SIEMENS
Ingenuity for life

Siemens Digital Industries Software

Femap

Powering today's most advanced engineering analysis environment

siemens.com/plm/femap

Best-in-class digital simulation

Why digital simulation?

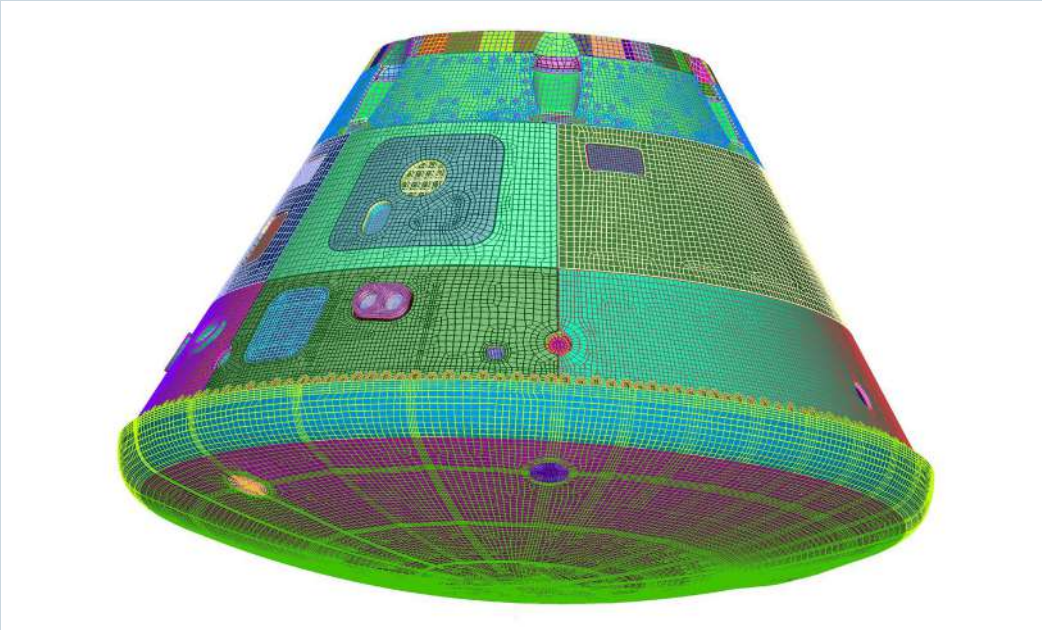
Industry pressure to reduce costs and improve quality is driving growth in the use of digital simulation throughout the product lifecycle. Choosing the right tools is key to achieving the business benefits of digital simulation.

Why Femap?

Siemens Digital Industries Software's Femap™ system is a part of the Simcenter portfolio of simulation products and facilitates an advanced engineering analysis environment. CAD-neutral and solver-neutral technology and cost-effective functionality have enabled Femap to become the world's most popular engineering analysis environment for Nastran users. It is widely used by the world's leading engineering organizations and consultants to model complex products, systems and processes, including satellites, aircraft, defense, automotive vehicles, electronics, heavy construction equipment, lift cranes, marine vessels and process equipment.

Femap with Simcenter Nastran® software are highly integrated and can be sold together as a bundled solution. But more than this, being open to all solvers, Femap demonstrates the power and value as a core analysis tool.

Femap is CAD independent and leverages Siemens Digital Industries Software's Parasolid® modeling kernel that allows direct access to Parasolid data for surface and solid modeling in addition to advanced geometric tools necessary for accessing non-Parasolid geometry.



From advanced beam modeling, midsurface extraction and hex meshing to robust CAD import and idealization, Femap gives you unparalleled model control and flexibility with a broad range of loads, materials, analysis types and visualization options.

Femap is not just a solid investment for those committed to excellence in the use of finite element analysis technologies. It's the right tool to help you realize your business goals.

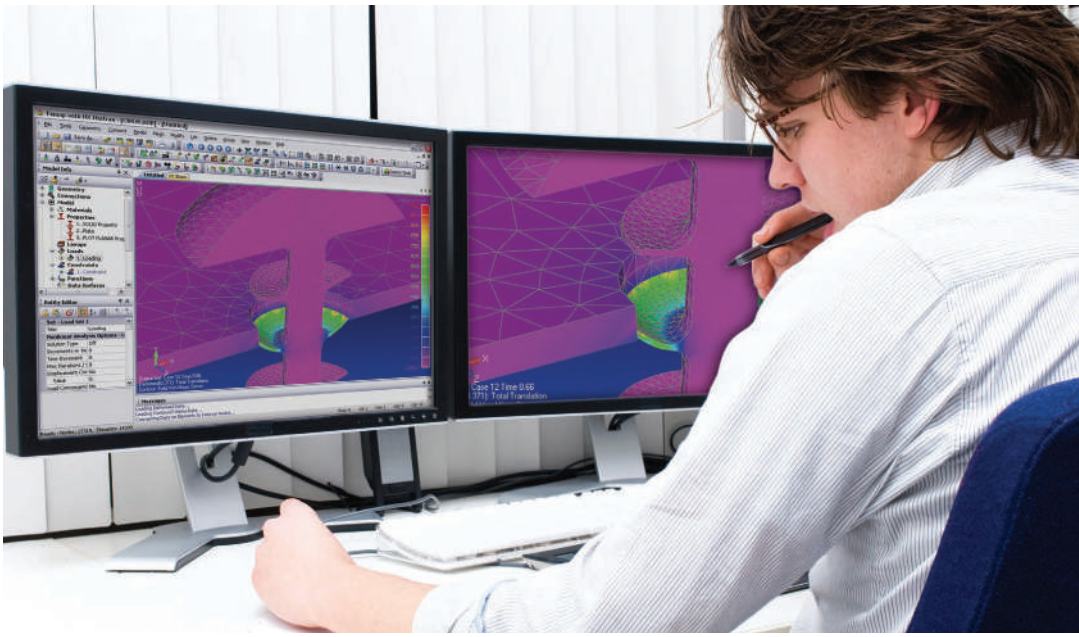
Your business benefits

- Faster to market with innovative new products
- Lower cost through reduced physical prototyping, fewer engineering change orders and better in-service warranty
- Improved product quality

