and results verification. Mathcad uses real mathematical notation, and captures the assumptions, methods and critical data behind every engineering calculation. Other tools don't, exposing your projects to a great deal of risk.

For any engineering project, the history of all the calculations made, of their inputs, assumptions, methods and results, is among the most important determinants of that project. Any unusual successes or failures in meeting the goals of that project would likely be reflected somewhere in that calculation history. For example, when failures such as the Hubble Telescope or loss of the Mars Lander were analyzed, faulty engineering calculations were the clearest record of the failure of those engineering processes.

With a spreadsheet or programming language, the logic behind your answer is invisible to everyone, so the probability that your work will be verified formally or informally to reveal an error is almost zero. A calculation error will likely only show up downstream, where the costs of re-work are multiplied exponentially, or worse yet in the final product.

Don't take this kind of chance with your projects.



The solution: **—■ Calculation Management™**

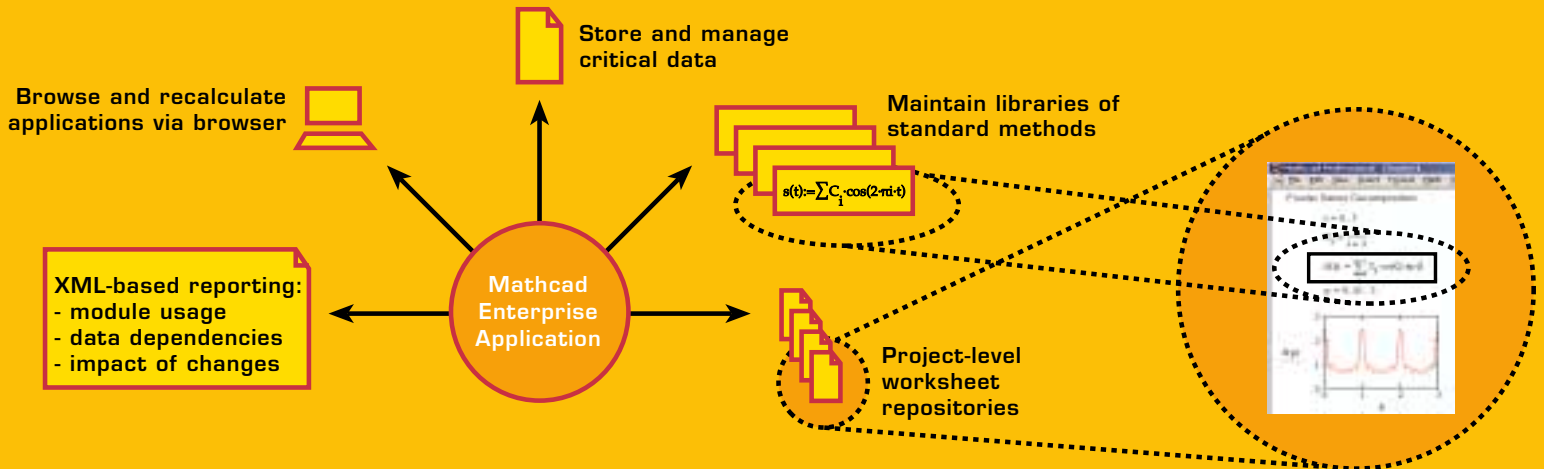
Your engineers' time is valuable, and time to market is a critical measure. By managing your calculation work more efficiently, you can optimize both. Mathcad allows you to do that.

With Mathcad, the result of your engineers' hard work is clearly documented. The original concepts, underlying assumptions, worked calculations, illustrative graphs, explanatory text, annotations, sketches and results are all there, plainly visible in the Mathcad worksheet: knowledge captured in a shareable form. They can be re-visited at any time, validated, refined and re-used.

