

SIEMENS



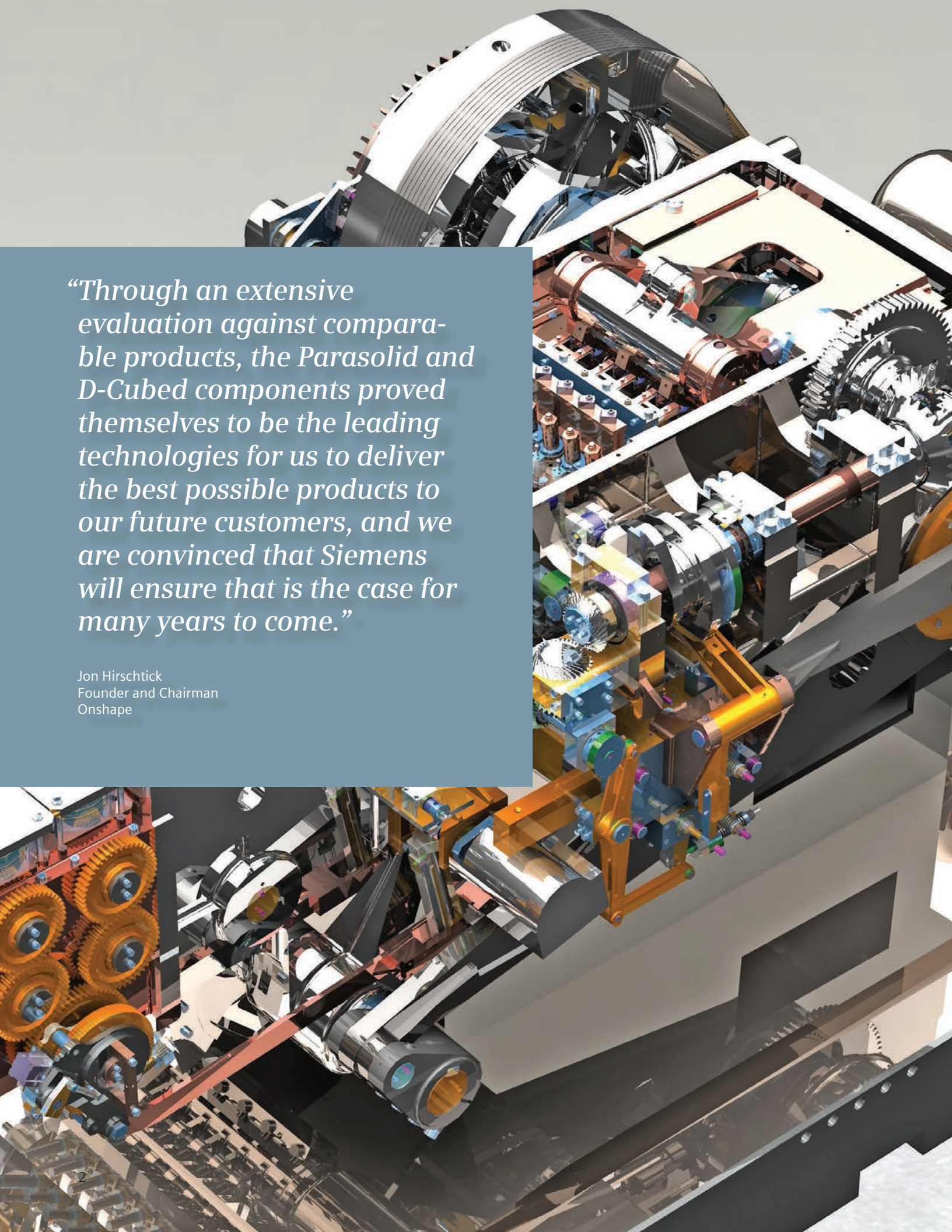
Siemens PLM Software

# PLM Components

Providing industry-leading functionality for your applications

[siemens.com/plm](https://www.siemens.com/plm)





*“Through an extensive evaluation against comparable products, the Parasolid and D-Cubed components proved themselves to be the leading technologies for us to deliver the best possible products to our future customers, and we are convinced that Siemens will ensure that is the case for many years to come.”*

Jon Hirschtick  
Founder and Chairman  
Onshape



# Business overview

Siemens PLM Software supplies a comprehensive portfolio of open 3D software components that are used by software developers and manufacturers to implement leading solutions in digital product design, manufacturing, analysis, visualization and collaboration. These components – the most widely used 3D software development toolkits in the industry – reduce development time and costs, while introducing proven quality, reliability and robust functionality into their host applications.

## Accelerate time-to-market

Our components bring industry-leading functionality to your applications and can be integrated in a fraction of the time it would take to develop an alternative solution in-house. This accelerates your time-to-market and allows you to focus resources on the core competencies of your company.

## Reduce overall cost of ownership

Our components are the result of decades of research and development (R&D) and allow you to incorporate comprehensive, robust geometric modeling and analysis capabilities for a fraction of the cost required to develop and maintain those capabilities with your resources.

## Leverage industry-proven technology

We satisfy the largest customer base in the industry, which provides us with unrivaled feedback for optimizing our solutions. We have access to the input of industry experts across computer-aided design (CAD), computer-aided manufacturing (CAM), computer-aided engineering (CAE) and architecture, engineering and construction (AEC) for driving our product innovation. More than 240 companies license Siemens PLM Software's PLM Components for use in over 350 commercial applications used by 6 million software end users. The substantial long-

term business relationships we have developed with our customers drive our ongoing investment to increase our leading technical position.

## Benefit from continuous innovation

We have a strong history of continuous innovation, always keeping pace with the demanding and constantly evolving requirements of our large global customer base. We support applications in rapidly emerging areas, such as cloud-based services and machine autonomy, while never losing our focus on providing the fundamental requirements of product stability, performance and a broad range of functionality.

## Access deep industry experience

Our R&D and support teams have deep industry knowledge and offer domain-specific expertise for integrating our components into your software. Our products are coupled with comprehensive customer support, training and documentation.

