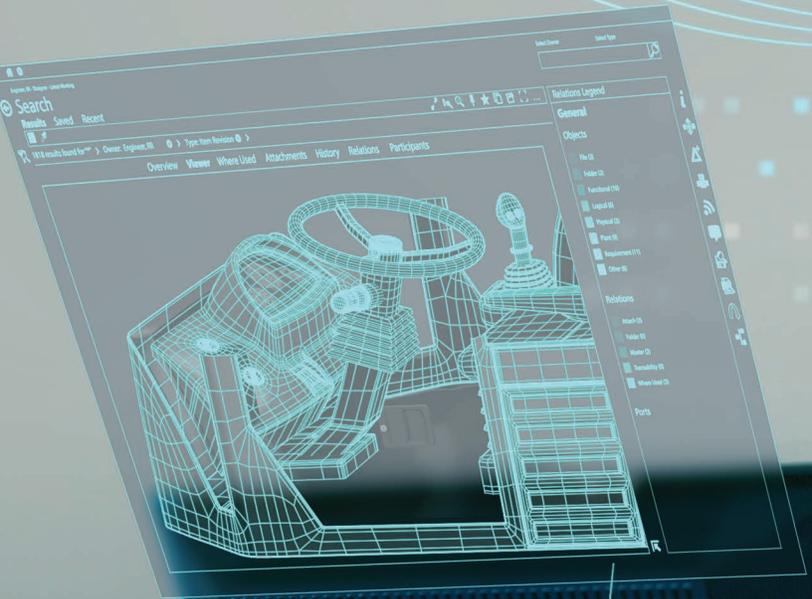


**SIEMENS**

*Ingenuity for life*



Siemens PLM Software

# Simcenter 3D

Realizing innovation with  
3D simulation

[siemens.com/simcenter3d](https://www.siemens.com/simcenter3d)

# Evolving product engineering

To meet complex challenges, product engineering teams need a unified, shared platform for all simulation disciplines, with leading-edge analysis tools that are easy-to-use, incorporate more productive workflows and produce consistent results.

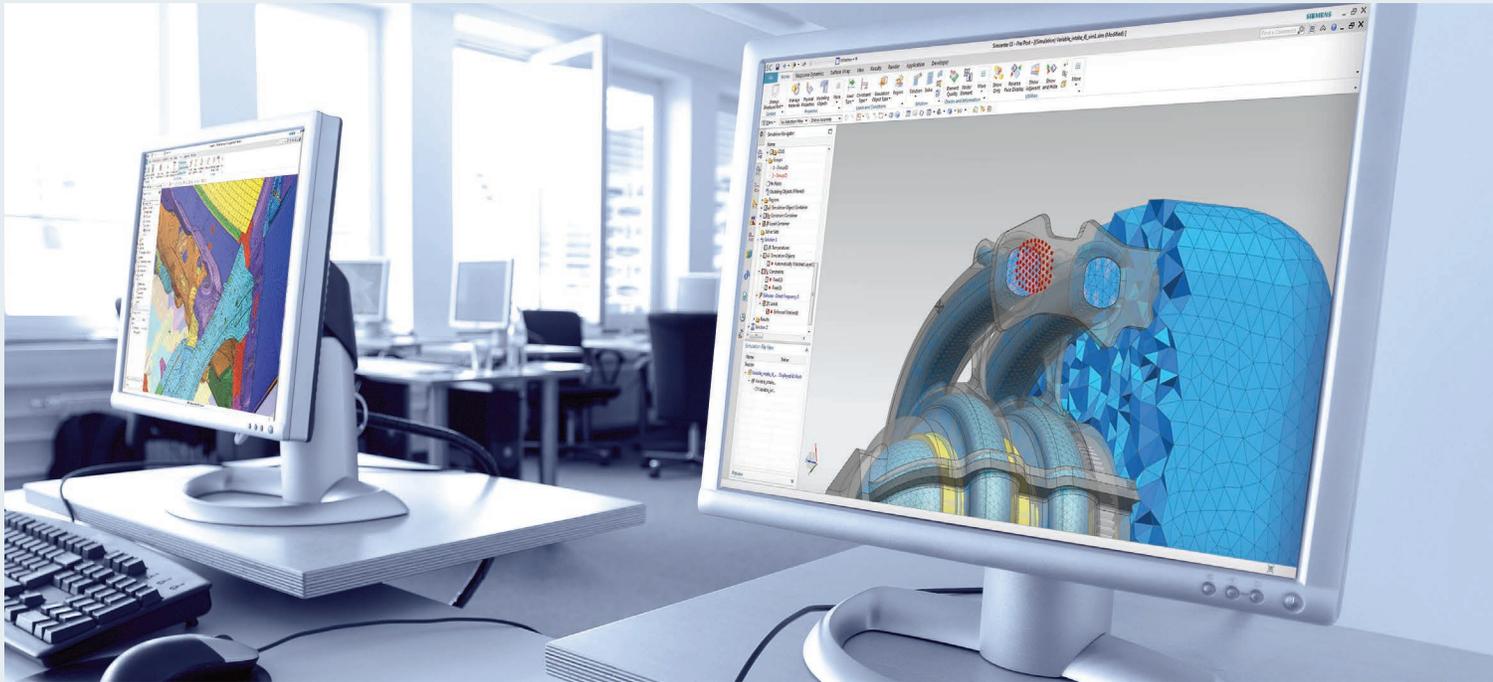
Engineering complex products is difficult. Product teams must integrate electronics and controls into mechanical systems, work with new materials and manufacturing processes and respond to stricter regulations while delivering innovations on shorter schedules and under budget constraints.

The classic verification and validation approach is no longer sufficiently effective. Modern development processes must become predictive, using a digital twin of the actual product that drives design and remains in sync as it evolves, and requiring simulation and testing technologies with intelligent reporting and data analytics.

Computer-aided engineering (CAE) has long proven its value as a troubleshooting and analysis tool, but is generally perceived as slow, delivering accurate results too late to drive development. Analysis specialists use disconnected tools and waste time translating data. Nonexperts have limited access to simulation results.

To meet complex challenges, product engineering teams need a unified, shared platform for all simulation disciplines, with leading-edge analysis tools that are easy-to-use, incorporate more productive workflows and produce consistent results.