FEA performance with ease-of-use

Inside front cover: Courtesy of Lockheed Martin Space Systems

Page 3: The modern Windows-native user interface provides a flexible and customizable analysis environment for structural, thermal, CFD and in-house applications.



"Femap with Simcenter Nastran simplifies the product validation process. Reduced prototypes also lead to reduced costs and shorter development times. The design cycle has been reduced by 40 percent."

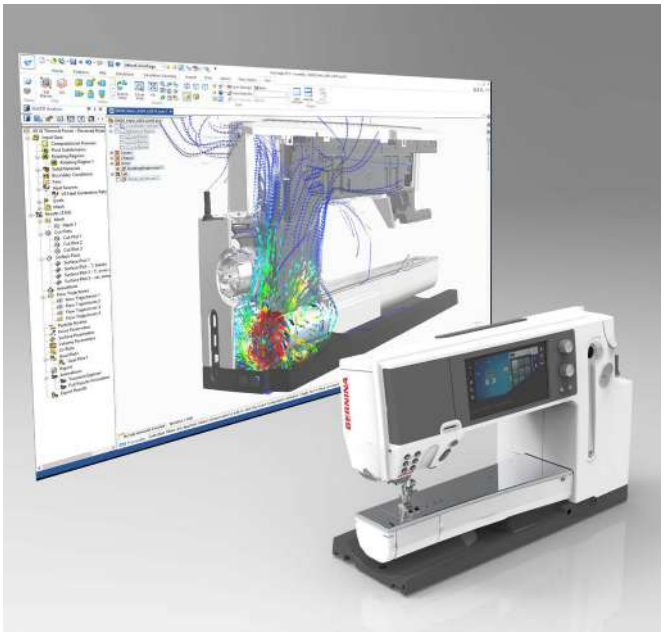
Cui Zhongqin, Baotou Hydraulic Machinery

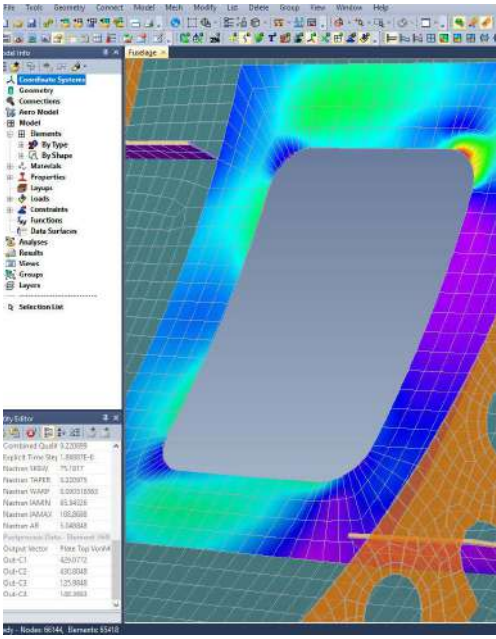
Femap is recognized as the world's leading CAD-independent Windows-native pre- and postprocessor for advanced engineering finite element analysis (FEA). It provides engineers and analysts with a mesh-centric FEA modeling solution to handle even the most complex tasks easily, accurately and affordably.

Femap has embodied the principles of power and simplicity for over 30 years and continues that focus today with a Windows-native graphical user interface and efficient workflows that simplify access to all Femap functionality and streamline the process of creating an accurate and representative simulation model.

As an engineer, you demand software that is not only cost effective and easy to use, but with the power to model the toughest problem. Femap delivers just that – affordable high-performance FEA modeling for the engineering desktop with Windows-native ease-of-use.

Solid Edge Simulation
FloEFD Analysis





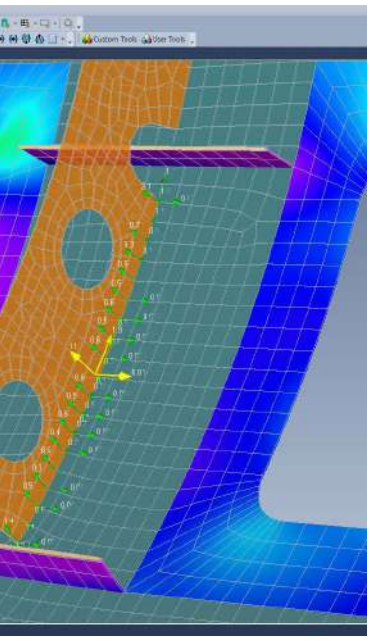
Scalable solutions

Powerful, affordable CAE

Femap is available standalone or bundled with Simcenter Nastran with add-on modules that form a series of powerful, robust and affordable solutions suitable for companies that have a diverse set of analysis requirements. In addition, the analysis capabilities in Solid Edge Simulation are powered by Femap. By providing engineering and design teams with advanced CAE tools, companies enable their engineers to focus on improving product performance and reliability while streamlining the product development process.