## Work with a reliable partner with an open business model

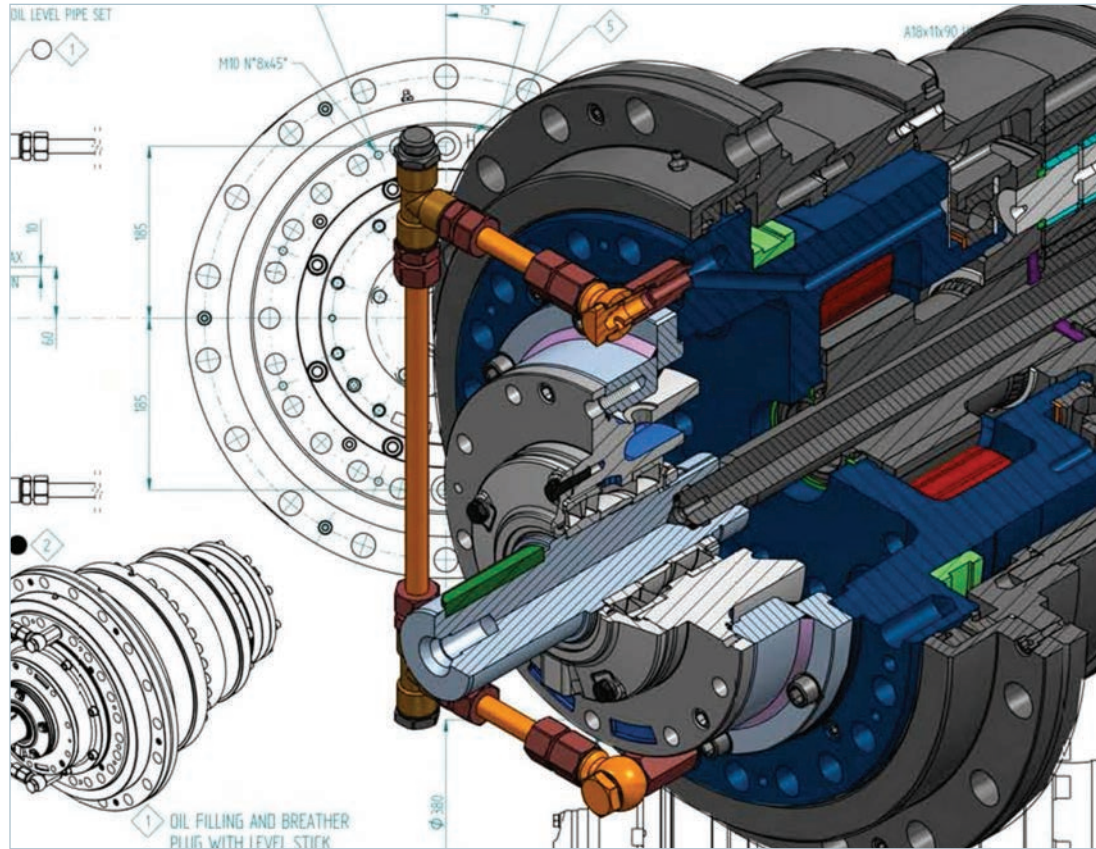
Siemens PLM Software has consistently delivered the right component technology to hundreds of customers over a period of decades, establishing a proven track record in the reliable, long-term supply of software components, even to its competitors. With our open approach to business, you get access to the same technology that we use in our own applications with our level playing field policy. Regular new releases are designed to be compatible with both subsequent and previous releases to maximize the compatibility of our solutions among the large number of applications on which they are based. Our data formats are published standards that enable your customers to easily exchange data with other applications.



# Product portfolio

*“Siemens PLM Software has proven itself to be a diligent and progressive market leader, consistently delivering the right PLM component technology that is used by millions of end users.”*

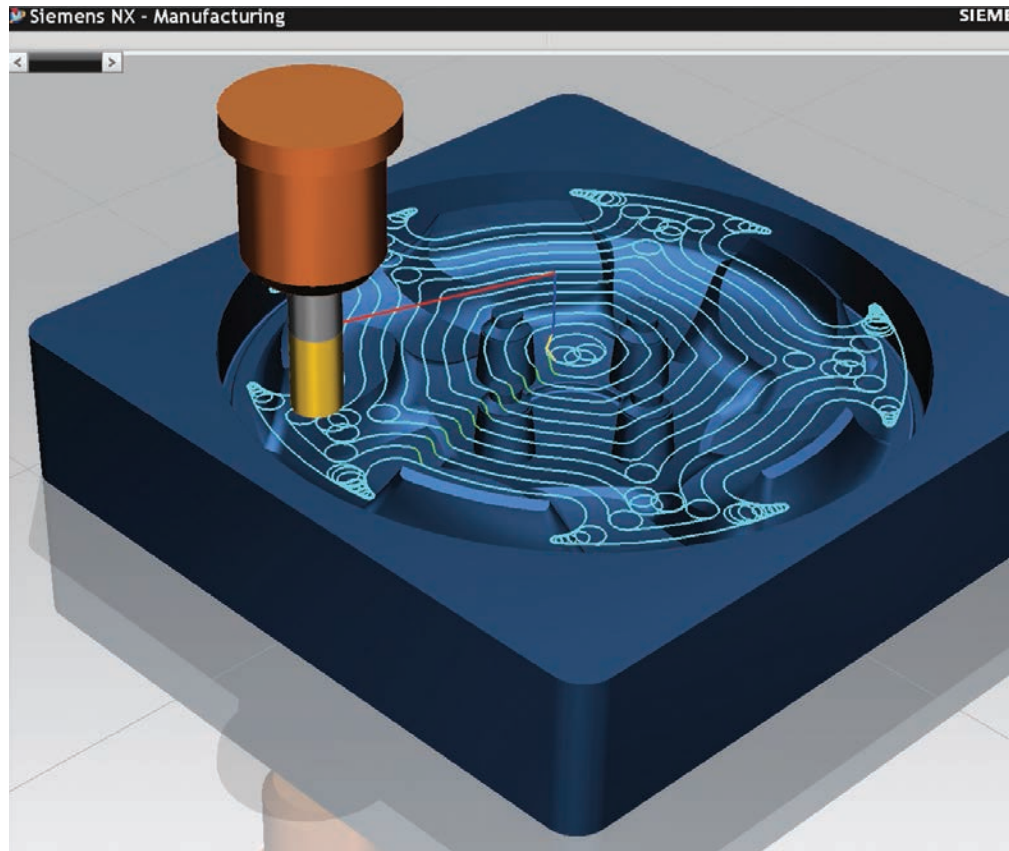
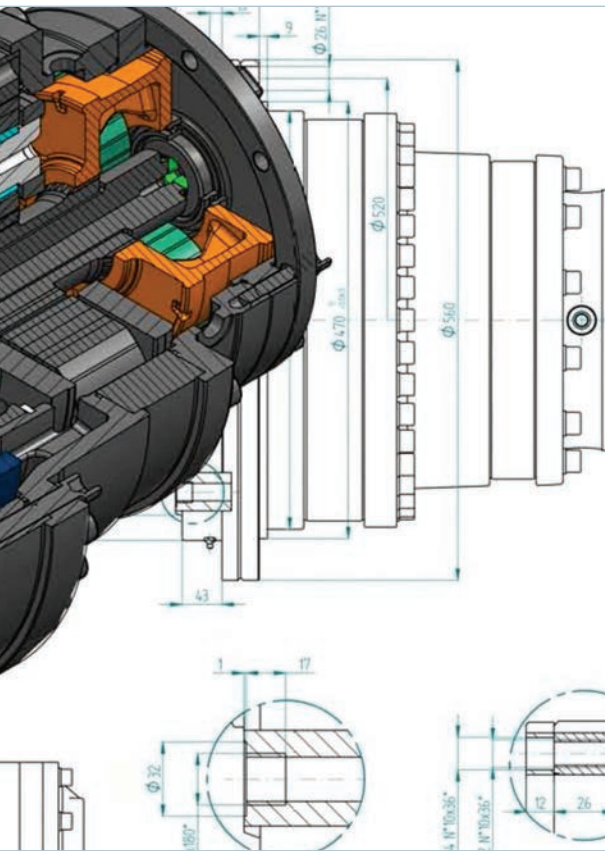
Jon Stevenson  
Vice President of Technology  
GrabCAD



