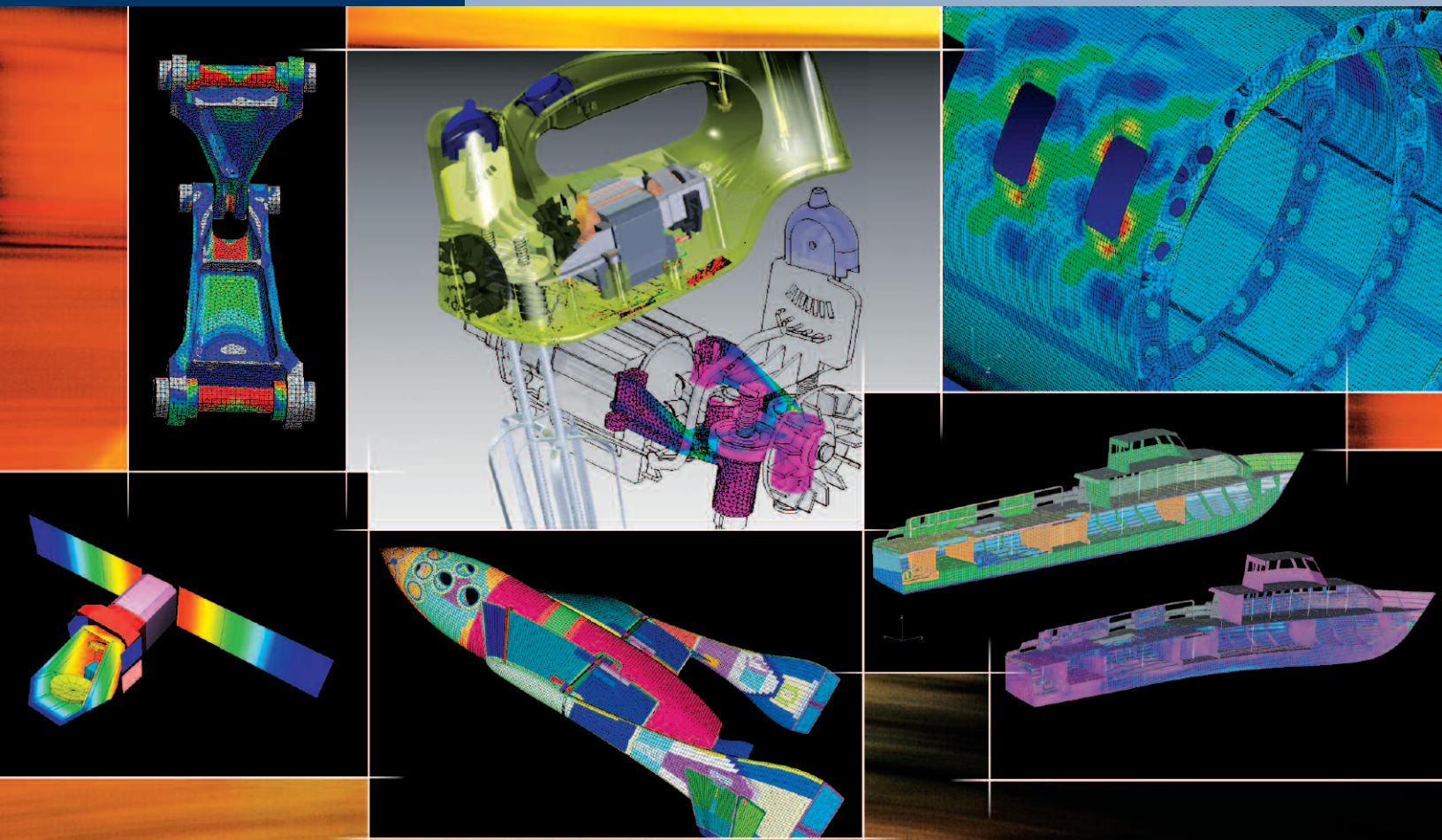


Femap:

World-class FEA solutions
for the Windows desktop

Siemens PLM Software

www.siemens.com/plm/femap



Developing exceptional products that meet strict quality and performance criteria cannot be left to chance. Femap® software and NX® Nastran software from Siemens PLM Software takes the guesswork and worry out of your product development process with a comprehensive suite of world-class digital simulation solutions.

VELOCITY SERIES

SIEMENS

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 Siemens PLM Software?