Femap with Simcenter Nastran

The Femap with Simcenter Nastran package seamlessly combines the advanced functionality of the Windows-native Femap pre- and post-processor with the powerful Simcenter Nastran solver. Femap with Simcenter Nastran allows engineers access to a much greater depth of analysis functionality to easily and efficiently solve complex engineering problems.



Additional Simcenter Nastran modules

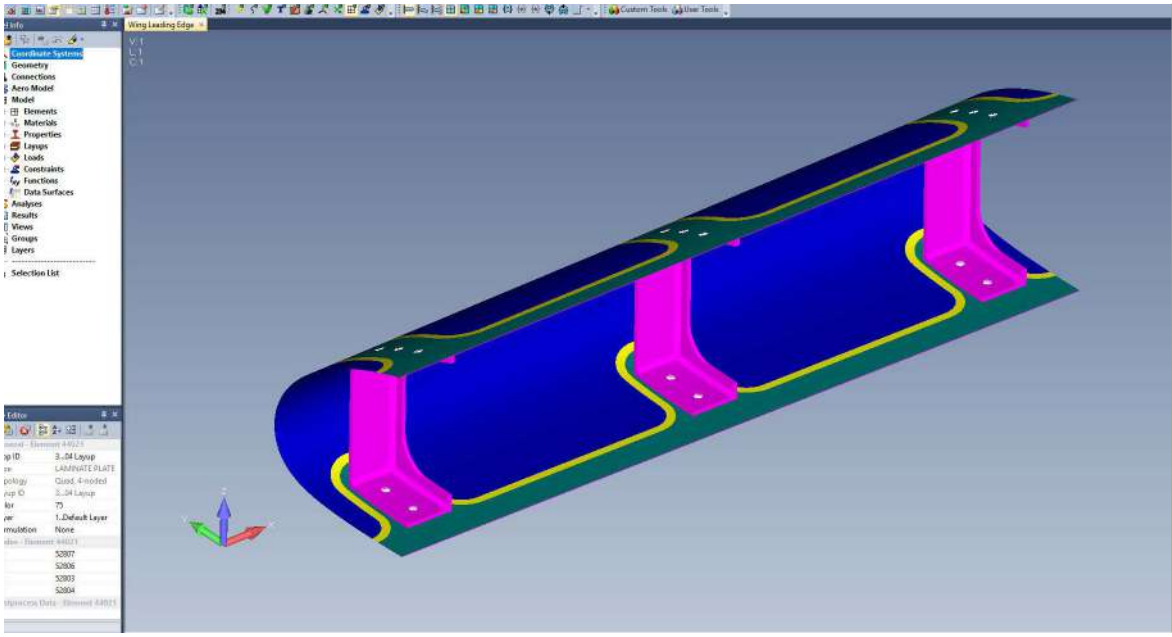
A series of advanced Simcenter Nastran solution capabilities are available as add-on modules, providing engineering desktop solutions for even the most advanced Nastran analysis.

Proven solutions

By leveraging over 30 years of integration effort, Femap with Simcenter Nastran provides direct access right on the Windows engineering desktop to the most complete suite of Nastran capabilities available today. Siemens Digital Industries Software combines flexible licensing and packaging with "fair value" pricing to provide all engineering tool users with an affordable way to access the most advanced Nastran capabilities at an attractive total cost of ownership.

"Creating advanced models that are both accurate and fast definitely gives us a competitive edge and has become a critically important contribution on these fast-paced, technically challenging spacecraft projects."

Jeff Preble
SpaceWorks



CAD independent

Serious engineering in a Windows environment

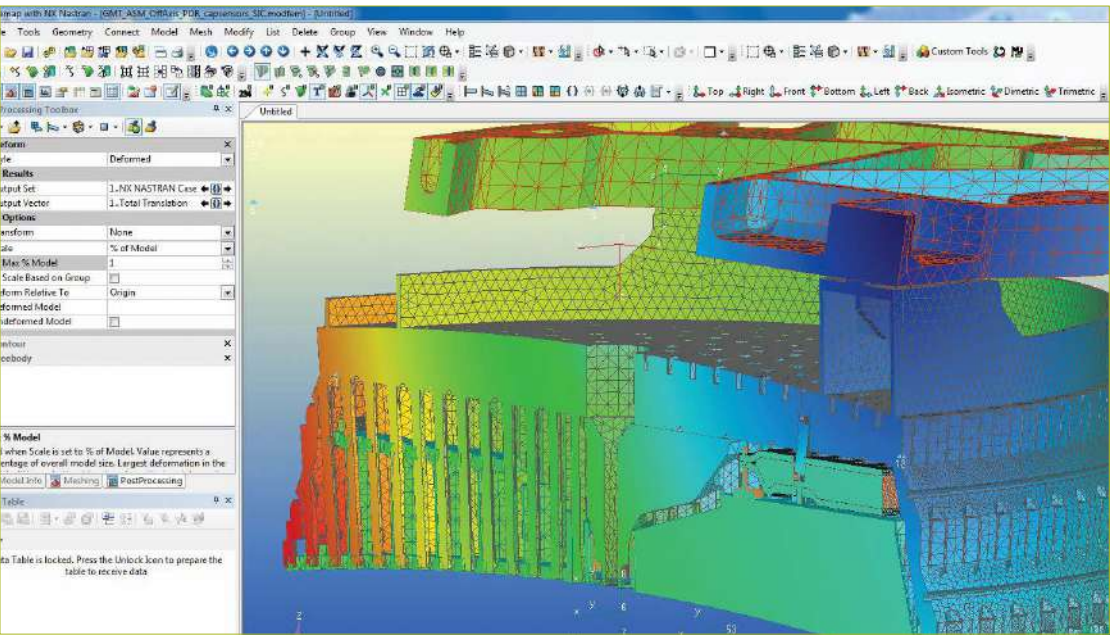
Femap delivers a depth of functionality normally only found in more expensive applications. With powerful tools easing all aspects of the creation, manipulation and review of an engineering analysis model, Femap is the natural choice for a complete CAD-independent analysis environment.