PLM Components include some of the industry's most widely used 3D software components for digital product design, manufacturing, analysis, visualization and collaboration. Marketed and delivered through Siemens PLM Software's level playing field business model, these open solutions include:

**Parasolid® software:** the leading 3D geometric modeling component on the market. Parasolid provides the geometry foundation for more of the world's CAD, CAM, CAE and AEC applications than any other solution. Complementary products include Parasolid Bodyshop, robust healing technology for imported data and Parasolid Translators for major formats

**D-Cubed™ software:** a suite of software components that includes geometric constraint solvers for parametric sketching and 3D part/assembly modeling, as well as advanced solutions for motion simulation, collision detection, clearance measurement and hidden-line visualization. D-Cubed components provide vital functionality to most of the world's leading CAD systems and many other applications



**Kineo™ software:** These components automate the computation of optimized, collision-free trajectories in machine and robotics operation/simulation. Kineo enables motion planning and collision detection in virtual prototyping applications, such as assembly validation and human accessibility studies

**JT™ format and JT Open Toolkit:** JT is the openly published International Standards Organization (ISO) standard for viewing and sharing lightweight 3D product information. JT offers multiple product representations, ranging from lightweight tessellated models to precise geometry representations. It also includes support

for comprehensive product manufacturing information (PMI). The JT Open Toolkit provides read/write capabilities and enables interoperability with the large number of JT-enabled applications within the industry. JT is supported by the JT Open Program, an active user community comprised of both software vendors and product manufacturers



# Applications

*“Licensing Parasolid to provide modeling capability has accelerated our new product development and will enable us to deliver applications that compete successfully at a functional level with other AEC software suppliers. Parasolid is a key component to this initiative based upon its open architecture and proven success in not only the AEC market, but also throughout the global manufacturing industry.”*

Jinwon Choi  
Chief Executive Officer and Founder  
Virtualbuilders

The majority of the world’s CAD, CAM, CAE and PLM developers – including many of Siemens PLM Software’s competitors – rely on PLM Components to provide their applications with proven, robust functionality. More than 240 companies integrate our components into their commercial applications for the benefit of millions of end users who enjoy a high level of functionality and data compatibility as a result. The broad range of applications for PLM Components includes:

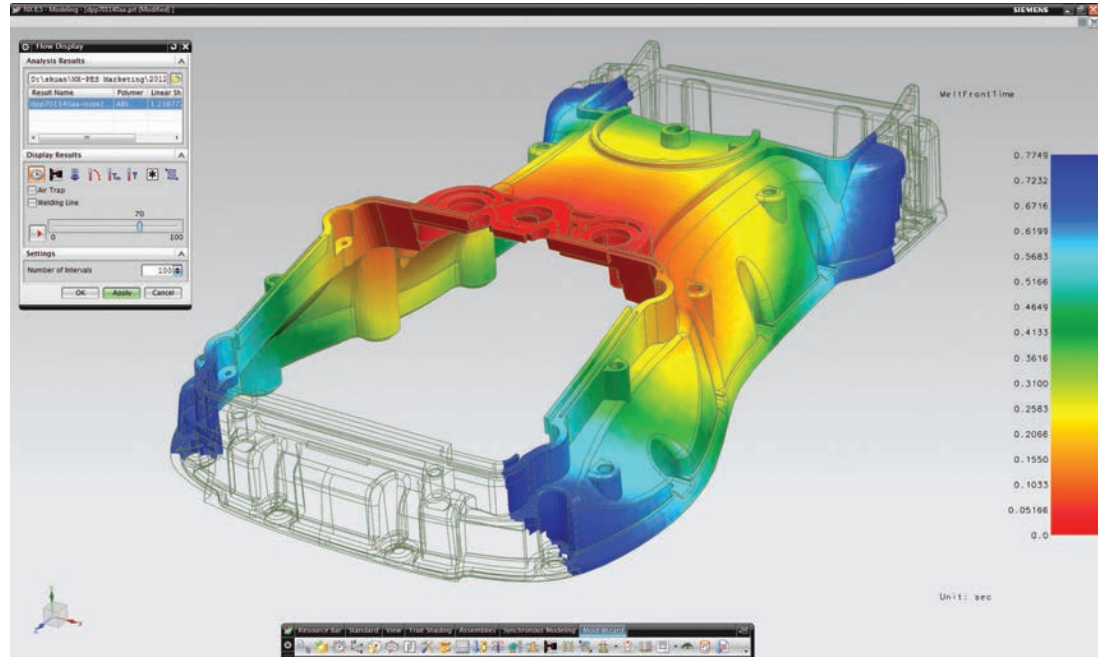
## Mechanical computer-aided design

Mechanical computer-aided design (MCAD) vendors use PLM Components to enable the rapid design, modification and visualization of digital 3D products,

and to ensure interoperability with other software applications. Our solutions enhance design validation tasks with tools for collision and clearance analysis, assembly verification and interactive motion simulation. MCAD customers include *3D Systems, Autodesk, Bentley Systems, Dassault Systèmes, Fujitsu, IronCAD, ISD, Onshape, PTC, SpaceClaim and ZWCAD.*

