

NX for Mechanical Simulation

Benefits

- Speed up development
 - Increase user productivity with a scalable interface that facilitates better communication between designers and analysts
 - Increase team productivity by enabling cross-discipline teams to work together and share models/data
- Reduce development costs
 - Minimize rework and maximizes existing investments with an open environment that leverages most commercial CAD and CAE applications
 - Reduce duplication through a common data model that drives simulation across multiple disciplines
 - Reduce need for physical prototyping and unnecessary testing by facilitating virtual prototyping

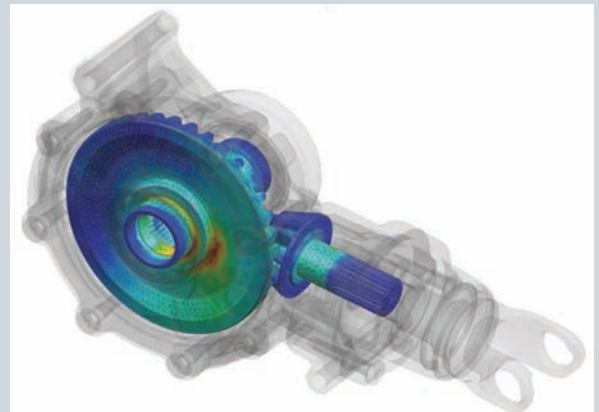
Summary

The NX™ solution for mechanical simulation provides designers, as well as new and experienced CAE analysts, with a comprehensive set of tools for geometry creation and manipulation, finite element preprocessing and postprocessing and a broad range of engineering analyses in an open multi-CAD environment. This approach will enable your company to introduce performance simulation into your product development process early and often, allowing you to investigate more design options and make better product decisions.

A comprehensive, open digital environment to enable mechanical simulation across the entire product development lifecycle

NX mechanical simulation capabilities enable companies to establish a comprehensive and open digital simulation solution for their product development environment, thereby allowing them to develop innovative products faster with lower development cost.

The NX mechanical simulation solution facilitates a dramatically faster and more efficient simulation process, while providing the flexibility you need to incorporate multiple analysis domains in a single environment. This open framework enables your designers and analysts to collaborate more effectively and work with a wide range of input data and solvers. Taken together, these advantages streamline your development process, eliminate duplication of effort and preserve the value of your technology investments.



NX geometry editing and finite element meshing tools are the fastest and most productive geometry modeling and analysis capabilities available today.

NX

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NX for Mechanical Simulation

Benefits *continued*

- Produce better products
 - Improve product innovation by using simulation to evaluate design alternatives, understand design tradeoffs and meet performance, quality and cost targets
- Increase confidence in product decisions by subjecting designs to more and broader virtual testing
- Reduce warranty exposure by enabling product teams to find and resolve issues earlier
- Improve product quality by increasing engineering team understanding of variability and design sensitivity
- Facilitate on-time product delivery
 - Tie simulation process to requirements and change management processes, ensuring that analysis is relevant
 - Ensure that simulations are based on correct data by leveraging common data pipelines across design and simulation domains
 - Accelerate simulation process and improve simulation quality by implementing best practices across the enterprise
 - Increase simulation visibility and its organizational impact by allowing more people to use simulation data

With this in mind, NX enables you to establish a comprehensive mechanical simulation environment, including:

- Design and design engineering solutions, which include tools for rapid geometry-based strength and vibration analysis, tools for embedded motion simulation and best-practice wizards – all supported by the power of NX NASTRAN®
- Advanced engineering solutions, which include a vast array of tools for structural analysis, flow analysis, heat transfer analysis, thermo-fluid and thermo-elastic simulation, multi-body dynamics, response simulation and model correlation
- Solutions optimized for enterprise deployment, which include tightly integrated Teamcenter® software for managing product, process and report information, Process Studio for capturing your best practices and NX-native environments for Ansys, Abaqus, Nastran, and LS-Dyna

Today's mechanical simulation opportunities and challenges

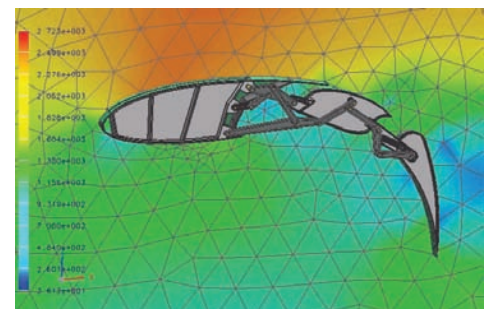
The pressure to increase quality while reducing product development cost and accelerating time-to-market is driving today's companies to increase their use of digital simulation and apply it across the entire product lifecycle. Specifically, companies are looking to accelerate innovation by using simulation to evaluate different design alternatives, conduct experiments and gain new insights into product performance.