Femap provides exceptional value and performance and is not limited to geometry-based digital data. Femap will also delight customers working with pure finite element model data. As a nuts-and-bolts, "bottom up" finite element pre- and post-processing solution, Femap provides a range of FEA model readers to rapidly import existing models from many FEA solvers. Advanced functionality then eases manipulation of finite element data at the node and element level.

The bottom line is that Femap makes it possible to quickly create models that accurately predict the structural, dynamic and thermal performance of single components, assemblies or complex systems.

CAD independent

Femap offers seamless geometry access with major CAD systems such as PRO/Engineer, CATIA, NX™ software, NX I-deas™ software, Solid Edge® software, AutoCAD and SolidWorks. Based on the industry-standard Parasolid geometry engine, Femap offers extensive geometry creation and modification tools including standard wireframe curves, surface and solid modeling. Powerful shelling, blending, Boolean operations, surface imprinting and lofting combine to make Femap extremely effective at creating or modifying geometry for analysis.



A better mesh, faster than ever

With fully automatic, high-speed tetrahedral solid meshing and quad-dominant surface meshing technology, Femap creates fast and accurate meshes easily and reliably. You can also take over full control and work interactively with Femap to manipulate the mesh or underlying geometry, while viewing element quality feedback live.

The right geometry for analysis

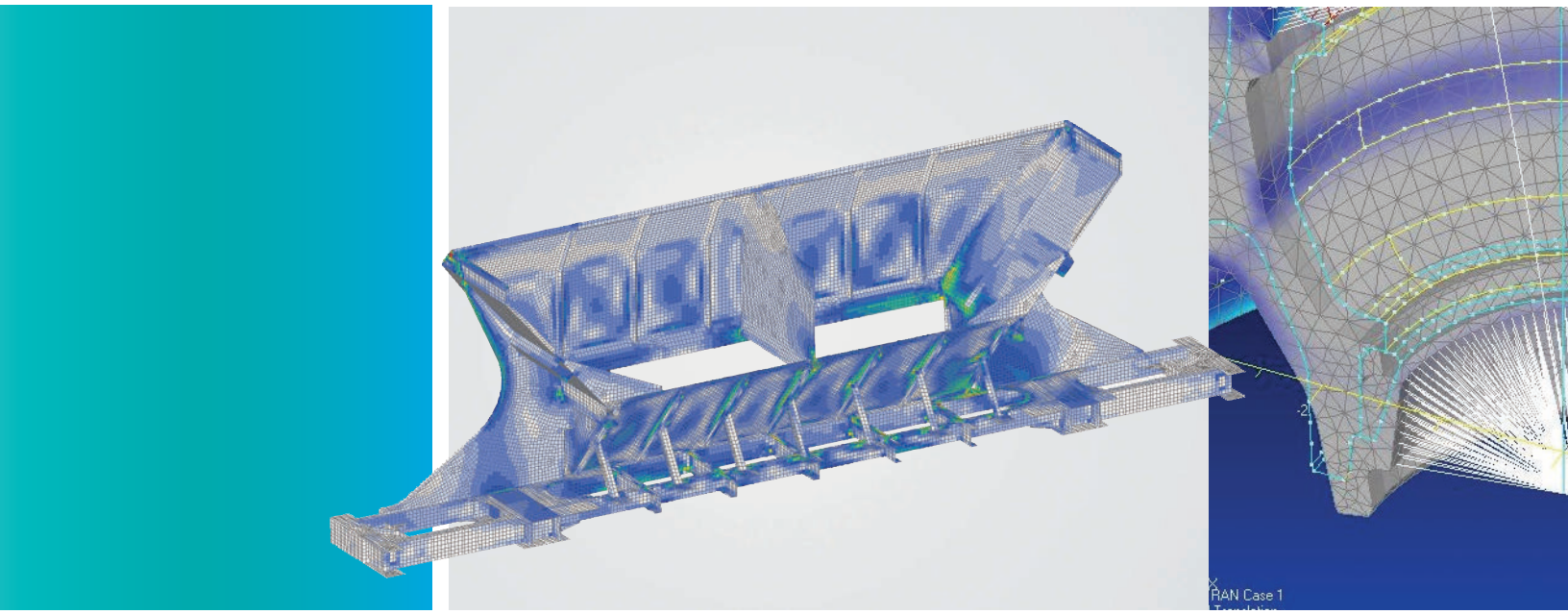
Engineers often encounter geometry that is not ideal for analysis model definition. Femap provides geometry creation and editing tools for curves, surfaces and solids, feature suppression and mid-surface extraction. Solids can be subdivided and automatically connected to represent dissimilar materials or to facilitate semi-automatic hexahedral mesh generation. Engineers can combine multiple surfaces to improve meshing areas for higher quality shell meshes.

Automatic assembly management

Femap can automatically detect components of an assembly that are in contact. The method of connection, whether glued or contact (linear and nonlinear) is easily specified allowing rapid setup for assembly models.