Siemens helps manufacturers develop products right the first time with a complete range of simulation, validation and optimization tools.

Product quality with fewer prototypes

With Siemens' digital simulation, companies accurately model and analyze product performance characteristics while minimizing physical prototypes.

Siemens product simulation applications include dynamic motion simulation, basic strength analysis, system-level performance evaluation and advanced response, durability, fluid flow and multi-physics engineering analysis for robust simulation of functional performance.

Why Femap?

Femap is an advanced engineering analysis environment. It is cost effective, both CAD and solver neutral, and has 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 and NX Nastran 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 both leverages the Siemens Parasolid® software modeling kernel that allows direct access to Parasolid data for surface and solid modeling in addition to providing advanced geometric tools necessary to access non-Parasolid geometry.

From advanced beam modeling, mid-surface 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 costs from reduced:
 - physical prototyping
 - engineering change orders
 - in-service warranty
- ▶ Increased product quality

FEA performance with ease-of-use

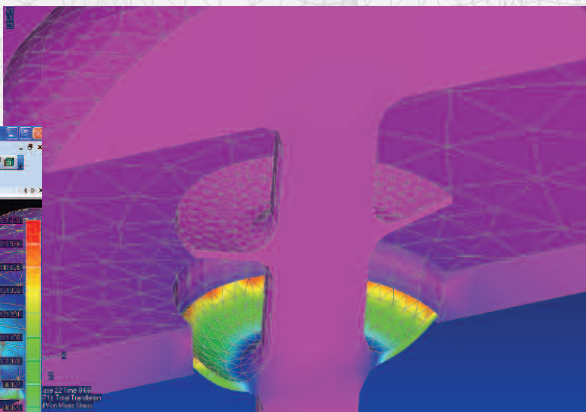
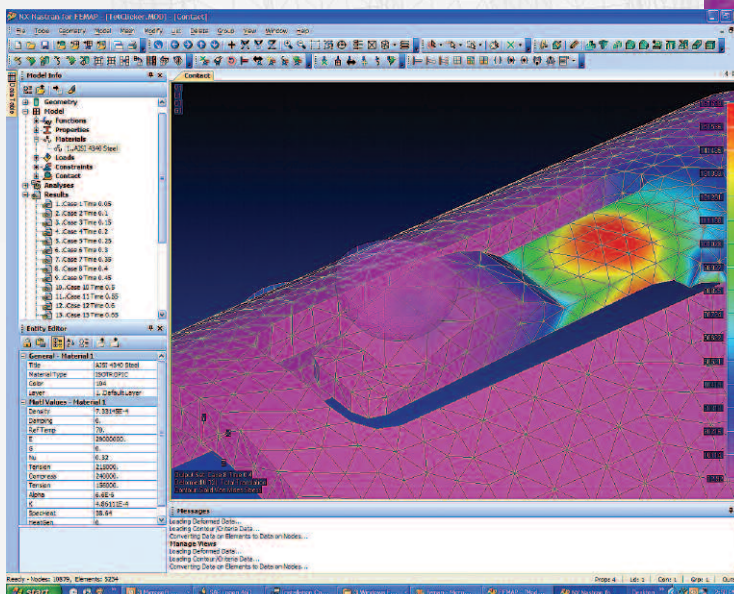
Femap is recognized as the world's leading CAD-independent Windows-native pre- and post-processor for advanced engineering finite element analysis (FEA). It provides engineers and analysts with an FEA modeling solution to handle even the most complex tasks easily, accurately and affordably.

Femap has embodied the principles of power and simplicity for over 20 years and continues that focus today with a new Microsoft Office-compatible graphical user interface, which streamlines working processes and access to all Femap functionality.

▶ 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.

Benefits of Femap's Windows-native user interface include:

- Work with multiple analysis models in the same session, use multiple views per model
- “Cut and paste” from one model to another
- Easy manipulation of modeling data, assembly management, analysis setup and results with the Model Info tree
- Review and edit Femap model data with the entity editor; copy and paste information between Windows applications
- Easily sort, group and edit model and results data using the convenient grid-based tabular representation of the data table
- Select Femap entities from the top level of the interface using the fully customizable toolbar interface
- Leverage the value of a common Windows-native implementation. Femap features a complete set of fully customizable, floating dockable toolbars



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

Scalable solutions

Powerful, affordable CAE

Femap is available in two core packages 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. By providing their 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 Express

Femap Express is a CAD-embedded solution for Solid Edge® software mainstream 3D CAD system that provides a guided step-by-step approach to the analysis of single components. Femap Express harnesses the Femap pre- and post-processor expertise with the time tested and proven Nastran solver technology. With Femap Express, designers will be able to determine quickly and easily whether the component under design will meet strength requirements – all within the Solid Edge environment.

