

# NX for Electromechanical Simulation

## Benefits

Speed up development

- Increase user productivity by providing a scalable interface that facilitates better communication between designers and analysts
- Increase team productivity by enabling cross-discipline MCAD, ECAD and CAE teams to work together and share models/data

Reduce development costs

- Minimize rework and maximizes existing investments by providing an open environment that leverages most commercial MCAD, ECAD 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 electromechanical simulation provides a comprehensive simulation environment with solutions to address all of the major issues of electromechanical design, including temperature, vibration, humidity and dust. This environment incorporates advanced capabilities for geometry creation and manipulation, finite element preprocessing and postprocessing and a broad range of engineering analyses solutions. The NX approach enables your company to meet the challenges of developing electromechanical products, where you need to integrate mechanical, electrical, controls and electronics elements.

## Enabling electromechanical simulation across the entire product development lifecycle

NX's electromechanical simulation capabilities enable companies to establish a comprehensive and open digital simulation solution for their product development environment, thereby allowing them to shorten time-to-market, control development costs and increase product quality.



*NX is ideal for simulating the performance of high-tech devices such as this thermal imaging camera, which is used in firefighting applications.*

NX

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## NX for Electromechanical 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 a common data pipeline 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

The NX electromechanical simulation solution facilitates a dramatically faster and more efficient simulation process that provides the flexibility you need to integrate multiple mechanical, electronics, controls and electronics domains in a single environment. NX's open framework enables a broad range of simulation users from designers to high-end analysts to collaborate more effectively and work with a wide range of input data and solvers.

Just as importantly, NX works with data from most commercial MCAD, ECAD and CAE tools. NX enables you to establish a comprehensive electromechanical simulation environment, including:

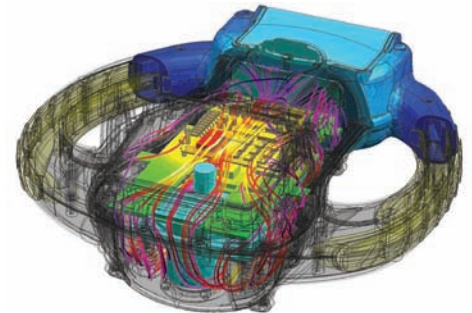
- *Design and design engineering solutions*, which include tools for rapid geometry-based strength and vibration analysis, tools for embedded motion simulation, and best-practice wizards – all supported by the power of NX Nastran®
- *Advanced engineering solutions*, which include prepackaged solutions for electronic systems cooling and space systems thermal analysis, 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 electromechanical simulation opportunities and challenges

Manufacturers across a broad spectrum of industries are facing a growing trend that requires them to blend mechanical, electrical, electronics and controls systems and components into their products. This trend adds a new level of complexity to product development since multiple disciplines with unique skill sets and distinctive work processes need to collaborate with one another.

Additionally, 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.



*NX includes advanced capabilities such as the ability to compute and display streamlines to visualize flow in densely packed, heat sensitive electronics systems.*

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

## 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 and other specialized capabilities

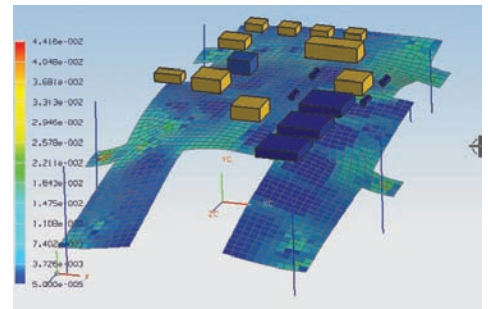
- Many disparate tools are needed to complete a comprehensive simulation process, requiring complicated and error-prone data transformations
- Advanced CAE tools are standalone systems intended for highly skilled specialists, limiting their use across multiple disciplines
- Different disciplines build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

## NX solutions for your entire digital simulation process

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

To fully address the challenges of electromechanical product development, the NX environment supports a concurrent process where designers and analysts can collaborate while developing and testing new product concepts. The NX electromechanical 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 software 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.



*NX displays the dynamic response of an electronic circuit board for a camera that was subjected to a drop test.*

**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 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.

More specifically, NX addresses the electromechanical 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's geometry editing and finite element meshing tools are the fastest and most productive geometry modeling and analysis capabilities available today.

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

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

- Bi-directional geometry data exchange with ECAD tools for packaging and thermal studies
- CAD-based finite element simulation environment
- Tools for geometry-based strength and vibration analysis
- 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 provides solutions to address all major causes of electromechanical product failure, including heat, vibration and impact, dust and moisture. The NX data model is designed to facilitate rapid user

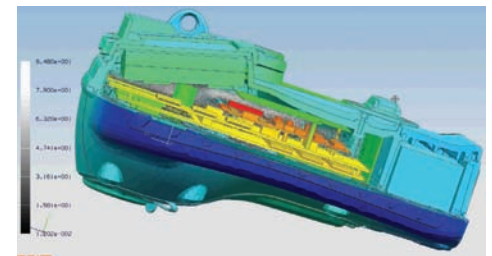
access and handle large amounts of information. NX maximizes re-use through common data and common models that support multi-discipline simulation.

NX provides a distributed model approach to assembly analysis whereby the Assembly FEM model does not contain the component FEM models, but instead holds pointers to these models. An assembly FEM contains occurrence and position data for multiple component FEMs as well as connection elements that join the component FEMs into a system. Assembly FEM enables a more efficient process for building large models comprised of multiple components.

NX supports a concurrent and collaborative process for electromechanical system design. Designers can provide assembly models to the systems analyst for rapid creation of motion models. The motion model can then be integrated with a controller model built in Simulink to perform co-simulation. This approach allows the team to discover and fix systems integration issues without the need for extensive physical prototyping. Finally, with NX geometry associativity, any design changes are immediately cascaded to downstream users who can update the simulations and provide new results rapidly, allowing for a very efficient development process.

NX electromechanical simulation offers the following advanced engineering solutions:

- Prepackaged solutions for electronic systems cooling and space systems thermal analysis
- An extensive set of model preparation tools for 0D, 1D, 2D and 3D finite element models
- Component assembly tools for building system finite element models
- 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 thermal and flow solutions enable you to identify problem areas and quickly iterate on new design concepts to improve heat distribution and eliminate hot spots.



Co-simulation with NX Motion allows mechatronics development teams to discover and fix systems integration issues early.

- 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 bi-directional MCAD and ECAD 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 re-use simulation hierarchies, options and variant configurations.

NX's 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's powerful design and analysis tools. You can design wizards to guide less experienced users through the simulation process, as well as 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 a 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.

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