"The significant meshing enhancements for hexa-elements in Femap helped our productivity to increase by 30 percent or more. Even for difficult shapes, Femap performs well. Without requiring a complicated operation, a good quality mesh can be obtained."

Yuka Fukunaga
Analysis Technology Research Center Sumitomo Electric Industries



Solver independent

Integrating analysis technologies

Leading firms recognize that a single analysis technology seldom meets all their requirements. By integrating multiple analysis technologies in a single modeling and visualization environment with Femap, they can make better design decisions faster.

Analysis set manager

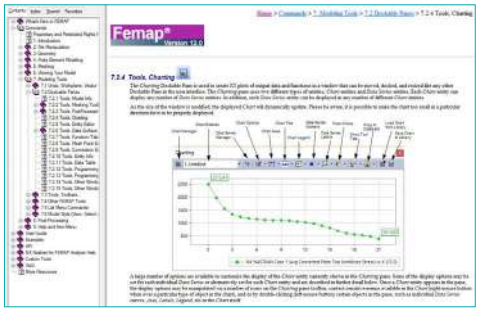
The analysis set manager in Femap allows you to store solver setup data with your models, so you don't need to complete numerous dialog boxes each time you edit your model and create a new analysis input file. The sets can also be saved in a library for use with other models.

Multiple solver support

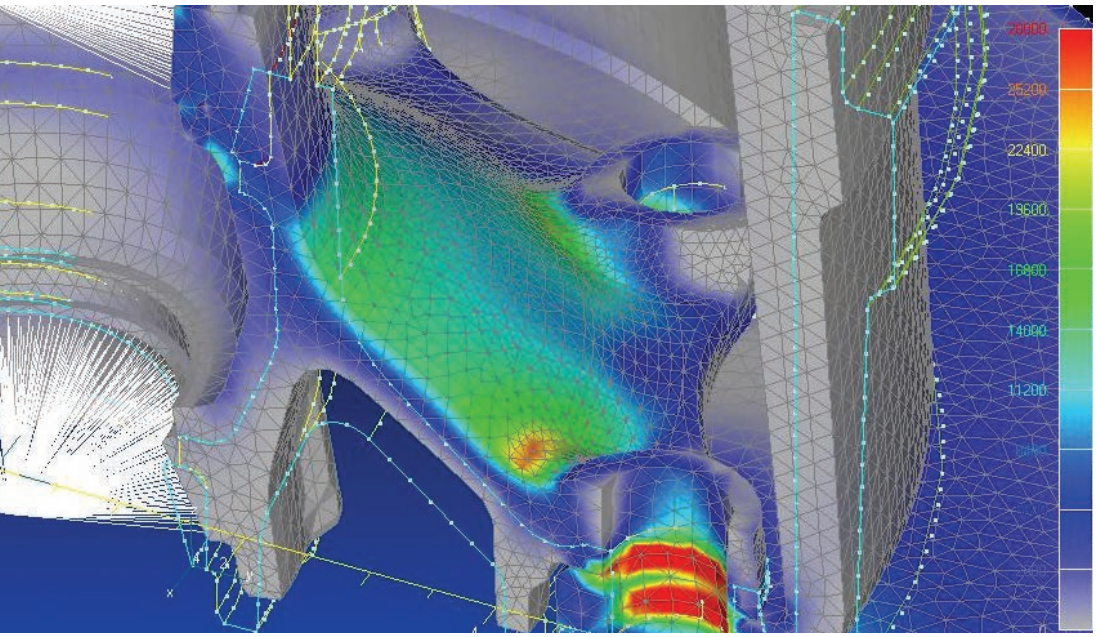
Femap provides in-depth, high-quality support for industry standard solvers, including the popular and proven Simcenter Nastran, MSC Nastran, Abaqus, ANSYS, MSC.Marc, LS-DYNA, SINDA and TMG.

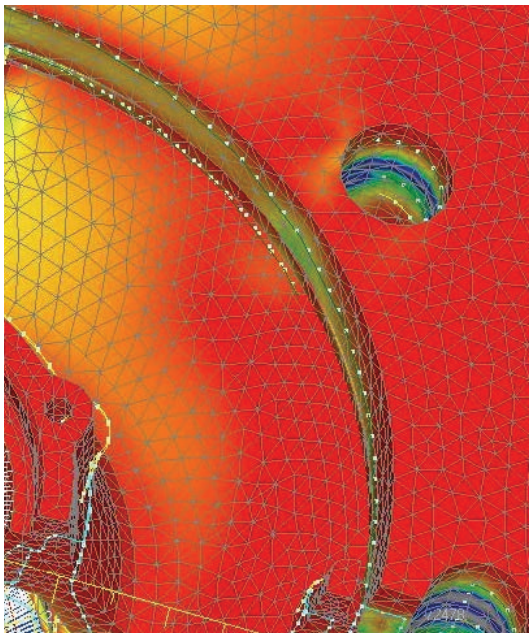
Femap provides the ability to re-use and integrate analysis models from legacy data as well as from customers and suppliers.

The complete Femap element library, with comprehensive support of physical and material definitions, takes full advantage of the advanced capabilities of these solvers, including dynamic, geometric and material nonlinear, heat transfer and fluid flow applications.



Easy-to-use online HTML and PDF documentation and help





Fully customizable

Integrated BASIC API Programming Environment

Femap offers a full-featured BASIC development environment in a separate window. Directly from the Femap user interface, you can access the OLE/COM object-oriented Femap application programming interface (API) that provides direct access to all Femap objects and functionality. The BASIC engine is fully OLE/COM compliant and can interface with Femap as well as any OLE/COM compliant program such as Word or Excel. You can create custom programs that automate repetitive tasks, search model or results data, or programs that transfer model information to Word or Excel to create customized reports.