Femap with NX Nastran

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

Additional NX Nastran modules

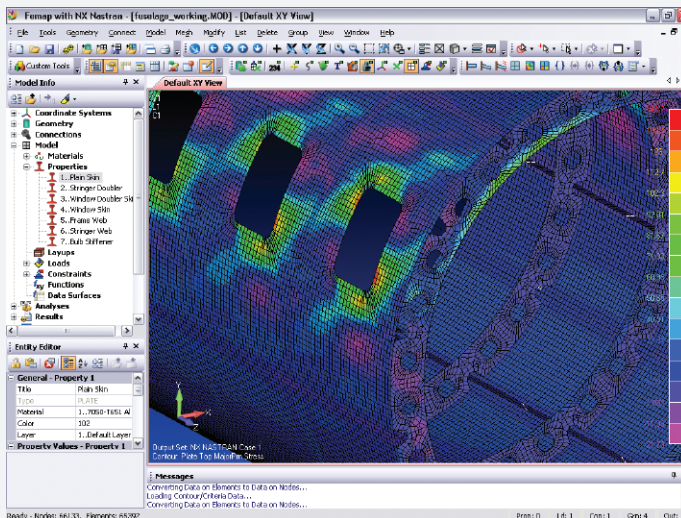
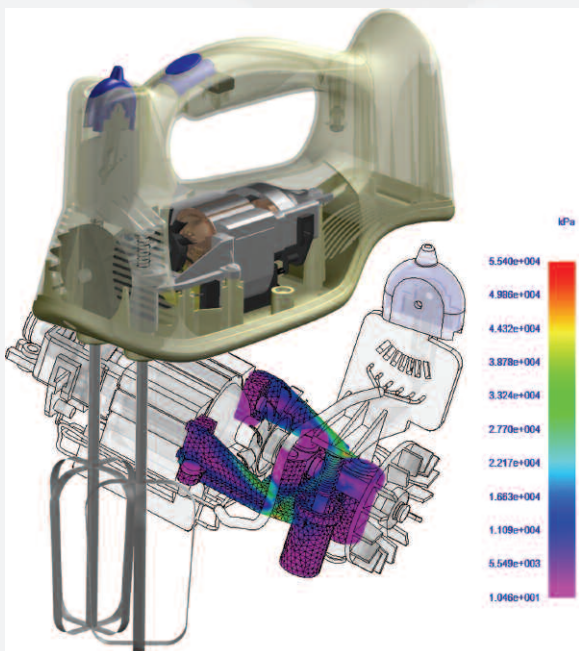
A series of advanced NX Nastran solution capabilities are available as add-on modules, providing engineering desktop solutions for even the most advanced Nastran analysis.

Proven solutions

By leveraging over 20 years of integration effort, Femap with NX Nastran provides direct access right on the Windows engineering desktop to the most complete suite of Nastran capabilities available today.

Licensing flexibility and packaging, combined with the “fair value” pricing philosophy of Siemens, provides all users of engineering analysis tools an affordable way to access the most advanced Nastran capabilities at an attractive total cost of ownership.

> An aerospace standard



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, NX I-deas® software, Solid Edge, AutoCAD and SolidWorks. Based on the industry-standard Parasolid geometry engine, Femap offers extensive geometry creation 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 geometry for analysis.

PROVEN VALUE

► *"The real value of simulation in aerospace is that you could not do what we're currently doing without it. Typical program schedules that used to take 5 years are now done in 2 years or 1 year."*

Chris Flanigan
Quartus Engineering

A better mesh, faster than ever

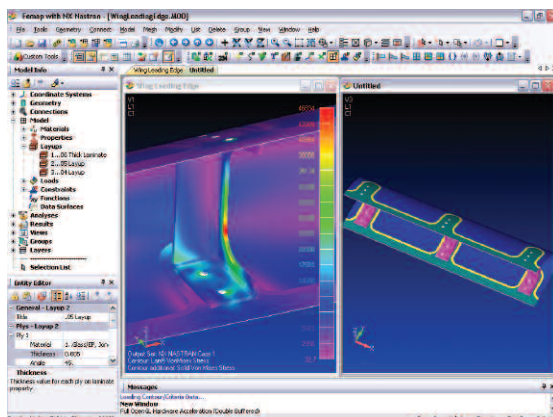
With intelligent default mesh sizing, Femap anticipates your meshing requirements. Femap also provides flexible mesh controls on points, curves and surfaces, with extensive options for biasing and control of mesh topology, plus fully automatic, high-speed tetrahedral solid meshing and quad-dominant surface meshing.