## Computer-aided engineering

PLM Components offer CAE vendors pre-processing tools for repairing and optimizing imported models for the analysis process, and solutions for implementing or enhancing an integrated model design and editing capability. CAE customers include *Altair Engineering, ANSYS, Autodesk, AVL,*



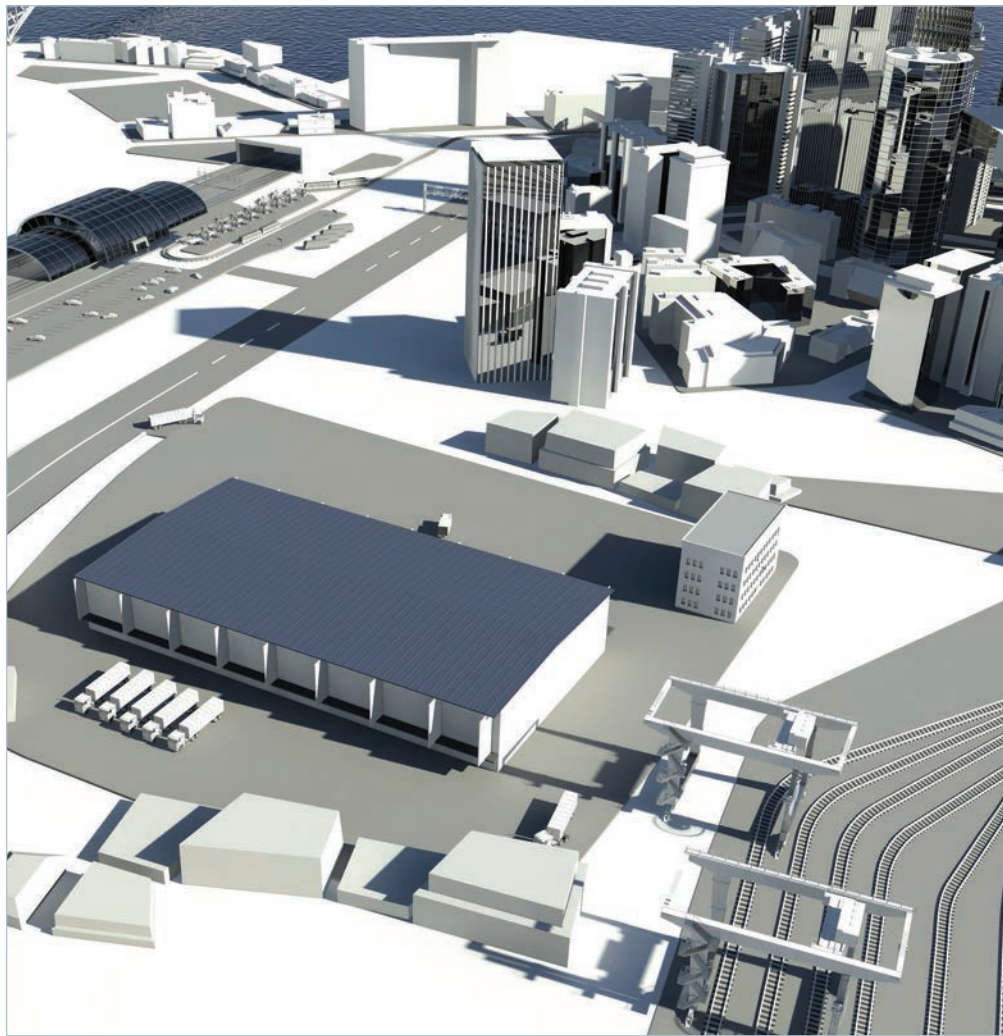
CD-adapco, Comsol, Dassault Systèmes, ESI, MIDAS IT, MSC Software, Numeca International and Simmetrix.

### Computer-aided manufacturing

Software vendors and machine manufacturers license PLM Components to integrate manufacturing-specific model design and editing capabilities, and to provide advanced solutions for machine simulation and verification. In addition, customers can benefit from exceptional support for CAD model import/export and data repair. CAM customers include ADIGE, Andor, Autodesk (Delcam), Camtek, Carl Zeiss, Cimatron, CN Industries, CNC Software, DP Technology, Hexagon (Vero), Makino Milling Machine, Missler Software, Mori Seiki and Profactor.

### Architecture, engineering and construction

Firms that rely on software solutions for modeling the built environment, including building information modeling (BIM) systems, use PLM Components to develop rich, accurate representations of complex real world objects. Our tools increase design productivity and enable advanced simulation capabilities, including human accessibility studies and collision-free equipment insertion and extraction. Our focus on software and data interoperability supports AEC projects with long lifecycles that engage multiple teams. AEC customers include Autodesk, Bentley Systems, CEA, Glodon Software, Intergraph, ITER, Midas IT, Nemetschek Vectorworks, TDCI, Tekla and Vertex Systems.



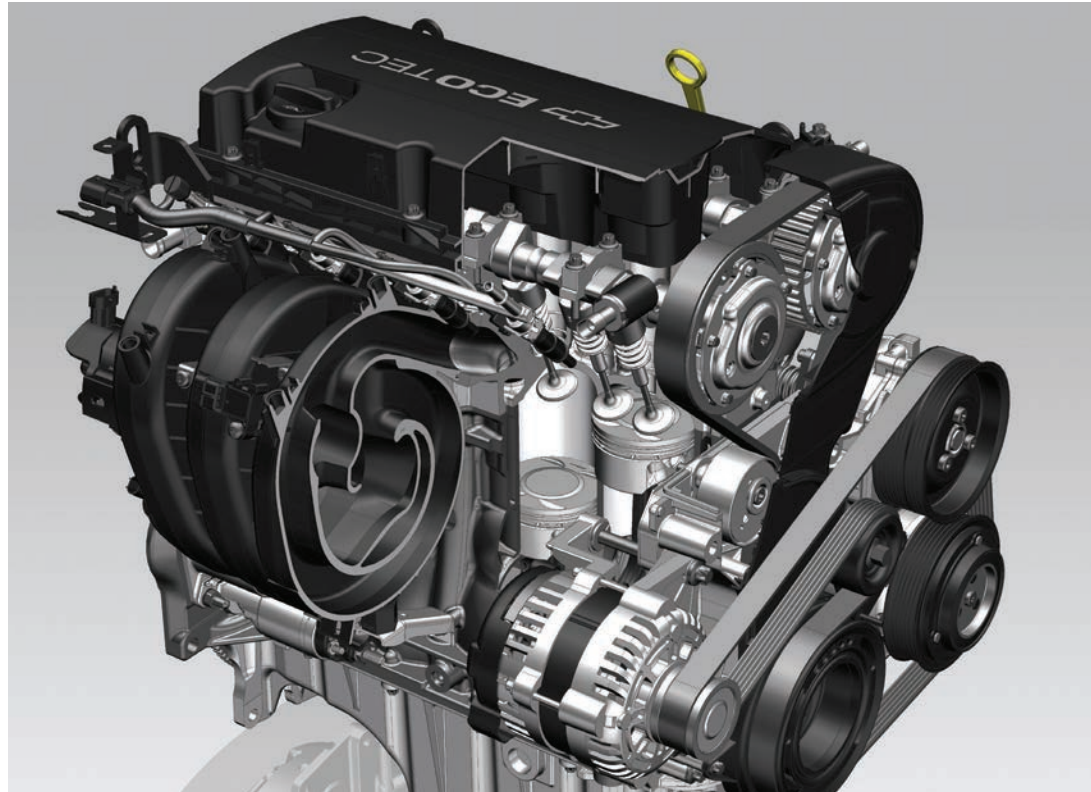
*“We are working on fundamentally redefining how CAE will be done going forward and we intend for D-Cubed software components to be part of this important effort. We found the D-Cubed components provided exceptional functionality, performance and reliability. Siemens has proven itself a reliable provider of these core technologies, so we have complete confidence they will meet the high quality standards we have established with our global customer base.”*

Ken Welch  
Vice President, Strategy & Product Management  
MSC Software

# Parasolid

*“The technical advantages of Parasolid, combined with the trust established in Siemens over the past several years, gave us confidence in our decision to select this solution. We look forward to delivering enhancements in future releases leveraging the advanced modeling functionality in Parasolid.”*

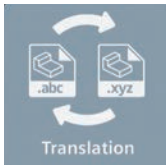
Massimo Fariello  
Senior Vice President, Software  
Technology Alliances and Strategies  
Altair



3D Modeling



Geometry Repair



Translation

Parasolid is the world’s leading production-proven 3D geometric modeling component software, providing core functionality that enables users of Parasolid-based products to rapidly and robustly model the industry’s most complex products. Based on high precision boundary-representation technology, Parasolid can be used to support solid modeling, generalized cellular modeling and freeform surface/sheet modeling within an integrated framework.

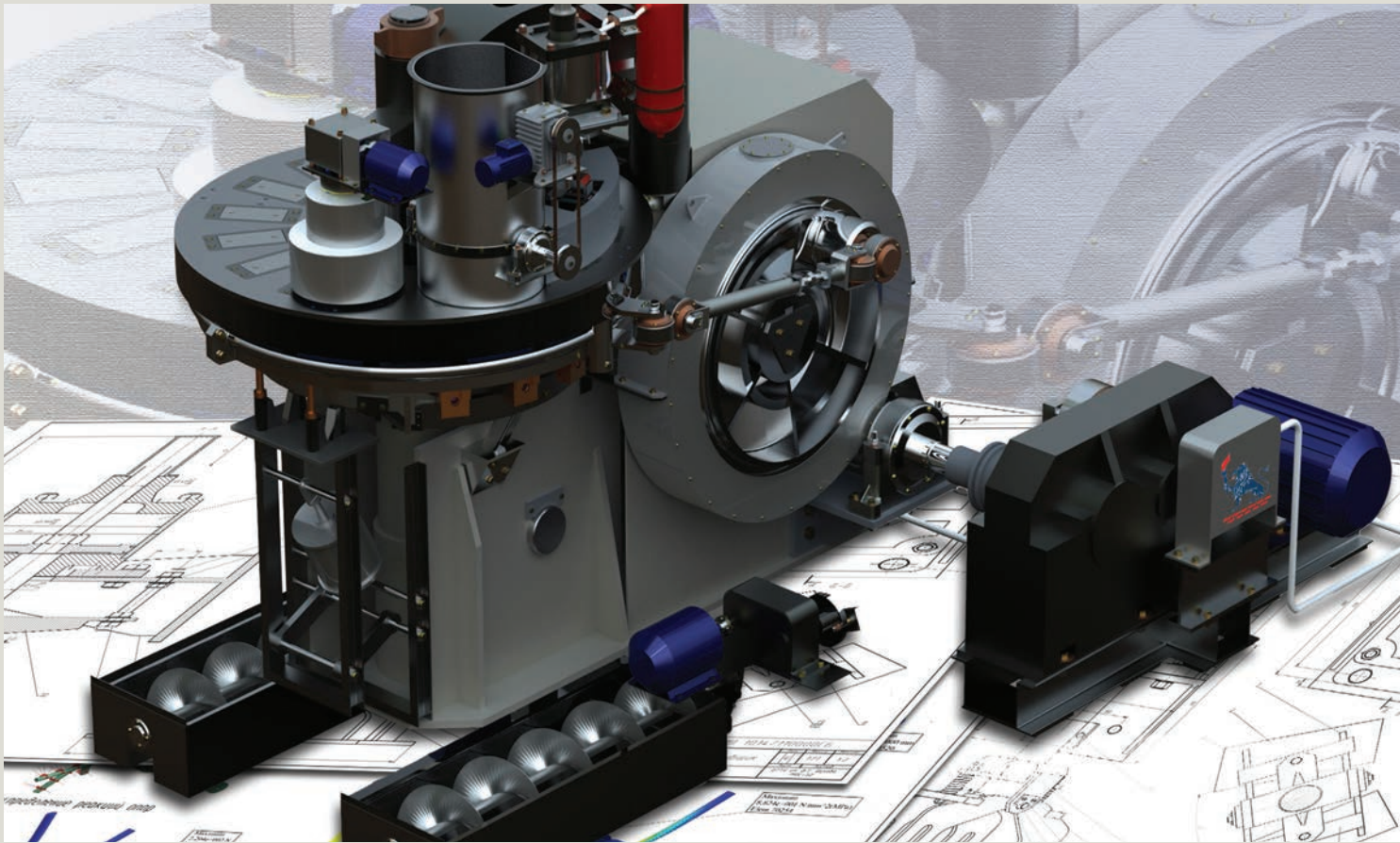
The comprehensive capabilities of Parasolid deliver over 800 functions that include a wealth of model creation and editing utilities, such as powerful Boolean modeling operators, feature modeling support, advanced surfacing, thickening and hollowing, blending and filleting and sheet modeling. In addition, Parasolid

offers extensive tools for direct model editing, including tapering, offsetting, geometry replacement and detail removal with automated regeneration of surrounding data.