Many useful programs are delivered with Femap in an ever expanding library, and can be found in the Custom Tools toolbar right in the user interface.

These powerful customization capabilities allow complete access to Femap full functionality through standard nonproprietary programming languages, and maintain Femap as the industry's premier independent and open engineering environment.

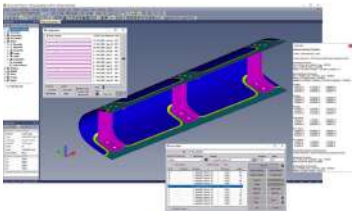
Macro program files

In addition to the API programming capability, Femap hosts a Program File capability in its own Femap window. User-defined macros can be recorded, edited, debugged, and played back all within the Femap interface.

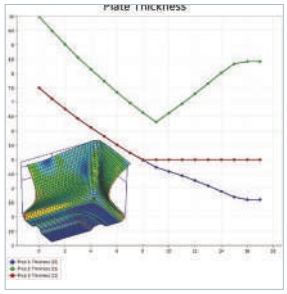
"The application of custom tools enabled us to reduce the time for developing finite element models and postprocessing analysis results by a factor of at least ten."

Chris Mairs
Cardinal Engineering

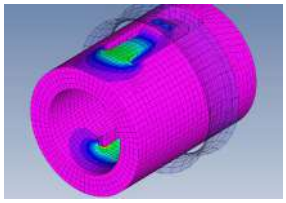
Flexible solution configurations



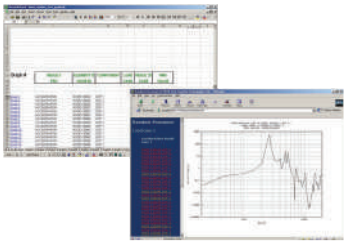
Femap with Simcenter Nastran



Optimization



Multi-step nonlinear



Structural analysis toolkit

Femap with Simcenter Nastran
Provides all of the capabilities that you will need in many instances, including linear statics, normal modes, buckling, steady-state and transient heat transfer, basic nonlinear, design sensitivity and unlimited problem size capabilities.

Dynamic response
Enables product performance to be evaluated in both the time and frequency domains.

Optimization
Determine optimal design parameters with sizing and topology optimization capabilities.

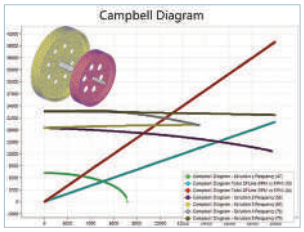
Rotor dynamics
Predicts the dynamic response of rotating systems such as shafts, turbines and propellers to determine critical shaft speeds.

Multi-step nonlinear
Facilitates large deformation; supports nonlinear materials, time-dependent loads, deformable and rigid contact. Provides nonlinear time integration for impact analysis.

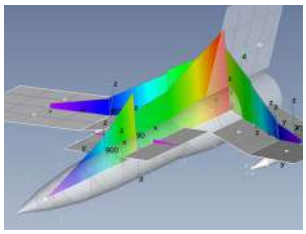
Structural analysis toolkit
Saves postprocessing time by organizing results data and calculating additional results quantities.

Aeroelasticity
Determine structural response from aerodynamic loading for static and flutter conditions.