The right geometry for analysis

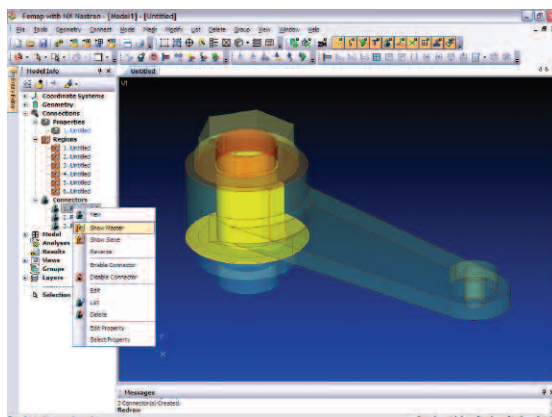
Engineers often encounter geometry that is not ideal for analysis model definition. Femap provides geometry creation and editing tools for curves, surfaces and solids, feature suppression and mid-surface extraction. Solids can be subdivided and automatically connected to represent dissimilar materials for 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.



Display multiple views of the same Femap model and/or multiple models in the same work session.



Assembly model

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.

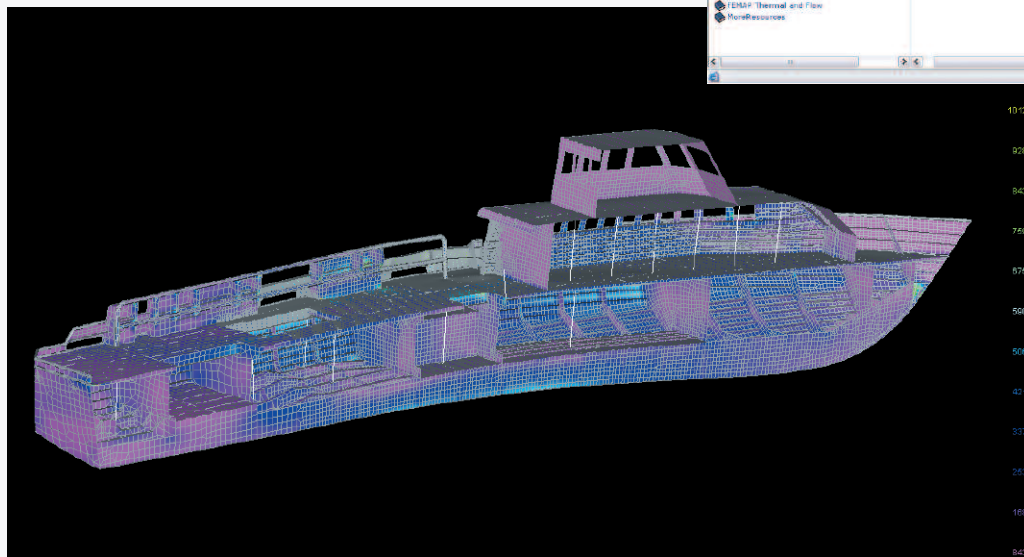
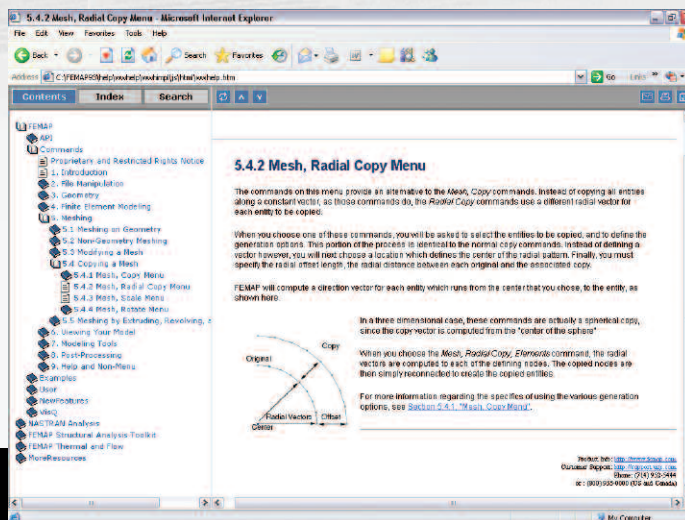
Analysis set manager