# Simcenter 3D – revolutionary improvements in 3D simulation



Simcenter 3D software from Siemens PLM Software addresses complex product engineering by delivering revolutionary improvements in simulation efficiency. With advanced-capability 3D simulation technologies and a comprehensive range of CAE applications, Simcenter 3D offers new methods that increase realism and deliver better insight. Simcenter 3D captures expert knowledge and best-practice workflows, enabling engineers and analysts to collaborate on a platform that accommodates all aspects of functional performance.

Simcenter 3D is a product of decades of experience in simulation, and it incorporates technologies from proven CAE tools, including Simcenter™ Nastran® software, I-deas™ software, NX CAE and LMS™ software. Simcenter 3D solutions deliver a unified, scalable, open and extensible environment for 3D CAE with connections to design, 1D simulation, test and data management. Simcenter 3D™ is delivered as a stand-alone simulation environment or as an integrated application with NX computer-aided design (CAD) software.

*“The ability to turn designs into real hard parts is critical for us and the Simcenter suite helps support every facet of that.”*

*Jim Wall  
Director, Engine Engineering  
Hendrick Motorsports*

# Next-generation simulation software

*“Using the automated process enabled by NX and Simcenter 3D, we cut about 60 percent of the model preparation time.”*

Patrice Klein  
Simulation Manager  
CAE Analysis Group  
LOHR

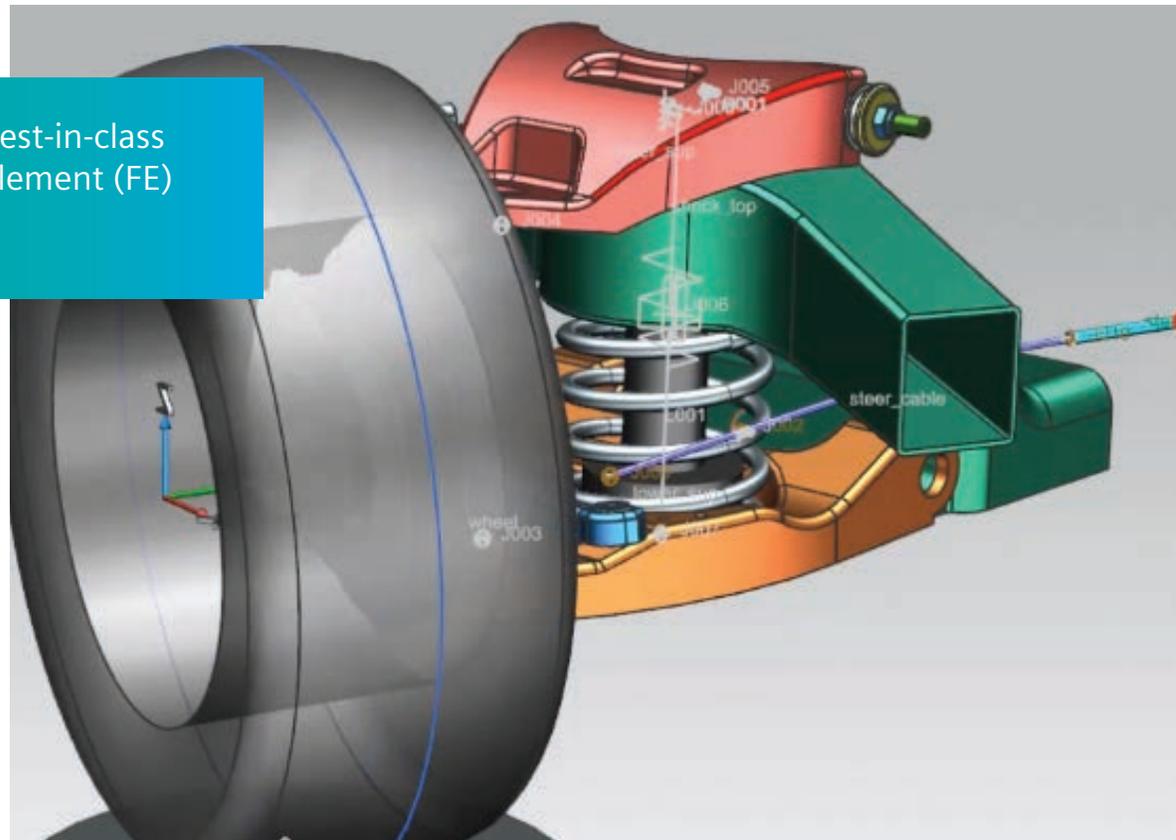
**Accurately predict product performance**  
Simcenter 3D includes powerful simulation solutions for multiple disciplines, including structural and acoustics, noise, vibration and harshness (NVH), flow, thermal, motion and composites analyses, as well as optimization and multiphysics simulation. With 1D/3D co-simulation and hybrid test/simulation modeling capabilities, Simcenter 3D delivers more simulation realism than ever before.

**Accelerate your simulation process**  
Synchronous technology in Simcenter 3D helps you reduce the time spent on model abstraction and geometry editing. Meshes, loads, and boundary conditions are all associated with the base design. So when the design topology changes, you can rapidly update your simulation results. The solvers and analysis tools provide all the accuracy and speed you need for timely simulation-driven insights.

**Enhance your team’s flexibility and throughput**

Simcenter 3D is open to multiple CAD formats and supports your preferred solver leveraging existing investments and processes. The software makes your process effective and flexible by offering you a uniform user experience across disciplines, capturing knowledge and providing features for customization and automation. And it includes industry and engineering expertise embedded in vertical solutions.

Simcenter 3D offers best-in-class geometry and finite element (FE) modeling capabilities.



### A complete pre- and postprocessing environment

Simcenter 3D helps you effectively build the simulation model you need from your 3D geometry. It includes unrivaled geometry manipulation tools that can handle CAD data from any source, as well as dedicated meshing and modeling for multiple applications.

### Multidiscipline simulation and optimization

Simcenter 3D combines all CAE solutions in one integrated platform, and takes advantage of industry-standard solvers for a full range of applications. This integration enables you to implement a streamlined multiphysical development process. You can let simulation drive the design by constantly optimizing multiple performance attributes simultaneously.