Companies are using simulation to identify and resolve quality issues before products are released to the market in order to

reduce testing cost and warranty exposure. Simulation also enables companies to increase product confidence by using virtual testing suites to cover a wider range of product usage.

While the benefits of digital simulation are widely understood, some companies are unable to realize the full potential of their simulation investments. Product simulation continues to be disconnected from the mainstream development process. In many instances simulation results are not available to key decision makers or they arrive too late to significantly influence design. A variety of factors are responsible for these problems:

- Preparing product geometry for analysis can be a slow and tedious process, frequently requiring significant rework
- Many disparate tools are needed to complete a comprehensive simulation process, requiring complicated and error-prone data transformations
- Advanced CAE tools are standalone systems intended for highly skilled specialists, limiting their use across multiple disciplines
- Different disciplines build product models independently, inhibiting a unified, accurate and complete understanding and alignment of the product design



NX advanced engineering solutions include a vast array of tools for structural analysis, flow analysis, heat transfer analysis, thermo-fluid and thermo-elastic simulation multi-body dynamics, response simulation and model correlation.



NX common and scalable environment enables a wide range of simulation users (from highly trained analysts to designers) to work with multiple tools and share their work.

NX solutions for each step in a comprehensive digital simulation process

NX facilitates continuous performance simulation, enabling you to establish comprehensive and open digital simulation capabilities for your product development

Features

- **Design simulation** capabilities for designers and engineers to predict structural strength, durability, vibration, buckling and thermal behavior of components and assemblies
- **Motion simulation** capabilities for analyzing complex motion behavior of assemblies, including for advanced kinematics and for conducting dynamics studies with contact and friction considerations
- **Advanced simulation** capabilities that combine the power of an integrated NX Nastran solver with comprehensive multi-CAD finite elements modeling and results visualization (including full suite of geometry creation and editing tools)
- **NX Nastran** available as a standalone solution or integrated with the NX simulation environment, including add-on modules for optimization, nonlinear analysis, aeroelasticity, rotordynamics and other specialized capabilities
- **Thermal and advanced thermal** capabilities for high fidelity simulation of conduction, convection and radiation phenomena (also can be used with flow capabilities for an integrated CFD solution)
- **Flow and advanced flow** capabilities for simulation of steady state and transient flow, including compressible fluids, particle tracking and multi-physics scenarios
- **Simulation process studio** for creating CAE best-practice wizards

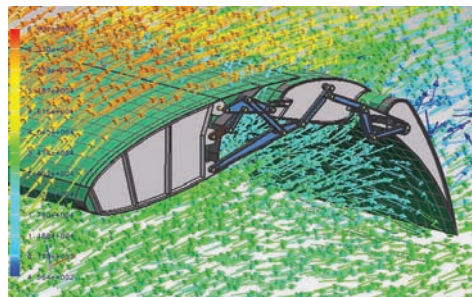
environment. NX allows you to introduce performance simulation into your product development process early and often. In turn, this enables you investigate more design options during your product development process, facilitating better and more informative product decisions.

NX common and scalable environment enables a wide range of simulation users (from highly trained analysts to designers) to work with multiple tools and share their work. The NX mechanical simulation solution provides your simulation user community with best-in-class modeling tools and market-leading solvers for each step in the simulation process.

Additionally, NX improves speed and efficiency while eliminating wasted work by providing unique technologies and methodologies, including:

Knowledge-enabled design NX automates and simplifies design by enabling you to leverage Teamcenter to manage the product and process knowledge that your company has gained from its experiences, as well as from industry best practices. Knowledge-enabled design helps your company reduce design costs, compress the design cycle and improve design quality.

Process innovation NX enables you to streamline everyday design and simulation processes through the implementation of task-oriented workflows that improve productivity. NX allows you to dynamically integrate your development processes, including planning, design, simulation, tooling and manufacturing. By unifying



NX can automatically update CFD models as the design evolves or enable the analysis of different configurations.

multi-discipline teams and coordinating their activities across all lifecycle processes, NX enables you to make informed design decisions that recognize the requirements of all design stakeholders.

NX addresses the mechanical simulation process directly through its capabilities for:

- Design and design engineering
- Advanced engineering
- Optimized enterprise performance

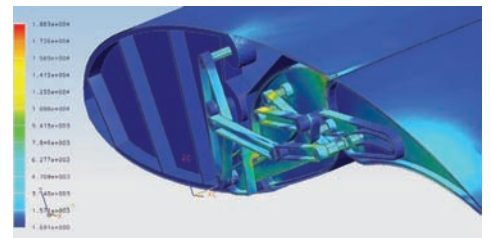
Design and design engineering

Today's designers highly value easy-to-use geometry based simulation solutions and their ability to facilitate rapid design feedback. NX delivers the most powerful and flexible modeling solutions available – solutions that enable you to freely use any modeling technique that fits your design challenge. NX geometry editing and finite element meshing tools are the fastest and most productive geometry modeling and analysis capabilities available today.

NX groundbreaking synchronous technology enables CAE users to quickly make geometry modifications for early “what-if” analyses. Synchronous technology drives the NX solution’s unparalleled multi-CAD capability that maximizes design model re-use, while enabling designers, design engineers and analysts to collaborate more effectively.

NX mechanical simulation includes the following design and design engineering solutions:

- CAD-based finite element simulation environment
- Tools for geometry-based strength and vibration analysis



NX facilitates rapid strength and vibration analysis and includes tools for embedded motion simulation.

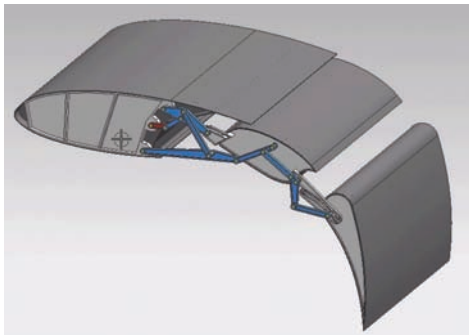
- Tools for embedded motion simulation
- Wizards for guided simulation
- NX Nastran solver for linear statics, normal modes, linear buckling and contact and steady state heat transfer

Advanced Engineering

Today's analysts are looking for rapid modeling, fast solvers and the ability to handle large models. The NX environment is unique because it enables CAE teams to analyze a model for strength or motion and then easily move on to perform high end analyses involving coupled physics. The NX data model is designed to facilitate rapid user access and handle large amounts of information. NX maximizes re-use through common data and common models that support multi-discipline simulation.

NX mechanical simulation includes the following advanced engineering solutions:

- An extensive set of model preparation tools for OD, 1D, 2D and 3D finite element models
- Component assembly tools for building system finite element models



NX enables you to introduce performance simulation into your product development process early and often.

- An extensive array of analysis solutions for:
 - Linear and nonlinear analysis
 - Steady-state and transient flow analysis
 - Conduction, convection and radiation heat transfer analysis
 - Fully-coupled thermo-fluid and thermo-elastic simulation
 - Multi-body dynamics with controls
 - Response simulation
 - Model correlation
- NX Nastran scalability for both desktop and high-performance clusters
- Integrated NX solvers for flow and thermal analysis
- Fully featured multi-CAD modeling environment powered by synchronous technology
- Best-in-class geometry tools to clean up and prepare geometry for analysis, including mid-surfacing, stitching and feature removal

Optimized enterprise deployment

A variety of NX capabilities enable you to optimize your design and engineering analysis solutions for enterprise deployment. NX provides the robust bidirectional associativity that your development environment needs to enable faster iterations between your design and analysis teams.

Equally important, NX supports multiple industry formats including the JT™, IGES, STEP, UNV, NBD and XML standards – as well as the Parasolid® geometry modeling kernel, the world's most powerful, robust and widely used modeling foundation.

In addition, NX provides the following solutions that you can incorporate into your product development environment.

Teamcenter integration You can manage all of your design and simulation processes

with Siemens' Teamcenter solutions. Teamcenter integration raises the value and visibility of simulation across your enterprise. It ensures that simulation users are always working with the right data in the right context. Teamcenter allows your simulation teams to create, track, manage and reuse simulation hierarchies, options and variant configurations.

NX out-of-the-box integration with Teamcenter enables you to establish a single source of product and process knowledge for your environment. This integration enables you to coordinate your design and simulation teams, standardize their processes and accelerate decision making throughout the development cycle.

Simulation process studio NX provides a graphical toolkit that you can use to create CAE best-practice wizards. These wizards can provide your environment with a perfect complement to NX powerful design and analysis tools. You can design wizards to guide less experienced users through the simulation process, as well as to automate the more mundane aspects of your process flow.

NX-native CAE environments For a variety of reasons, most companies leverage a wide range of CAE solutions across different organizations. NX provides unifying platform for incorporating today's most popular CAE solutions in an NX-native environment, including Ansys, Abaqus, Nastran and LS-Dyna. You can also customize in-house CAE software into your NX digital product development solution. This ensures that you can continue to gain value from your existing investments in solver technology while moving forward with a more streamlined digital development process.

Contact
Siemens PLM Software
Americas 800 498 5351
Europe 44 (0) 1276 702000
Asia-Pacific 852 2230 3333

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