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 NX Nastran, MSC/MD Nastran, Abaqus, Ansys, MSC.Marc, LS-DYNA, SINDA and TMG. Femap provides the ability to re-use and integrate analysis models from legacy data and from customers and suppliers. Femap's complete 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.

Leading third party solution providers use Femap to perform CFD, soil modeling, advanced thermal analysis and electromagnetic simulations.



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

Fully customizable

Macro program files

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. Macros to automate repetitive modeling tasks for example, can be created in an easy and straightforward manner. Once created, you can add these Macros to any Femap toolbar, providing powerful automation tools that are easy to produce, deploy and use.

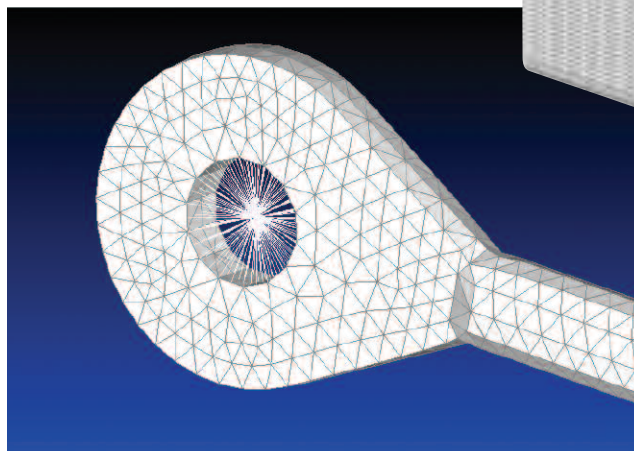
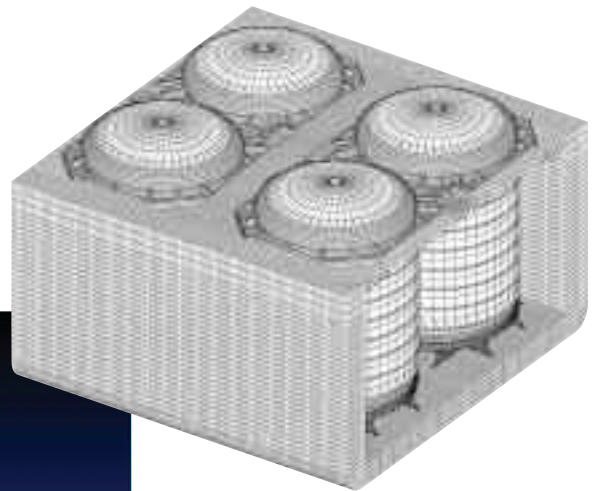
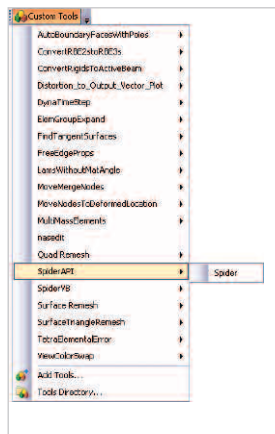
Integrated BASIC API Programming Environment

In addition to the macro-driven Program Files, Femap also offers a full-featured BASIC development environment in a separate window. Directly from Femap's 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.

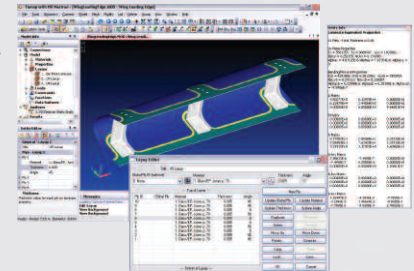
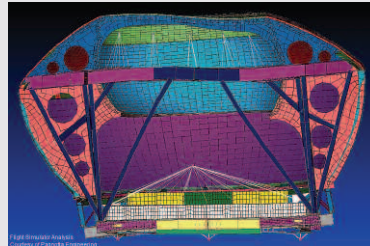
These powerful customization capabilities allow complete access to Femap's full functionality through standard non-proprietary programming languages, and maintain Femap as the premier independent and open engineering environment.