### High-end solutions for dedicated applications

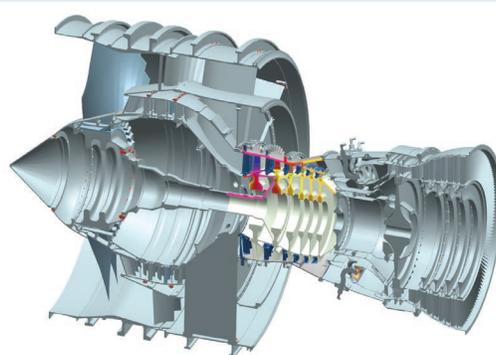
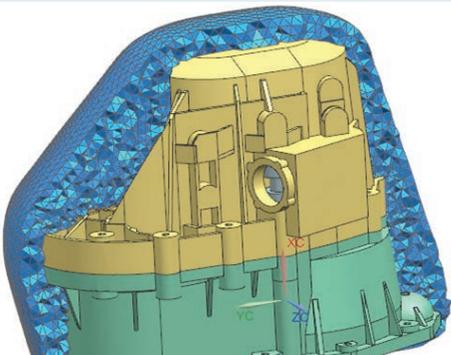
Simcenter 3D includes solvers that dive deep into the physics. Every application specialist will find state-of-the-art technology that exactly fits the problem – static or dynamic, linear or nonlinear, composite or other, for mechanics, acoustics, thermal, flow and many other analyses.

### Intelligent, complete models for complex products

Simcenter 3D allows you to effectively and accurately simulate your entire complex product. It includes efficient assembly modeling tools, co-simulation with controls, solvers that have the required performance for large problems, and data management functionality specifically designed for the CAE analyst.

*“The Simcenter 3D GUI is intuitive and follows practical simulation execution logic.”*

*Marius Cronje  
Lead Engineer  
SIMERA*



# The engineering desktop for pre- and postprocessing

**“A model with 1,000,000 degrees of freedom can be meshed in only 10 minutes.”**

Lu Xianglin  
Deputy Manager  
Guangxi Yuchai Machinery

## Leveraging a strong geometry foundation

Simcenter 3D includes unrivaled geometry creation and manipulation capabilities in a CAE preprocessing environment that yields significant benefits. It gives analysts access to, and control over geometry parameters. At the same time, it improves collaboration with designers as they can work on the same models. The entire analysis preprocessing can be dynamically associated with the CAD model.

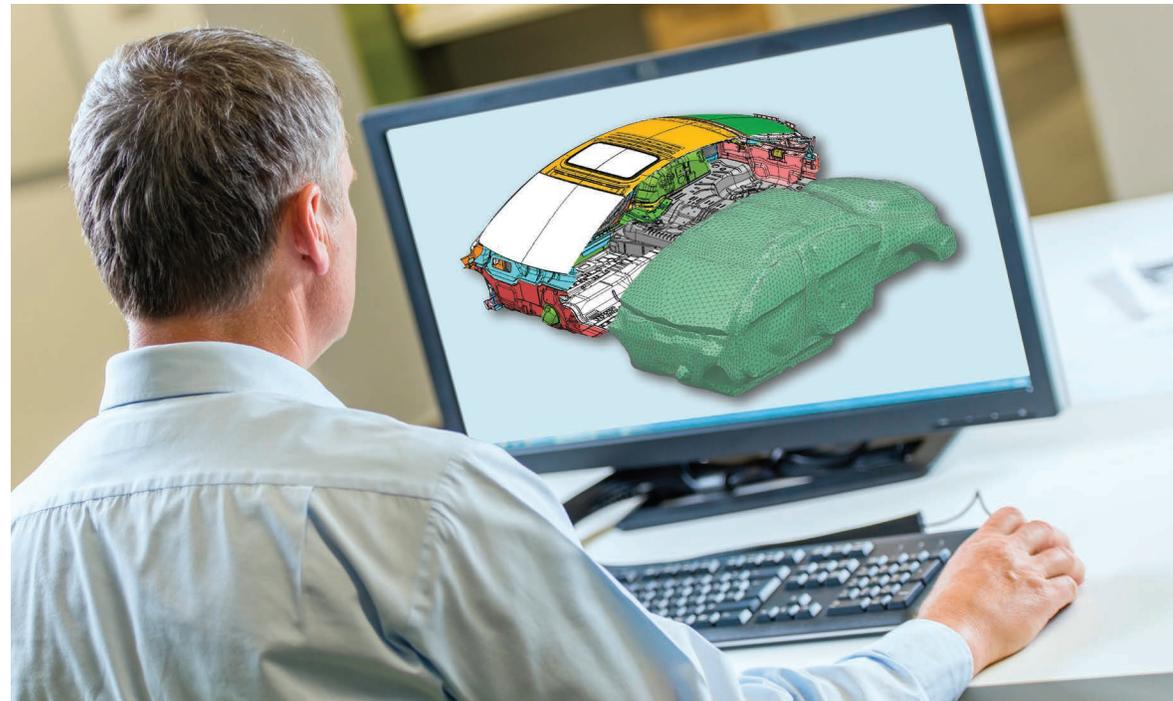
Simcenter 3D delivers direct geometry editing capabilities powered by synchronous technology. You can quickly edit geometric models from any source in an intuitive way that is impossible using traditional CAE preprocessors or feature-based CAD systems. Using the Convergent Modeling™ technology in Simcenter 3D, CAE engineers can perform advanced reverse engineering of digitally scanned models by combining classic boundary representation (b-rep) and facet model operations in a single geometric modeling component.

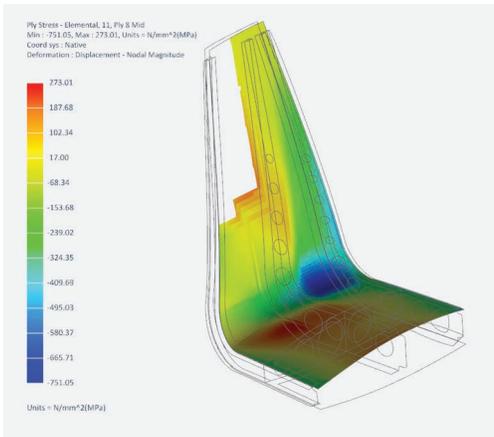
In addition, powerful geometry defeaturing and idealization tools help you effectively clean features like small holes, steps and slivers that can impact meshing speed and quality.

## Application-oriented analysis preparation and postprocessing

With Simcenter 3D you can automatically convert CAD assemblies into mechanisms for motion analysis. The assembly constraints become joints or connections, and component geometry forms the rigid body motion links.

Simcenter 3D includes extensive functions for automatic and manual mesh generation using 1D, 2D and 3D elements, assembly of subsystems, and application of materials, properties (including composites), loads and boundary conditions. The universal assemblies and connections feature enables the same assembly to be used for different analysis types in various FE solvers. It also incorporates advanced tools for meshing fluid domains.





All of these capabilities are available in a shared application-oriented user environment. Using Simcenter 3D enables you to prepare models for both built-in and industry-standard solvers, and includes subject-specific or scenario-based postprocessing tools. Simcenter 3D supports a wide variety of disciplines, including structural, thermal, flow, acoustic analysis, motion and more.

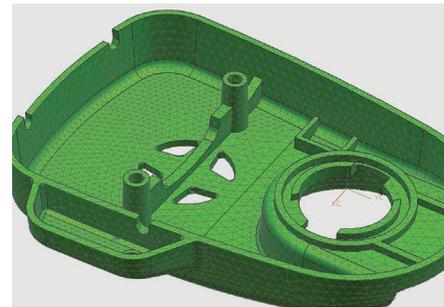
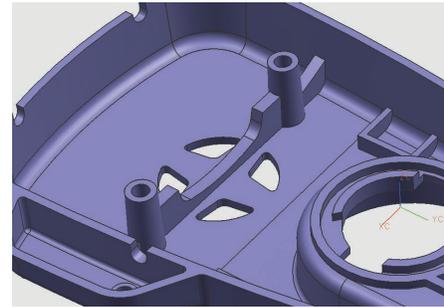
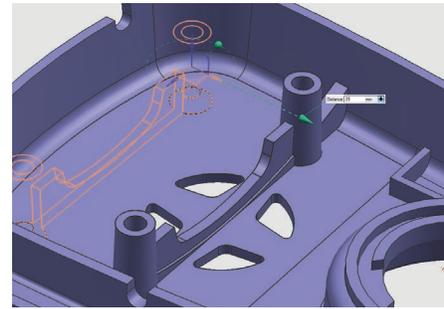
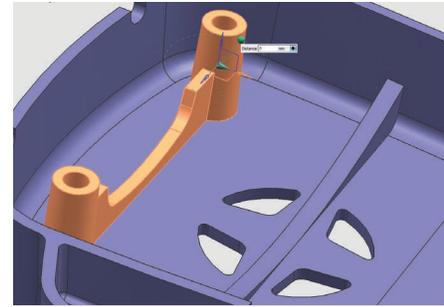
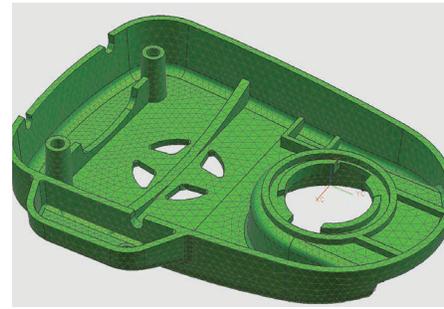
### Modeling and simulating composite structures

Simcenter 3D includes dedicated tools for efficient modeling of laminar composite structures, using zone-based (on the mesh) and ply-based (on faces and/or 2D elements) modeling techniques, or a combination of both.

You can keep your model up-to-date with the latest design through associativity with the geometric model. In addition, Simcenter 3D can communicate with the Fibersim™ portfolio of software for composites engineering, facilitating a tight collaboration between analysis teams and composite designers.

### Your benefits

- Dramatically reduce modeling time by tightly integrating a powerful geometry engine within a robust analysis environment
- Enable quick analysis of design iterations by implementing an associative simulation process
- Deploy an easy-to-learn common platform that lets all analysts and specialists prepare solver-specific models and perform application-specific postprocessing
- Leverage world-class functionality for effective modeling of composite structures



# Scalable solutions for your engineering team

Simcenter 3D offers the option of creating simulation templates and guided workflows.

## Delivering all solutions for product development

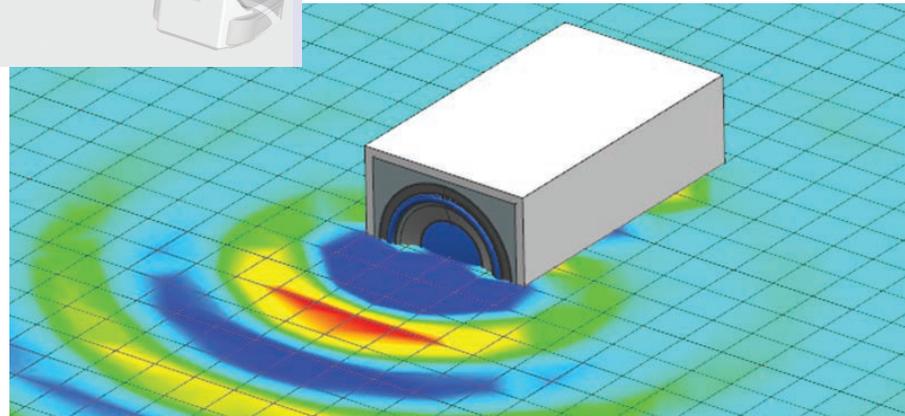
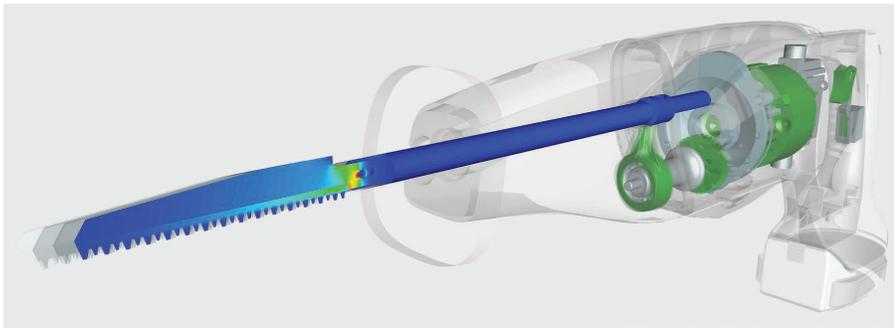
The advanced modeling and multi-discipline simulation capabilities of Simcenter 3D are ideal for dedicated analysts. Discipline experts can employ integrated industry workflows and postprocessing. For companies looking to expand simulation access to novice engineers or designers, Simcenter 3D offers the option of creating simulation templates and guided workflows.

The software features an interactive, visual environment for linear and nonlinear evaluation of the structural dynamic response of systems subjected to complex loading conditions, such as random vibration, transient, harmonic and shock spectra.

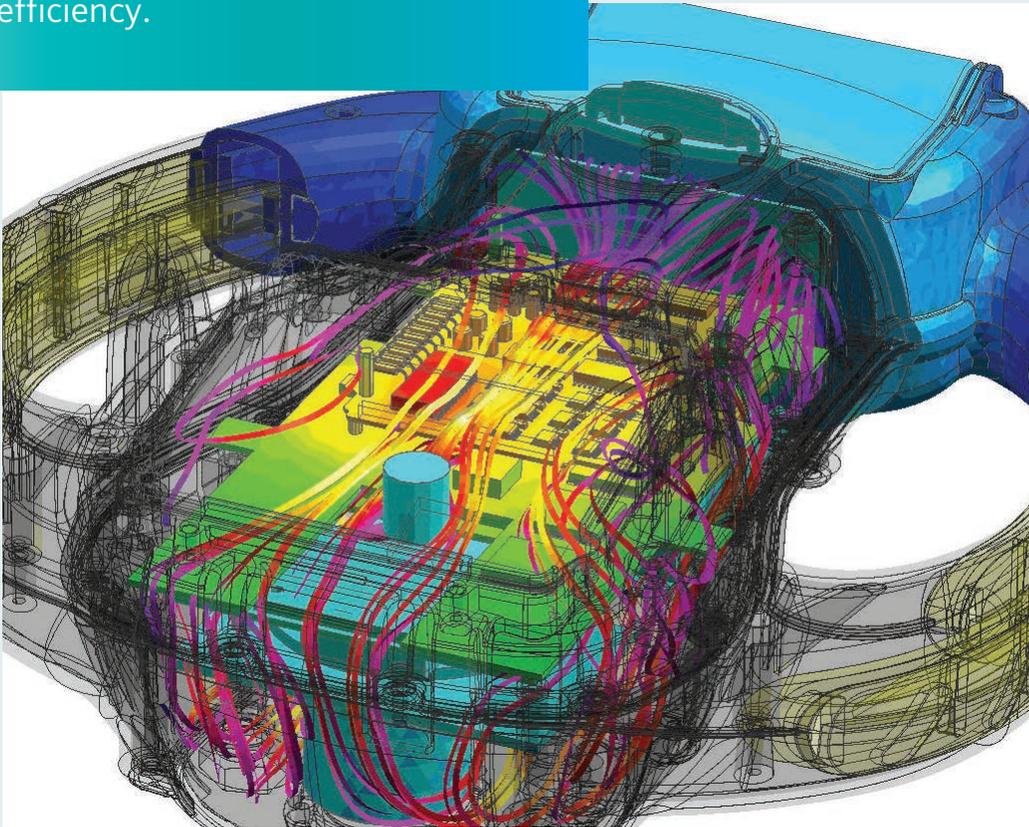
Simcenter 3D includes specialized applications to evaluate the thermal characteristics of electronics products and space systems like satellites.

You can rapidly create fluid domains for complex geometries and perform computational fluid dynamics (CFD) analysis to understand fluid flow effects that influence your product's performance, such as compressible flow, incompressible flow, 1D fluid networks, non-Newtonian flow and CFD modeling.

Simcenter 3D also includes mesh preparation and solvers for both boundary element and finite element acoustics, allowing accurate interior and exterior vibro-acoustic studies. With automatically matched layer (AML) and finite element method adaptive order (FEMAO) technology in the Simcenter Nastran® solver, Simcenter 3D delivers the most powerful solution for interior and exterior acoustic radiation. In addition, the software includes many tools for precise modeling of acoustic absorption and trim materials.



With Simcenter 3D, you can capture expert knowledge and best-practice workflows to increase modeling efficiency.



*"Simcenter is really fast and, in the same day, we could do many iterations."*

Stephane Arsenault  
Head of FEA Department  
Précicad software

Composite properties can be used in state-of-the-art dynamic, nonlinear progressive failure and delamination simulations, in solvers such as Simcenter Nastran, Simcenter Samcef™ software, Ansys, Abaqus and LS-Dyna. Specific post-processing and advanced reporting tools allow you to effectively identify problem areas from simulation results.

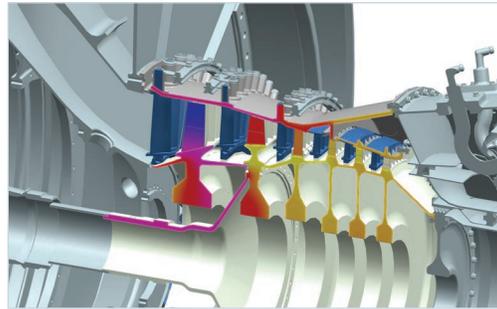
With Simcenter 3D, you can capture expert knowledge and best-practice workflows to increase modeling efficiency, and automate tedious processes. These capabilities can also be used to extend the reach of simulations and to integrate proprietary tools and solution techniques.

#### Your benefits

- Deploy a solver suite that includes the right solutions for all designers, analysts and specialists involved in the product development process
- Find dedicated solutions for various applications that have gained accuracy, performance and stability over decades
- Flexible solution access through a cost-effective, value-based licensing system

# Enabling multidiscipline simulation and optimization

Simcenter 3D brings together world-class solvers in one platform, making multiphysics analysis safer, more effective and reliable.



## Depth and breadth of disciplines

Simcenter 3D includes:

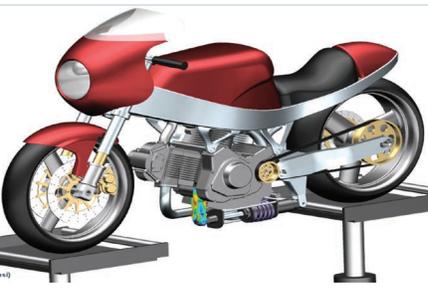
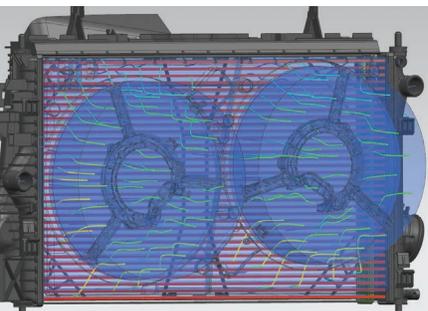
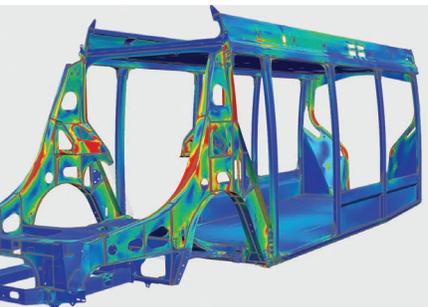
- Linear and nonlinear structural analysis for statics and dynamics, normal modes, buckling, large displacement/strain, material hardening, creep and other advanced capabilities
- Analysis for short- and long-fiber composites, optimization of composite layups, and techniques for damage and crack propagation
- Multibody dynamics capabilities, including use of flexible bodies and integration with controls and 1D models
- Durability and fatigue-life prediction capabilities
- Thermal analysis for steady-state and transient solutions, including conduction, convection and radiation
- Flow analysis for laminar and turbulence models, two-phase flows, mixed convection, condensation and particle tracking
- Vibro-acoustics with finite element and boundary element methods, including advanced postprocessing
- Aerostructure sizing solution to streamline the aircraft structural certification process
- Additive manufacturing solution to industrialize 3D printing process

## Combining multiple disciplines on a common platform

Simcenter 3D streamlines analysis workflows with an integrated platform that combines all disciplines. This avoids modeling incompatibility because the same data can be used in different analysis from the same base model and have similar dialogs for model setup.

The integrated platform eliminates time-consuming and error-prone file transfers. You can efficiently re-use data from one analysis to the next in an associative manner.

The integrated approach simplifies software use. Once analysts become familiar with the interface, they can understand how to build models for various applications. This increases flexibility, as team members can more easily perform assigned tasks to manage workloads.



### Enabling multiphysics analysis

Realistic simulation must consider the real-world interactions between physics domains. Simcenter 3D brings together world-class solvers in one platform, making multiphysics analysis safer, more effective and reliable. Results from one analysis readily cascade to the next. Various physics domains can be securely coupled without complex external data links. You can easily include motion-based loads in structures, conduct multibody dynamic simulation with flexible bodies and controls, vibro-acoustic analysis, thermomechanical analysis, thermal and flow analysis and others, strongly or weakly coupled.

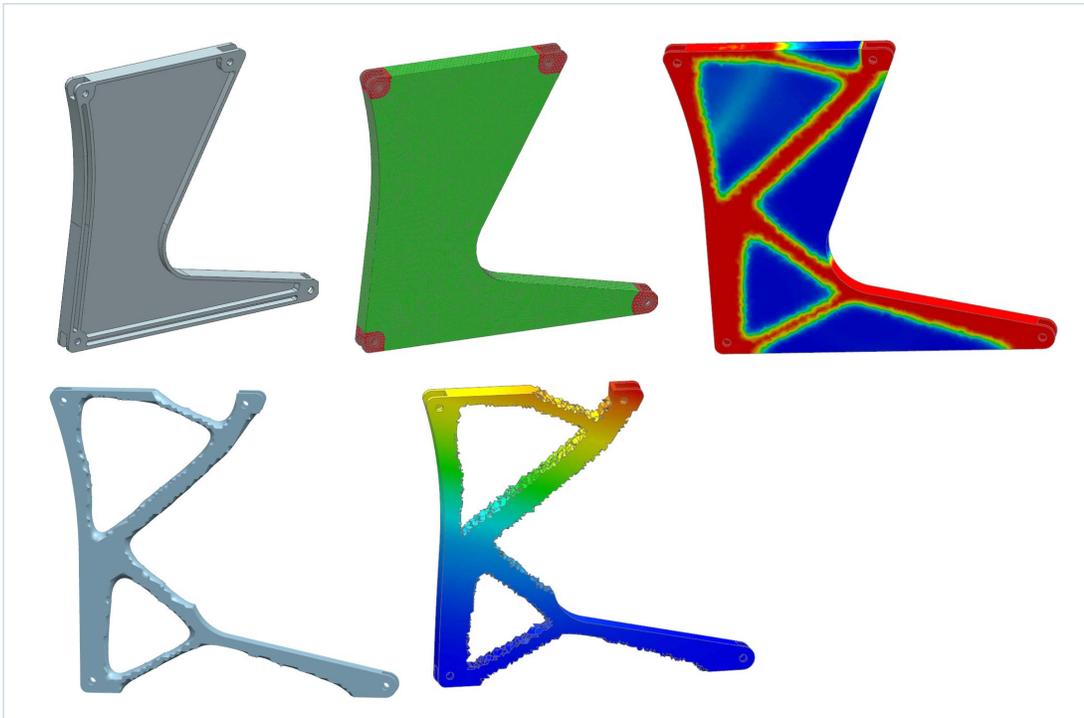
### Driving the design through optimization

The breadth of solvers in a common platform allows everyone in the process to optimize designs for multiple aspects simultaneously.

Simcenter 3D delivers very fast iterations following changes in the design. Advanced geometry-based and FE-based optimization features enable simulation-driven design that optimizes geometry throughout the process.

### Your benefits

- Achieve more realism by coupling multiple physics
- Streamline your simulation process using world-class solvers for various disciplines in a unified environment
- Optimize multiple attributes simultaneously throughout the entire design cycle



# Intelligent full models for complex products

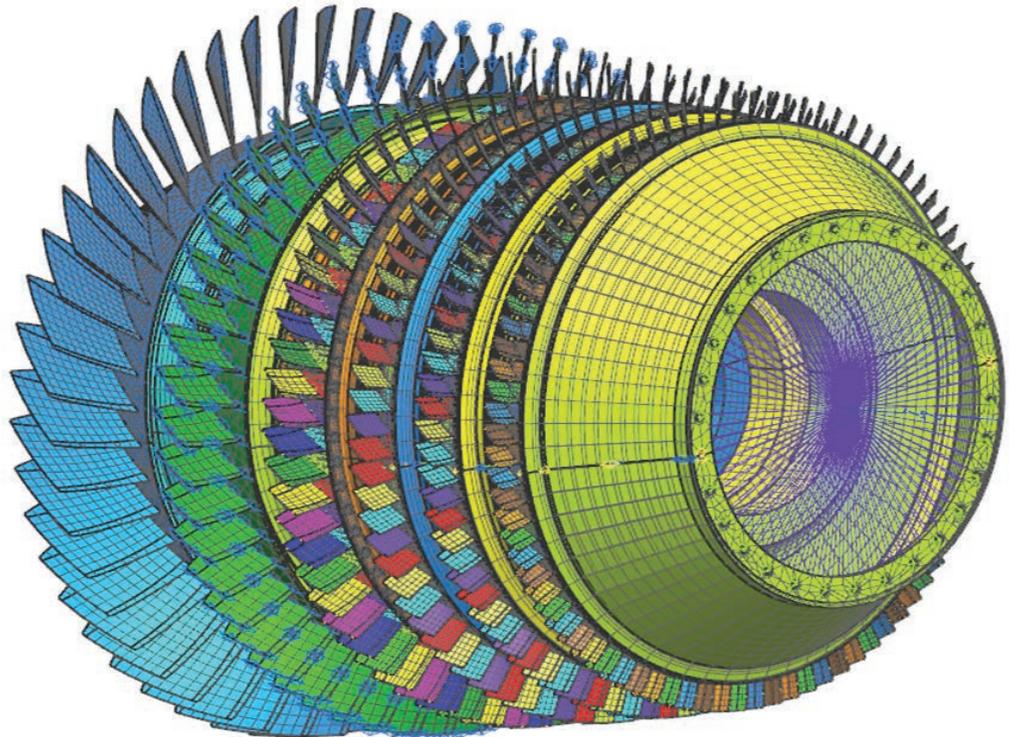
Simcenter 3D also includes co-simulation capabilities with LMS Imagine.Lab Amesim software.

## Effectively modeling the complete system

Simcenter 3D helps you efficiently deal with full product models comprising various components. Unlike traditional CAE preprocessors that typically generate large monolithic analysis models, with Simcenter 3D you can create FE assemblies by instancing and connecting component models, similar to CAD assembly modeling. As the design changes, the software automatically updates all component instances and connections in the assembly.

FE assembly models can routinely have tens of millions of degrees-of-freedom (DOF), and model size is expected to grow strongly in the coming years. The solvers in Simcenter 3D are designed to keep pace so that large analyses will never be a problem. Structural, flow and acoustic solvers can be used in distributed memory parallel (DMP) and shared memory parallel (SMP) processes to dramatically accelerate calculation whenever needed.

To improve prediction accuracy, measurement data of existing components, including dynamic behavior, can be used in Simcenter 3D with a so-called hybrid modeling approach. With its unique capability to incorporate both test-based and FE-based models in an assembly, the Simcenter 3D hybrid approach



offers the accuracy and design flexibility to produce realistic simulation results.

#### Automating full-system analysis

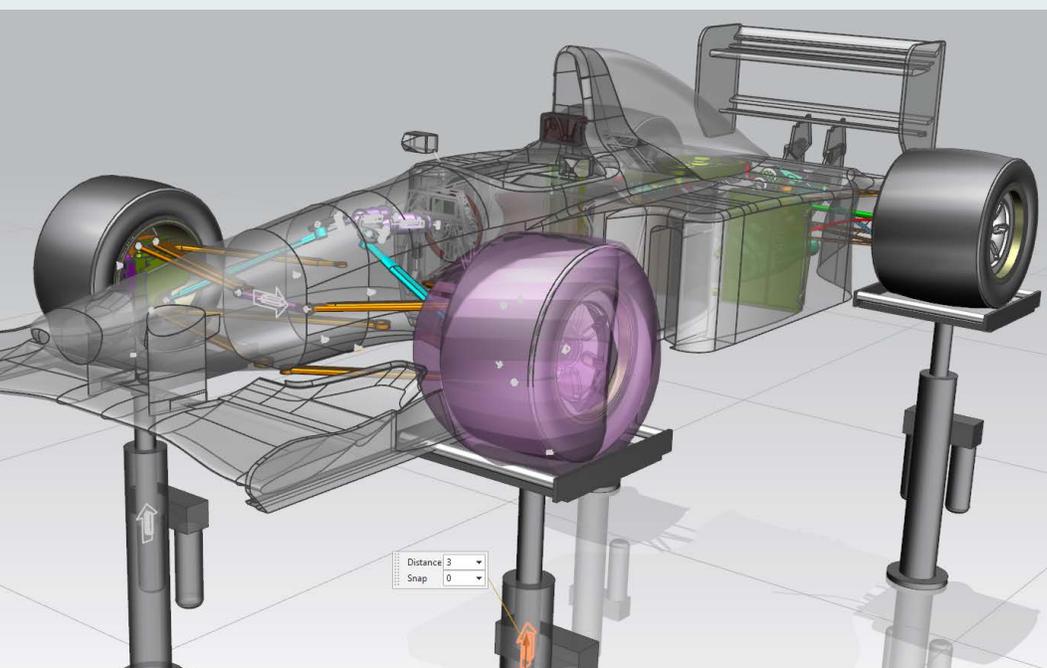
Simcenter 3D is an open platform that easily connects to external data sources and solvers. It integrates very well in any development process. The underlying data model has been specifically designed for collaboration and data sharing between CAE analysts.

Today's complex products include mechanical components, software, electronics and controls. During development it is crucial to understand how these mutually interact. Simcenter 3D has co-simulation capabilities that

can combine motion analysis with controls designed and simulated in the MATLAB® environment and the Simulink® environment. With these, you can analyze mechanics and controls simultaneously and efficiently evaluate how a smart product will perform.

#### Your benefits

- Increase the performance of your full product simulation process with intelligent modeling techniques and powerful solver schemes
- Implement an assembly process that allows you to easily perpetuate component changes into the full system
- Automate your process by capturing expert knowledge and best-practice workflows
- Accurately analyze your smart product as it will behave in real operation by including multiphysics and controls



Simcenter 3D is an open platform that easily connects to external data sources and solvers.

# Supporting predictive engineering analytics

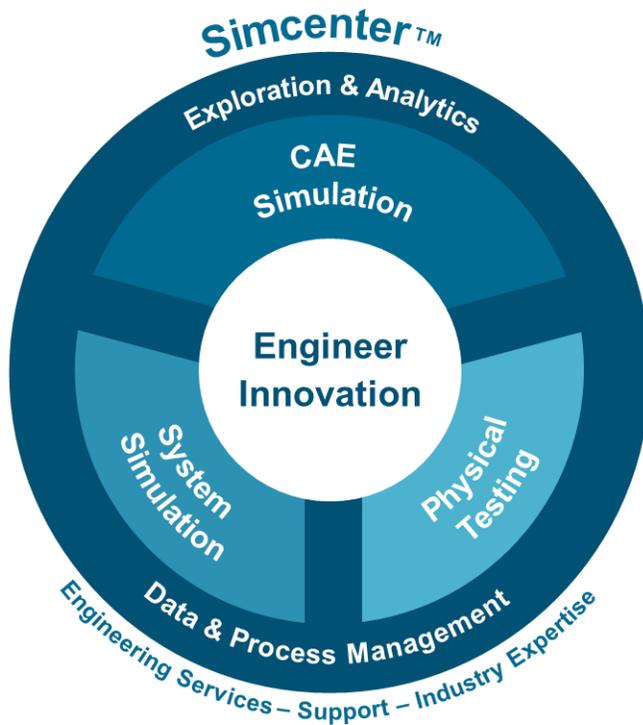
The Simcenter portfolio helps companies tackle the most difficult challenges in achieving new products and innovations.

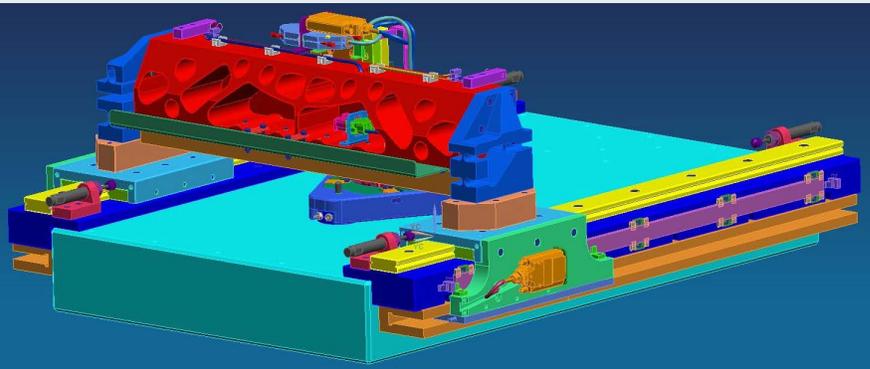
Simcenter 3D is part of the larger Simcenter solution portfolio. The digital twin concept requires realistic and powerful multi-domain simulation, combined with advanced testing to help you create a predictive model for every stage of the product lifecycle. A strong underlying data management structure must close the loop between requirements, design, simulation and usage.

The Simcenter portfolio from Siemens PLM Software helps companies tackle the most difficult challenges in achieving new products and innovations.

The portfolio includes solutions that span 1D simulation, 3D simulation and testing, combined with intelligent reporting and data analytics. The result is a rapid engineering process that you can have confidence in.

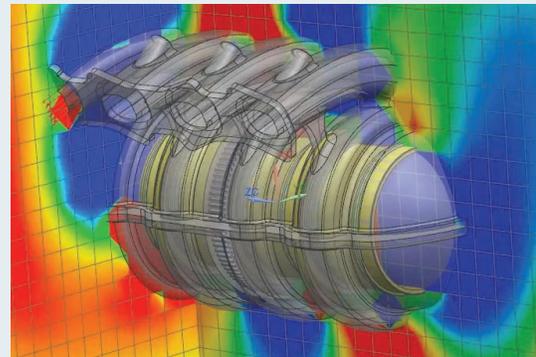
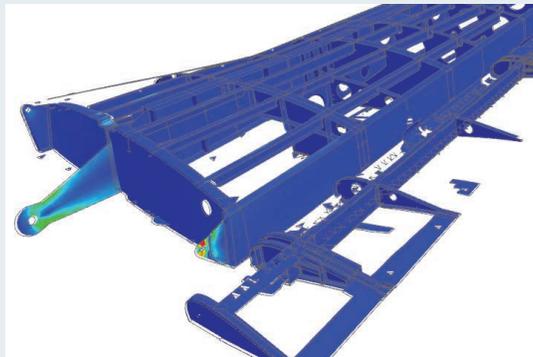
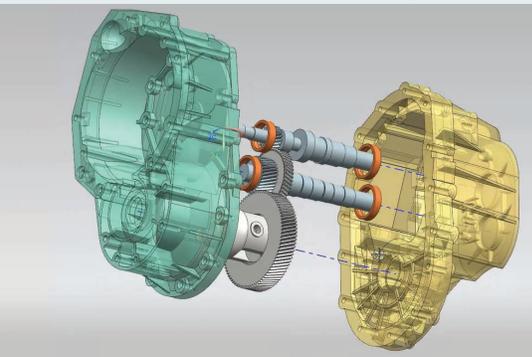
As part of the Simcenter portfolio, Simcenter 3D solutions offer uniquely tight integration with 1D simulation and test. Simcenter 3D also works seamlessly with design and data management solutions, allowing tight collaboration across the enterprise and enabling you to realize the vision of predictive engineering analytics.





*"In order to keep delivering the most accurate bearing and positioning slides, we digitalized our entire engineering and manufacturing process using Siemens PLM Software solutions."*

*Jan Willem Ridderinkhof  
Manager of research and  
development and engineering  
PM-Bearings*



## About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Digital Factory Division, is a leading global provider of software solutions to drive the digital transformation of industry, creating new opportunities for manufacturers to realize innovation. With headquarters in Plano, Texas, and over 140,000 customers worldwide, Siemens PLM Software works with companies of all sizes to transform the way ideas come to life, the way products are realized, and the way products and assets in operation are used and understood. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

Headquarters: +1 972 987 3000  
Americas: +1 314 264 8499  
Europe: +44 (0) 1276 413200  
Asia-Pacific: +852 2230 3333

© 2019 Siemens Product Lifecycle Management Software Inc. Siemens and the Siemens logo are registered trademarks of Siemens AG. Femap, HEEDS, Simcenter 3D and Teamcenter are trademarks or registered trademarks of Siemens Product Lifecycle Management Software Inc. or its subsidiaries in the United States and in other countries. Simcenter, Simcenter Amesim, Simcenter Samcef, Simcenter SCADAS, Simcenter Testxpress, Simcenter Soundbrush, Simcenter Sound Camera, Simcenter Testlab and LMS Virtual.Lab are trademarks or registered trademarks of Siemens Industry Software NV or any of its affiliates. Simcenter STAR-CCM+ and STAR-CD are trademarks or registered trademarks of Siemens Industry Software Computational Dynamics Ltd. All other trademarks, registered trademarks or service marks belong to their respective holders.

56037-A40 1/19 A