And with the Mathcad Enterprise Edition, you get calculation management and deployment capabilities within the product, which have never been available before without custom integration. Integrated with Microsoft® SharePoint™ Team Services, Mathcad worksheets can be archived, versioned, and published to intra- and extranets with full access control. Designed with the same power and speed of the Mathcad Single-User Edition, the Enterprise Edition features additional capabilities to support networked deployment, license management, customized applications, complete automation, and more, making Mathcad even more effective as a knowledge capture and calculation management tool.

With Mathcad Enterprise, your investment is protected. Knowledge and methods are not lost, even if the people who produce them move on.

The Calculation Management™ Solution



Mathcad Enterprise lets you capture, manage and share engineering knowledge and data easily. The result: increased efficiency, continuous improvement, and a higher return on your engineering investment.

“

Mathcad is the only calculation package that leverages and understands math. It enables me to quickly see the whole calculation process, unlike spreadsheets where I cannot see how a result was derived. With Mathcad, I can track, update and publish the resulting data.”

Satish Matani [Structural Project Manager, Martin, Chow & Nakabara]



— ■ Licensing, support and training

Mathcad Enterprise offers you a broad range of installation and licensing options. The software may be installed on local PCs or run from a server. Mathcad Enterprise includes widely used FLEXlm[®] license management software, which may be used to monitor and manage license usage in server-based installations. The FLEXlm license manager makes it easy to monitor usage of your Mathcad license and add additional licenses as required.

Use of a license manager allows corporations the economical option of floating (sometimes called “concurrent”) licensing. Under a floating license, an organization purchases only as many licenses as will be needed at the same time. Mathcad can potentially be used by thousands of workstations on the same network, provided that the simultaneous usage (monitored by the license manager) does not exceed the number of licenses purchased.

Alternatively, in organizations where Mathcad is used in frequent daily sessions and must be available to users at all times, conventional node-locked (non-concurrent) licenses guarantee access to everyone who needs to use the software.

You can also mix node-locked and floating licenses so that key users who need constant or frequent use of Mathcad are allocated node-locked licenses while occasional users can share a number of floating licenses.

When you purchase a Mathcad volume license, you are covered under the Software Assurance program for one year from the date of purchase at no additional charge. Under this plan, you’ll always be using the latest Mathcad technology because you’ll receive all full product releases, updates, electronic content and other resources released during those twelve months. You will also receive the highest priority technical support, by telephone or email, or through the extensive Web-based Mathcad Knowledge Base, for the duration of your Software Assurance agreement. Other benefits include beta testing program eligibility, product newsletters and special offers.

To get you up to speed quickly, Mathsoft’s proven training courses teach your organization how to optimize Mathcad usage and capture engineering knowledge and calculation work. Mathsoft Training Services offers 2-day and 3-day on-site training programs with options for online training and management seminars, all led by Mathsoft Certified Trainers and customizable to your organization’s needs. Outside the U.S. and Canada, contact your local distributor for training options.

Mathcad

The worldwide calculation and calculation management solution.

Used by the most prestigious engineering organizations throughout the world.

- Delphi Automotive Systems
- Turbine Air Systems
- Federal-Mogul Corporation
- The Open University
- Torrington Division of Ingersoll Rand
- Qualcomm
- BAE SYSTEMS
- University of Bath
- BOC Edwards
- Northrop Grumman
- Boeing
- Cleveland State University
- General Electric
- Civil Aviation Authority
- Intel
- Michigan Technological University
- Volkert & Associates
- DLR
- General Motors Corporation
- Los Alamos National Laboratory
- DSTO
- Thales
- ESO
- Moog Inc.
- University of Virginia
- European Space Agency
- Lucent Technologies
- GKN Westland Helicopters
- Pennsylvania State University
- Honeywell
- Stevens Institute of Technology
- Boge North America
- Motorola
- Loral Space & Communications
- NASA (National Aeronautics and Space Administration)
- Delphi Delco Electronics Systems
- Robert Bosch GmbH
- SAAB Dynamics
- SUNY - Buffalo
- SNECMA
- Ford Motor Company
- Societa' Italiana Avionica
- Textron
- Thales Air Defence
- TRW Aeronautical
- Massachusetts Institute of Technology (M.I.T.)
- United Technologies
- Kettering University
- Volvo Aero Corporation
- 3 Com
- Robert Bosch GmbH
- United States Departments of Transportation
- University of Manitoba
- Chevron Refinery
- Korea Airlines
- Agilent Technologies
- University of Wisconsin-Madison
- Analog Devices
- Enator Moveo
- Asco Industries
- Cisco Systems
- Hewlett Packard
- Lockheed Martin
- Hitachi
- INA Walzlager
- Gulfstream Aerospace
- DERA
- Lucent Technologies
- MAN Technologie
- ESA/ESTEC
- Nokia
- Alenia Spazio
- Nortel Networks
- Danish Space Research Institute
- Plasmaco
- The Citadel
- RF Micro Devices
- Singapore Technologies Aerospace
- Siemens AG
- SKF
- Mississippi State University
- ARCO
- Sony
- Bofors Defence
- Texas Instruments
- ABB
- DMJM
- Swedish Space Corporation
- Dynamic Air
- Fluor Daniel
- Johnson Controls
- Hazra Engineering, Inc.
- Compaq Computer
- Bucknell University
- MAN Technologie
- HNTB Corporation
- AEA Technologies
- Washington University
- Kellogg-Brown & Root (Halliburton)
- Kvaerner
- Sharp
- Sargent & Lundy
- URS Corporation
- Advanced Digital Imaging Research
- Brookhaven National Laboratory
- Dornier Satellitensysteme
- New Jersey Institute of Technology
- Bechtel
- NIST (National Institute of Standards and Technology)
- Aerostructures
- Oak Ridge National Lab
- US Army, Navy & Air Force
- BP/Amoco
- IBM
- Exxon/Mobil
- Matra Marconi Space
- Kellogg-Brown & Root (Halliburton)
- Schlumberger
- Shell
- General Dynamics
- Fairchild Semiconductor
- Intel
- United States Military Academy
- Skidmore Owings & Merrill, LLP
- National Semiconductor
- Orbital Sciences
- Alcatel
- Ericsson
- Purdue University
- Harris Corporation
- Nokia
- AT&T
- Qualcomm
- Arizona State University
- Meteorological Satellite Center
- Carnegie Mellon University
- ST Microelectronics
- Huddersfield University
- Ohio State University
- NOAA (National Oceanic and Atmospheric Administration)
- Stanley Consultants
- Rose-Hulman Institute of Technology
- Antennas for Communications
- ITT Aerospace/Communication
- Lawrence Livermore Laboratory
- Nortel Networks
- Raytheon
- University of Texas - Arlington
- Texaco
- University of Waterloo
- Philips Semiconductor
- Parsons Brinckerhoff
- Webb Institute

Distributeur officiel en FRANCE :

INTEGRAL SOFTWARE

1, rue Favart
75002 Paris
FRANCE
Tél. 01 42 46 61 29
Fax 01 42 46 36 38
info@intesoft.com
www.intesoft.com

Mathsoft Engineering & Education, Inc.

HEADQUARTERS

101 Main Street,
Cambridge, MA
02142-1521
USA
T 617-444-8000
F 617-444-8001
sales-info@mathsoft.com

UK OFFICE

Knightway House
Park Street
Bagshot, Surrey
GU19 5AQ
United Kingdom
T +44(0) 1276 450850
F +44(0) 1276 475552
int-info@mathsoft.co.uk

JAPAN OFFICE

Level 11, Aoyama Palacio Tower
3-6-7 Kita-Aoyama, Minato-ku
Tokyo, Japan 107-0061
T +81-3-5778-7684
F +81-3-5778-7676
asia-info@mathsoft.com

www.mathsoft.com