Flexible solution configurations

► Femap with NX Nastran

In many cases this may be all that you need. It includes linear statics, normal modes, buckling, model checkout, spot weld, steady-state and transient heat transfer; basic nonlinear; design sensitivity and unlimited problem size capabilities.



► Dynamic response

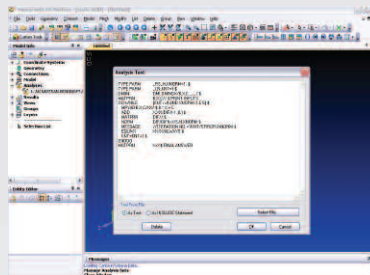
Enables product performance to be evaluated in both the time and frequency domains.

► Superelements

Enables very large and complex finite element models to be solved as smaller substructures called superelements.

► DMAP

Is a programming capability that allows customers to expand NX Nastran and support custom applications.

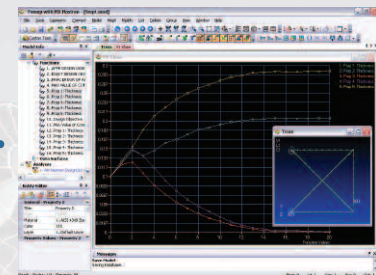
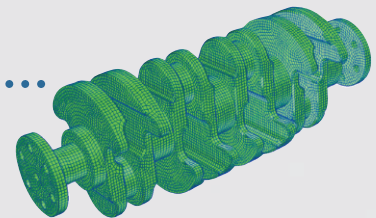


► Optimization

Automates the iterative process of improving product performance.

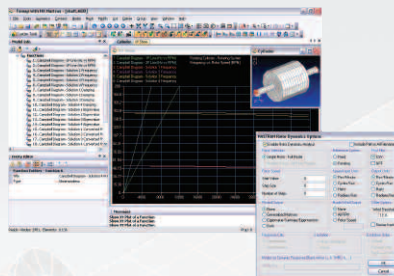
► Rotor dynamics

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



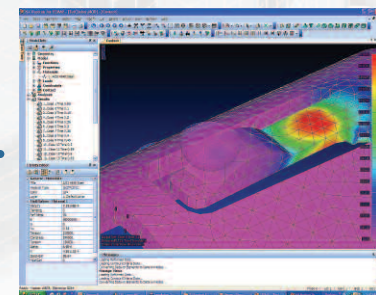
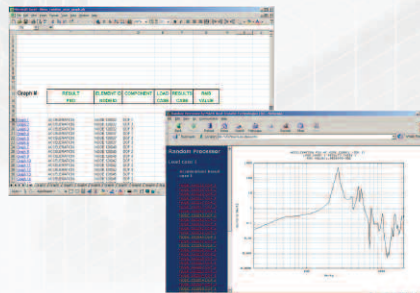
► Advanced nonlinear

Large deformation; nonlinear materials; time-dependent loads; deformable and rigid contact. Explicit nonlinear time integration for impact analysis.



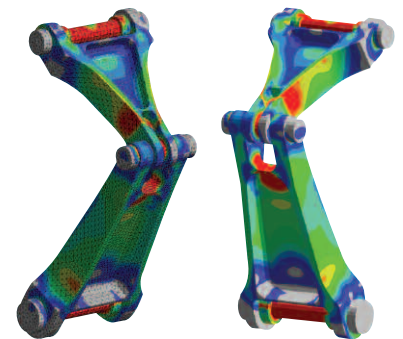
► Structural analysis toolkit

Saves postprocessing time through organization of results data and calculation of additional results quantities



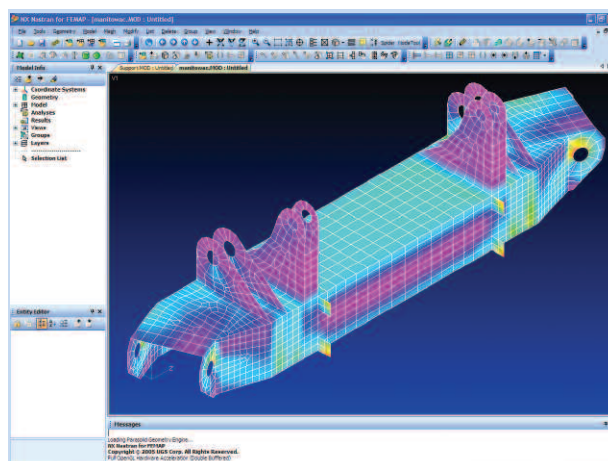
NX Nastran analysis capabilities available for Femap