Parasolid also provides wide-ranging graphical and rendering support, including precise hidden line and wireframe, as well as versatile tessellation functionality and a full suite of model data inquiries. Parasolid functionality is underpinned by configurable mechanisms that help tightly and efficiently integrate Parasolid into diverse applications.

Parasolid provides the modeling foundation for hundreds of the world’s leading CAD/CAM/CAE/AEC applications. It serves as the corporate standard for Siemens PLM Software’s own market-





leading portfolio of product lifecycle applications, providing 3D digital representation capabilities for the company's NX™ software, Solid Edge® software, Femap™ software and Teamcenter® software solutions. The global reach of Parasolid-enabled applications spans multiple industries and has grown beyond 3.5 million end users, all of whom benefit from the ability to seamlessly share geometric models through the Parasolid native XT file format. Parasolid users also benefit from intrinsic, tolerant geometry processing that enables them to operate successfully with imported data of variable accuracy without loss of robustness.

To further boost interoperability for Parasolid-based systems, Siemens PLM Software provides complementary tools that augment the intrinsic capabilities of Parasolid:

Parasolid Bodyshop is an add-on component that validates and optimizes the integrity and reliability of imported data using model healing and repair technology.

Parasolid Translators are toolkits that facilitate high-quality data exchange between Parasolid and major formats.

When combined, these technologies provide Parasolid users with one of the most robust interoperability platforms available today.

The position of Parasolid as the kernel-of-choice for powering the world's premier product development applications has been solidified due to the combination of unsurpassed 3D modeling functionality, industrial-strength interoperability and proven customer support.

# D-Cubed components

*“When we decided to enhance our parametric sketcher, we turned to Siemens, the industry’s most open and trusted supplier, to provide a new geometric constraint solving engine to support this important objective. We found that D-Cubed 2D DCM offers improved functionality, performance and quality. Leading component software technology combined with Siemens’ stability and service excellence made this the right decision for CD-adapco and our customers.”*

Jean-Claude Ercolanelli,  
Senior Vice President,  
Product Management  
CD-adapco



D-Cubed components comprise six software libraries that are licensed by CAD, CAM and CAE software developers for integration into their products. Applications include geometric constraint solving, parametric sketching, part and assembly design, motion simulation, collision detection, clearance measurement and visualization.

## Product portfolio

### 2D Dimensional Constraint Manager (2D DCM)

D-Cubed 2D DCM is a geometric constraint solver optimized for solving dimensions and constraints for 2D geometry. It enables parametric sketching, design modification and kinematic simulation in 2D and 3D applications.

### Profile Geometry Manager (PGM)

D-Cubed PGM enables parametric offset profile computations and constraint solving on profiles in CAD/CAM applications. It is often integrated to enhance 2D DCM-based sketchers.

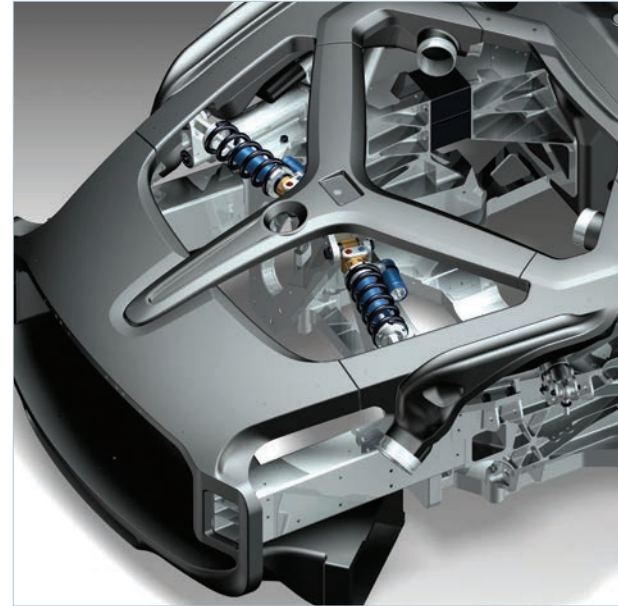
### 3D Dimensional Constraint Manager (3D DCM)

D-Cubed 3D DCM is a geometric constraint solver that supports a wide range of geometries, dimensions and constraints. It enables 3D parametric sketching, direct modeling of part shapes, assembly part positioning and kinematic simulation.

The 2D DCM and 3D DCM components are the most widely adopted foundations for parametric design applications.

### Assembly Engineering Manager (AEM)

D-Cubed AEM enables motion simulation of assemblies and mechanisms in the core of a CAD system. It takes account of mass properties, the effects of engineering forces and devices, and the interaction of parts as they collide and transmit motion.



### Collision Detection Manager (CDM)

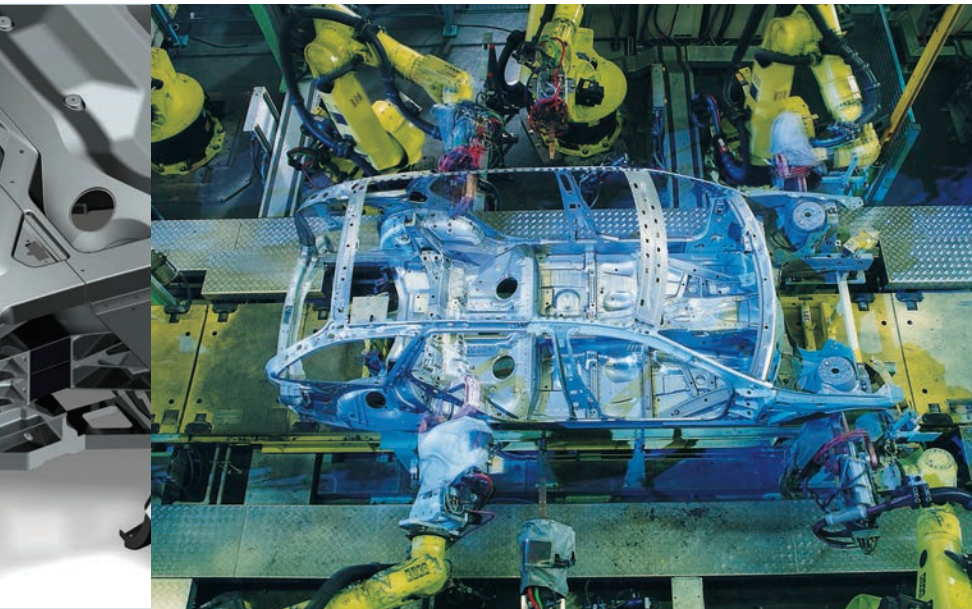
D-Cubed CDM offers fast and accurate collision detection and clearance measurement, commonly used during interactive assembly and mechanism motion simulation. CDM operates on solids, surfaces and wireframes, and supports exact, tolerant and faceted geometry.

### Hidden Line Manager (HLM) D-Cubed

HLM performs fast hidden line computations on solids, surfaces and wireframes, and supports exact, tolerant and faceted geometry.



# Kineo components



planning in applications such as measurement/inspection, welding and pick-and-place. In digital mockup, KineoWorks enhances virtual prototyping by validating collision-free assembly/disassembly processes.

KineoWorks is used to support complex motion environments and model highly-articulated systems with many degrees-of-freedom, enabling sophisticated analyses in human accessibility and ergonomics.

## Kineo Collision Detector

Kineo Collision Detector enables you to perform very high-speed collision analyses – including object clearance and collision penetration measurements – on faceted geometry. The option for direct analysis of point cloud data from laser scanning or optical sensors is also available. Optimized for parallel processing and low memory consumption, Kineo Collision Detector supports demanding collision detection applications ranging from interactive digital mockup to complex motion simulation and large scale maintenance, safety and accessibility studies. An option for computing collisions and clearance on a continuous path ensures collisions are not missed between sample points and enables the computing of collision-free trajectories.

*“The speed and accuracy of Kineo has enabled us to move from being a reactive force to a proactive one; a key challenge for any function in today’s world of ever shorter development cycle times”*

Peter Kinch  
C3P Supervisor,  
Service Engineering Operations  
Ford Europe

Kineo software components enable path planning, collision detection and related functionality in product design, manufacturing and simulation applications. More than 200 companies spanning the automotive, aerospace, energy and shipbuilding industries benefit from Kineo technology in their CAD, CAM, robotics and virtual prototyping applications.

## Kineo product portfolio

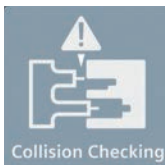
### KineoWorks

The leading path planning solution for motion simulation environments, the KineoWorks™ library, is used to compute collision-free paths between start and goal positions, optimizing trajectories for path length and/or obstacle clearance. The option to interactively influence collision-free motion planning for preferred paths is also available.

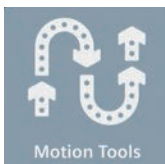
Developers of robotics/machine simulation and control software benefit from specific tools that KineoWorks provides for offline and real-time motion control, with advanced object handling and trajectory



Path Planning



Collision Checking

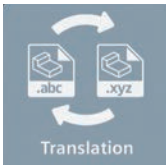
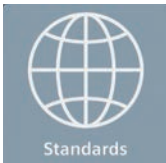
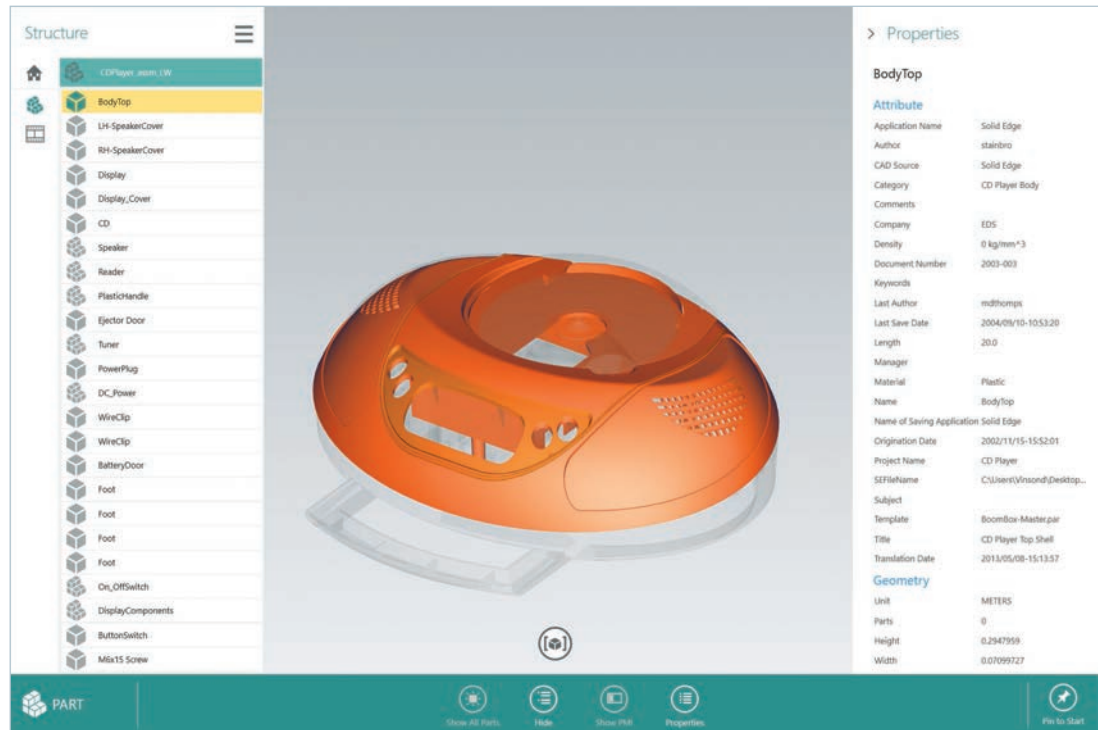


Motion Tools

# JT Open

*“Internally, we exchange information between the various parts of a design using JT, even if the parts were originally developed in different CAD tools...There’s a lot of information technology infrastructure that we would have had to put into place that is now not required because of JT. This helps us improve cycle times and reduce costs.”*

John Jewel  
IT Director, Global Climate  
Product Groups & Engineering IT  
Visteon Corporation



## JT file format

JT is the openly published International Standards Organization (ISO) standard (14306:2012) for viewing and sharing lightweight 3D product information. JT supports multiple levels of fidelity, ranging from precise 3D product geometry to lightweight/high-performance product visualization. This full spectrum of capability makes it possible to view and share product data, manufacturing information and interactive 3D images worldwide in real time and throughout all phases of the product lifecycle.