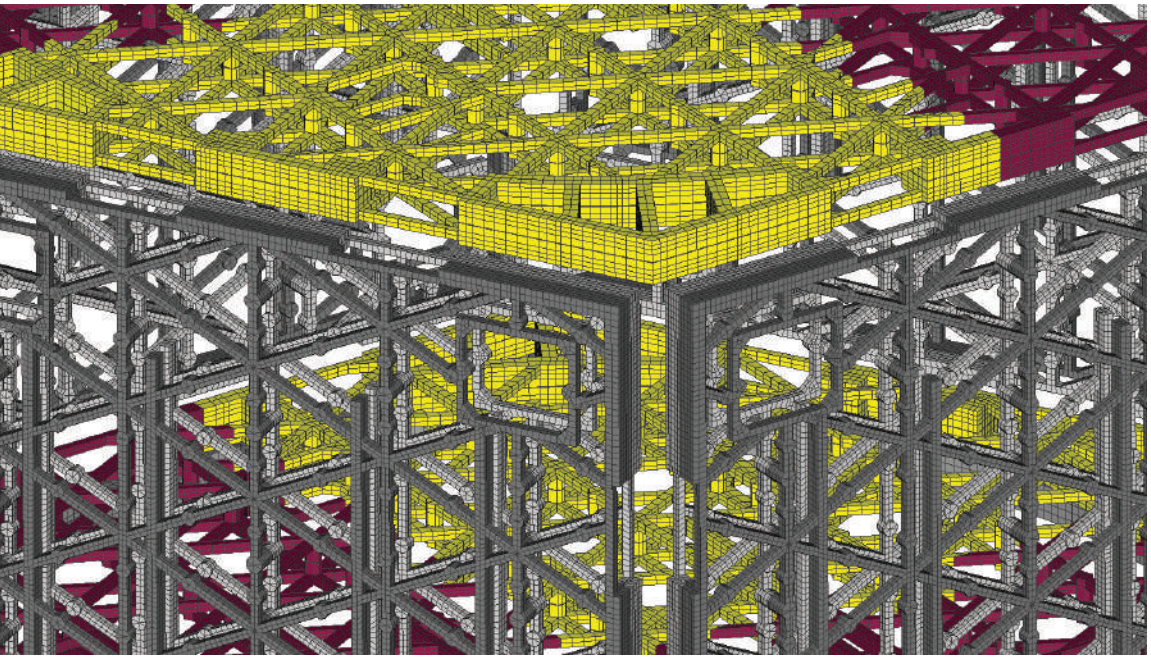
Dynamic response



Rotor dynamics



Aeroelasticity



Simcenter Nastran and TMG analysis capabilities available with Femap

	Femap with Simcenter Nastran base module	Analysis extensions	Advanced bundle	License extension
Linear static	•		•	
Normal modes	•		•	
Buckling	•		•	
Heat transfer (steady-state and transient)	•		•	
Basic nonlinear	•		•	
Linear contact	•		•	
Glued connection	•		•	
Bolt preloads	•		•	
Dynamic response (transient and frequency)		•	•	
Design optimization		•		
Topology optimization		•		
Multi-step nonlinear		•		
Rotor dynamics		•		
Superelements			•	
Direc matrix abstraction programming (DMAP)			•	
Aeroelasticity			•	
Distributed memory parallel (DMP)			•	
Desktop extension				•
Femap thermal solver		•		
Femap advanced thermal solver		•		
Femap flow solver		•		

Integrated multi-physics solvers for Femap

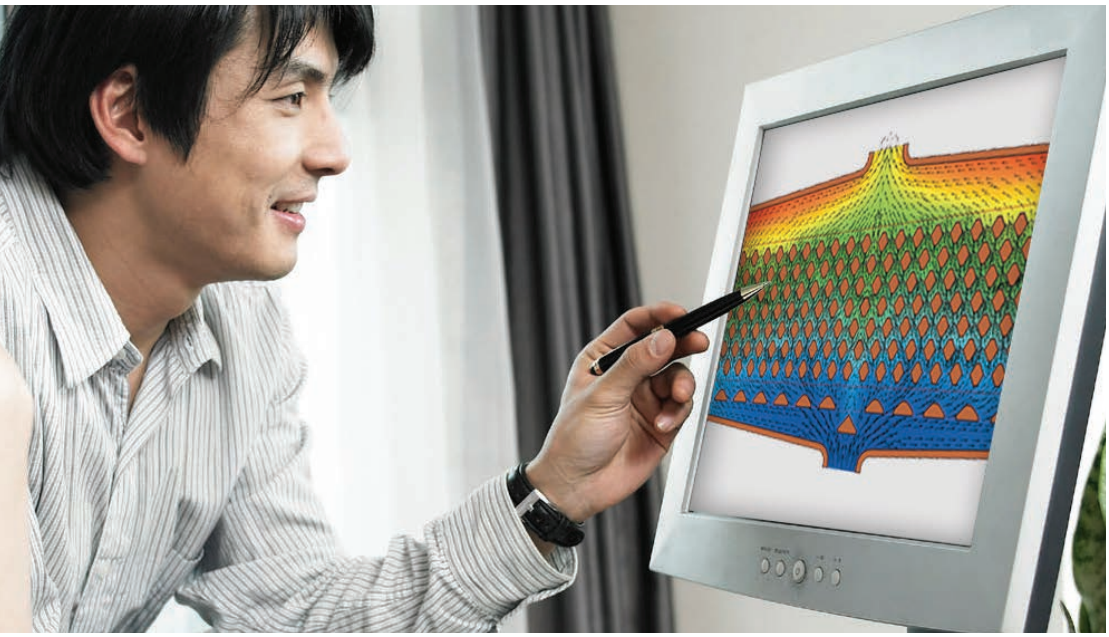
Femap Thermal

Femap Thermal includes both the transient and steady-state thermal analysis capabilities required to solve a majority of common engineering problems. Capabilities include the modeling of conduction, convection, radiation and phase change. Femap Thermal provides a range of thermal boundary conditions and solver controls as well as a powerful thermal modeling tool for assemblies. This thermal coupling capability allows users to create paths for heat to flow between parts in large, complex assemblies.

Femap Advanced Thermal

Femap Advanced Thermal adds many advanced thermal and fluid flow modeling capabilities to the Femap Thermal package. For example, fluid duct flow modeling includes coupled convection and fluid flow analysis. An extensive set of tools for advanced radiation and spacecraft modeling includes solar and orbital heating, orbit modeling and display, specular reflections with ray tracing and articulating structures.

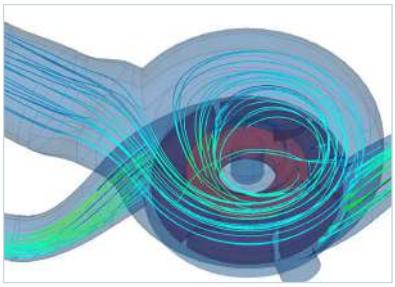
Femap Advanced Thermal also provides advanced solver features such as custom user subroutines, model simplification, substructuring and interfaces to industry thermal codes.

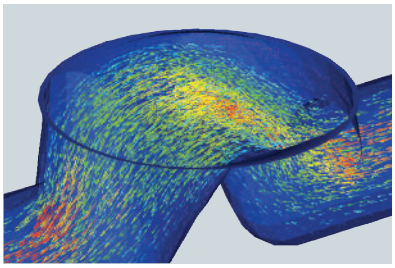


Femap Flow

Femap Flow provides a comprehensive 3D computational fluid dynamics (CFD) solution fully integrated within Femap. When combined with Femap Advanced Thermal, it solves a wide range of multi-physics problems that involve fluid flow and heat transfer. Both low-speed and high-speed compressible flows can be modeled. The Femap Flow solver uses an efficient and robust element-based finite volume, multi-grid solver to compute 3D fluid velocity, temperature and pressure for both steady-state and transient applications.

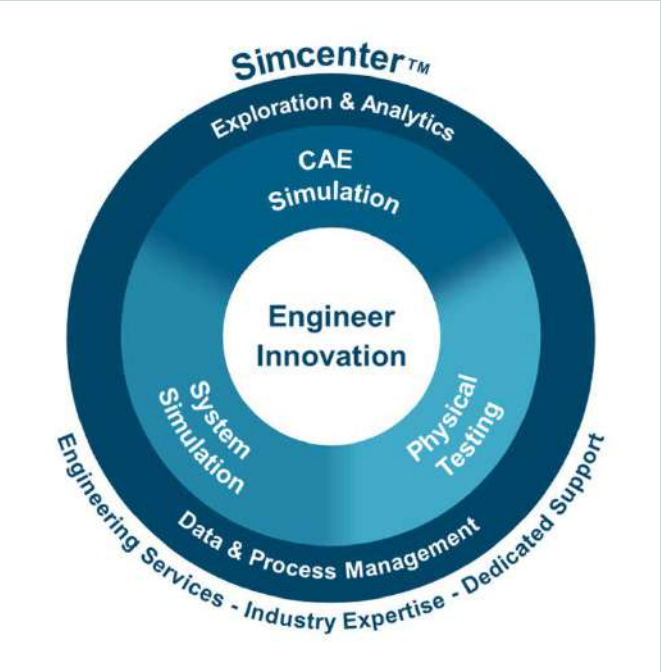
Forced flow, natural convection and mixed flows can be modeled with multiple inlets, outlets and internal flow boundary conditions. For electronics cooling applications, the package easily models fan curves, inlet and outlet resistances as well as convection from thin structures. Rotating systems, moving walls, flow turbulence models, humidity and other features are available for the most advanced fluid flow modeling requirements.





Simcenter portfolio

Femap is a part of the Simcenter portfolio of simulation products. Simcenter software from Siemens Digital Industries 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 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 and connects to design, system simulation, test and data management.



The Siemens Digital Industries Software advantage

Siemens Digital Industries Software's digital simulation applications are part of a broader portfolio that empowers development teams at the world's largest OEMs as well as thousands of the world's smaller companies. Value depends on the ability of solutions to scale, ensuring the right software is available to the right people and that specialists can leverage the work of the much wider development team.

Throughout its product portfolio, Siemens Digital Industries Software leverages key attributes that help companies achieve business objectives such as waste reduction, quality improvement, shorter cycle times and greater product innovation. These unique attributes directly support business process initiatives aimed at transforming product development:

Managed development environment

Full integration, synchronized management of all product data and process knowledge to transform product development with a structured collaborative environment.

Unified product development solution

Seamless integration of applications to rapidly propagate changes of product and process information, replacing point solutions with a unified development system, from concept to manufacturing.

Knowledge-driven automation

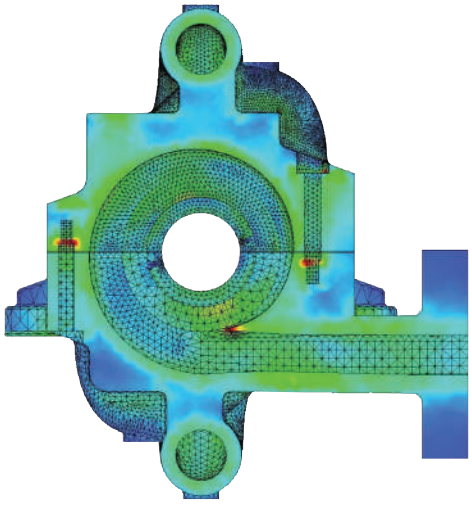
The application of product and process knowledge across all elements of product development to automate processes and maximize re-use.

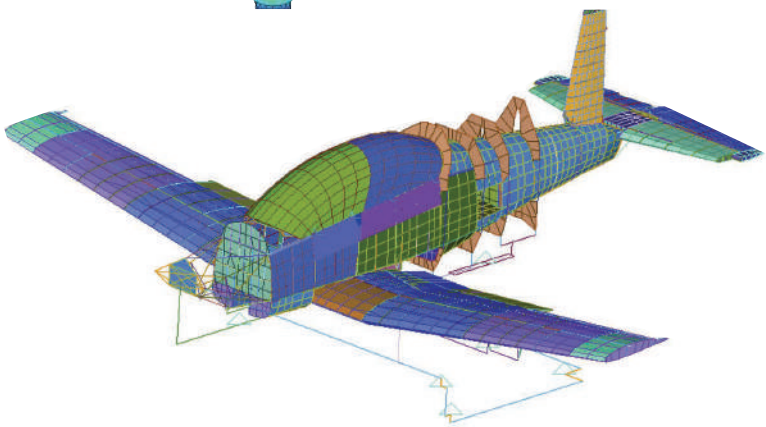
Simulation, validation and optimization

Comprehensive simulation and validation tools to automatically check performance and manufacturability at every step of the development process for closed-loop, continuous, repeatable validation.

System-based modeling

Structured conceptual models standardized design practices that allow rapid creation of variants, transforming development from component-based design to a systems engineering approach.





About Siemens Digital Industries Software
Siemens Digital Industries Software, a business unit of Siemens Digital Industries, 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, we work 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 our products and services, visit siemens.com/plm.

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