Basic analysis capabilities	Femap with NX Nastran	Available separately
Linear static analysis	•	
Normal modes analysis	•	
Buckling analysis	•	
Heat transfer analysis (steady-state and transient)	•	
Basic nonlinear analysis	•	
Spot weld analysis	•	
Linear contact	•	
Glued connection	•	
Bolt pre-loads	•	
Advanced analysis capabilities*		
Dynamic response analysis module		•
Advanced nonlinear analysis module		•
Superelements analysis module		•
Direct matrix abstraction programming (DMAP)		•
Design optimization module		•
Rotor dynamics		•



Courtesy of Predictive Engineering Inc.

* Femap with NX Nastran is a prerequisite for all Advanced add-on modules.
Individual product data sheets describing the detailed functionality available in each of the NX Nastran modules are available at www.siemens.com/plm/femap



Courtesy of Manitowoc Cranes

Integrated multi-physics solvers for Femap

Femap Thermal

Femap Thermal includes both the transient and steady-state thermal analysis capabilities required to solve the 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 and provides 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

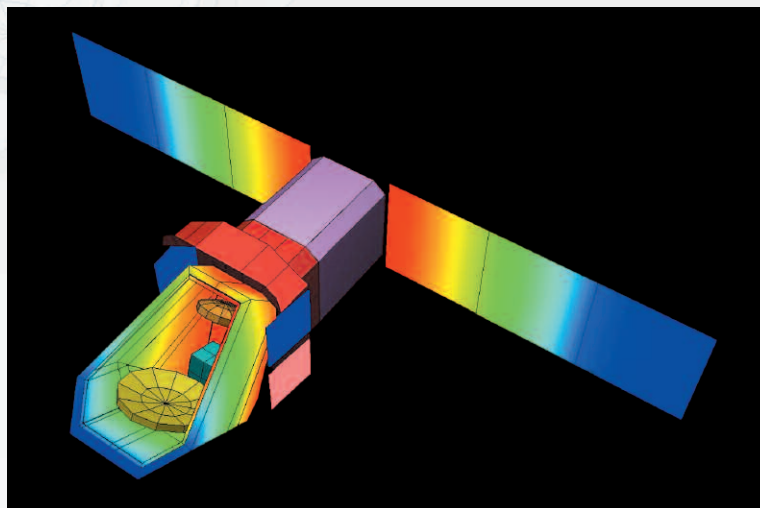
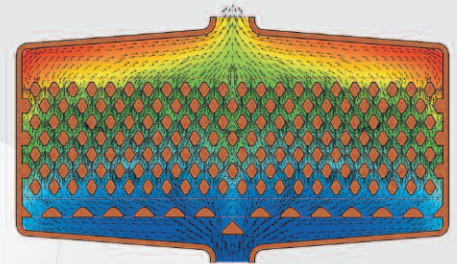
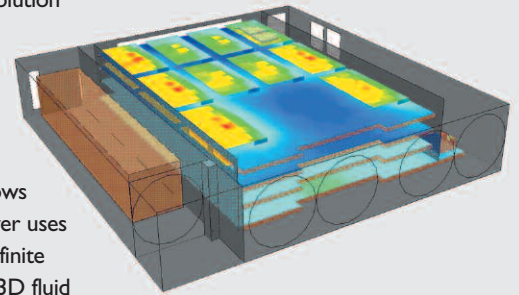
Femap Advanced Thermal adds many advanced thermal and fluid flow modeling capabilities to the Femap Thermal package. For example, fluid duct flow modeling includes coupled convection and fluid flow analysis. An extensive set of tools for advanced radiation and spacecraft modeling includes solar and orbital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