Thanks to its unmatched flexibility, robust functionality and proven reliability, JT is supported by more product lifecycle management (PLM) applications than any other lightweight 3D data format.

## JT Open Toolkit

The JT Open Toolkit is the leading toolkit for interacting with JT data quickly and easily. In addition to enabling read/write operations for the JT format, the toolkit offers a range of functions and utilities, including:

- Read/write of Parasolid XT B-rep data for accurate solid modeling and precise measurement and associations to product manufacturing information in the JT file
- Create multiple tessellated data sets, including individual geometry, bodies, parts and assemblies with associations to the underlying geometry
- Manage part and assembly level PMI. With supporting systems such as NX, JT PMI can be read directly into CAD models as live data



- Create an ultralightweight precise (ULP) data segment. ULP is tessellated on the fly by supporting applications such as Teamcenter Visualization
- A series of example programs and utilities

### JT2Go

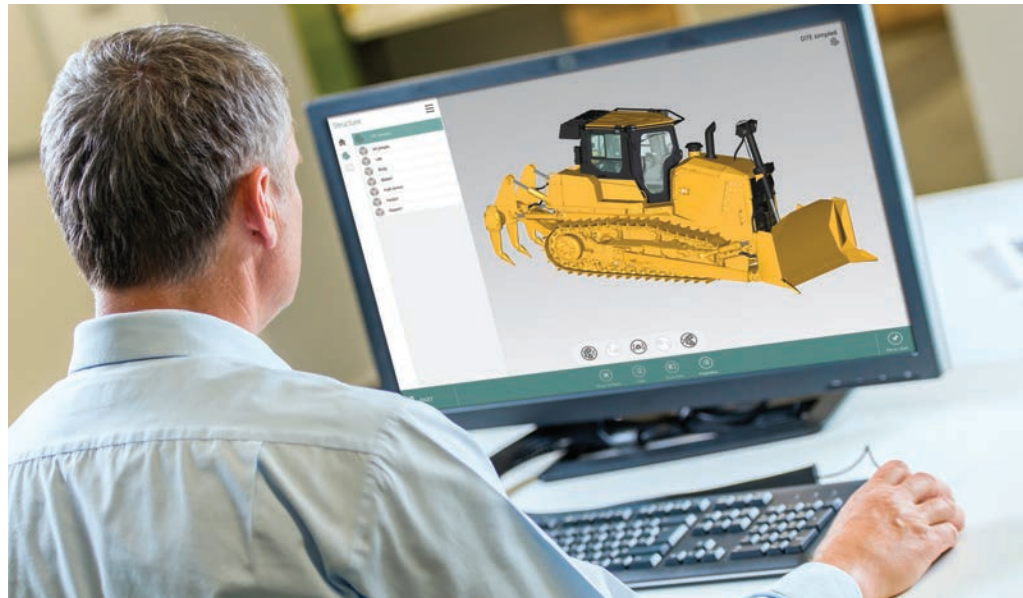
JT2Go is a no-cost 3D viewing product that enables companies to globally share detailed 3D product and manufacturing data using the lightweight 3D JT format. Downloadable viewers are available for Windows desktop, Windows 8 modern interface and Apple iOS-based devices. JT2Go helps streamline collaboration between manufacturers and their supply chains across all industries. JT2Go is a deploy-on-demand Windows-based solution that enables data sharing across heterogeneous PLM software environments utilizing existing infrastructure. JT2Go allows users to embed 3D JT data in Microsoft Office products to provide rich collaboration using standard desktop applications. Microsoft Office plug-ins enable an embedded 3D JT file to be viewed in any Microsoft Office document.

The JT2Go viewer enables product development teams and supply chains to easily review drawings, view and interrogate 3D product information and collaborate in the context of complete bills-of-material (BOM).

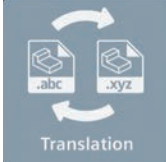
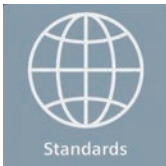
### JT Open

JT Open is an active community of software users, independent software vendors (ISVs) and academic institutions that are committed to the adoption of the JT format as the preferred technology for 3D visualization, and collaboration and data sharing within PLM-related workflows. The JT Open program provides participating members with level playing field access to JT technology while promoting the development of best-in-class applications offered by the program's vendor members.

Membership in JT Open is available to all corporate user communities, ISVs, academic institutions and non-profit industry organizations. Visit [www.jtopen.com](http://www.jtopen.com) for a list of JT Open program members.



# Open components for world-class software



Companies increasingly demand software applications that ensure interoperability with other systems (openness) to facilitate collaboration across the enterprise. Siemens PLM Software has maintained openness as a core company value throughout its history. A few examples of our commitment to openness include:

- Siemens PLM Software is a core member of the Code of PLM Openness (CPO), an international initiative for establishing a common understanding of the importance of openness to software applications. Through our commitment to openness, we license components that enable you to offer your customers superior interoperability when integrating your solution with other software applications
- JT is the ISO standard (ISO 14306) for viewing and sharing lightweight 3D product information, and supports data collaboration across a wide range of manufacturing industries
- Parasolid XT is the open, published data format that enables translation-free interoperability between hundreds of Parasolid-based applications, while Parasolid Translators and data repair tools are used to maximize the compatibility of applications with alternative data formats
- Siemens PLM Software's open approach to licensing components ensures you get access to the same technology that we use in our own applications with our





level playing field policy. Regular new releases are designed to be compatible with both subsequent and previous releases to maximize the compatibility of our solutions among the large number of applications on which they are based.

Siemens PLM Software's PLM Components can help you improve your software's functionality, quality and time-to-market. Leveraging the proven capability, widespread adoption and open design of these components ensures that your applications will interoperate seamlessly in the most diverse PLM environments.

Additional product information can be found at:  
[www.siemens.com/plmcomponents](http://www.siemens.com/plmcomponents)  
Siemens Industry Software

D-Cubed components  
[d-cubed.sales.plm@siemens.com](mailto:d-cubed.sales.plm@siemens.com)  
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## About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of product lifecycle management (PLM) and manufacturing operations management (MOM) software, systems and services with over nine million licensed seats and more than 77,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with its customers to provide industry software solutions that help companies everywhere achieve a sustainable competitive advantage by making real the innovations that matter. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

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