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

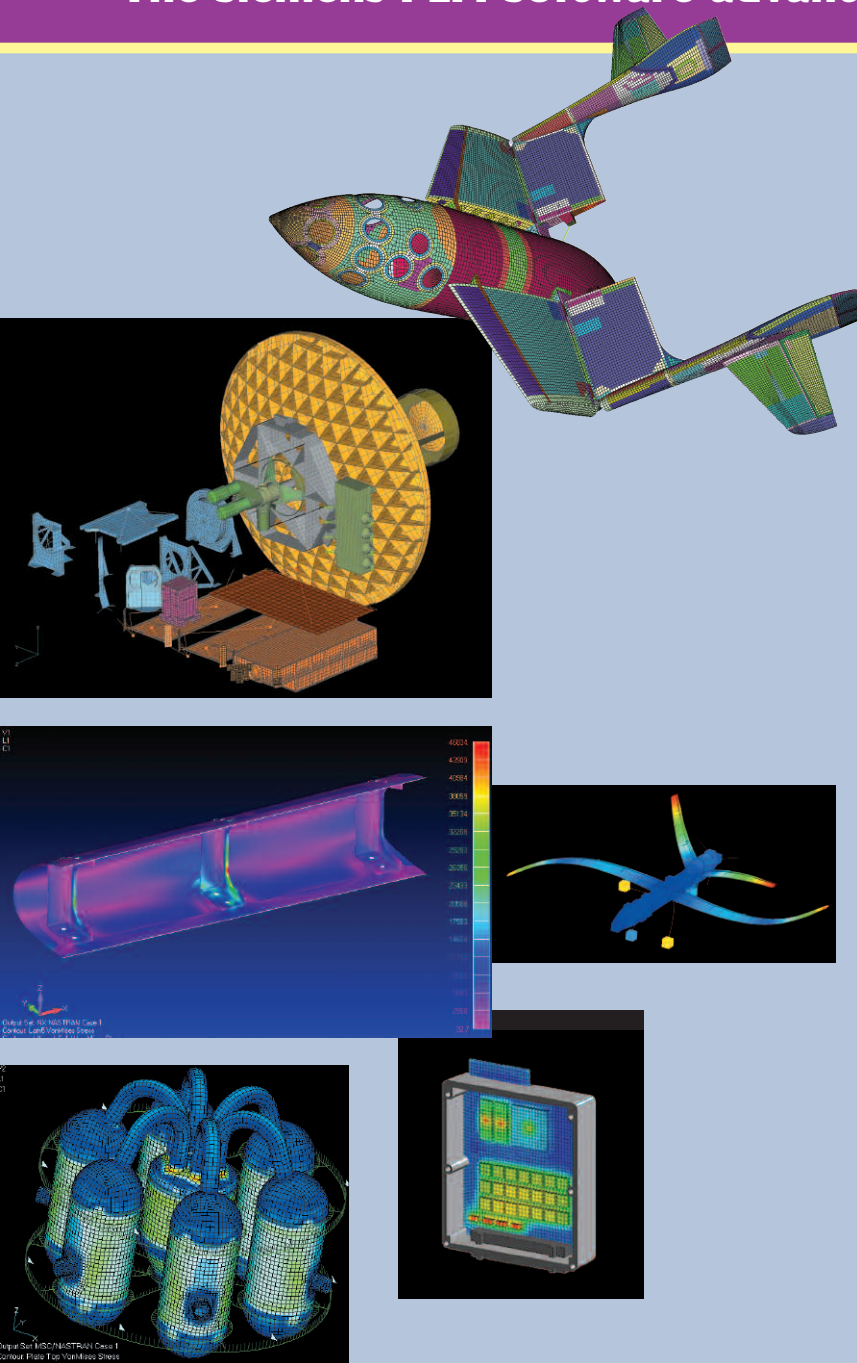
Femap Flow

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.



The Siemens PLM Software advantage



Siemens 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 leverages key attributes that help companies achieve business objectives of 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 PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with 4.6 million licensed seats and 51,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software's open enterprise solutions enable a world where organizations and their partners collaborate through Global Innovation Networks to deliver world-class products and services. For more information on Siemens PLM Software products and services, www.siemens.com/plm.

Siemens PLM Software leads to greater innovation

There is no single road to innovation, but there are signs you're headed in the right direction. Leading innovators get to market faster, manage compliance, optimize resources and achieve globalization. They're also four times more likely to use PLM software to plan, develop, execute and support their products. Siemens PLM Software's family of PLM solutions helps businesses establish Global Innovation Networks that transform their process of innovation. Drive your business to greater innovation and accelerate your growth.



MOVE FASTER



BE COMPLIANT



GET OPTIMIZED



GO GLOBAL

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Asia-Pacific

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► For more information, contact your local representative: