SIEMENS

NX

ATA Engineering

Use of NX enables design and analysis to work together more efficiently and productively

Industry

Aerospace and defense

Business challenges

Increase productivity and efficiency

Eliminate tedious rework

Devise advanced methods of integrating design and analysis models

Adapt to changes in specifications or requirements

Keys to success

Exploit NX integrated design and analysis modeling approaches

Create parameterized design definitions; updates to design and analysis follow automatically

Leverage NX with synchronous technology for design changes with no part history, or for analysis idealization, meshing and studies

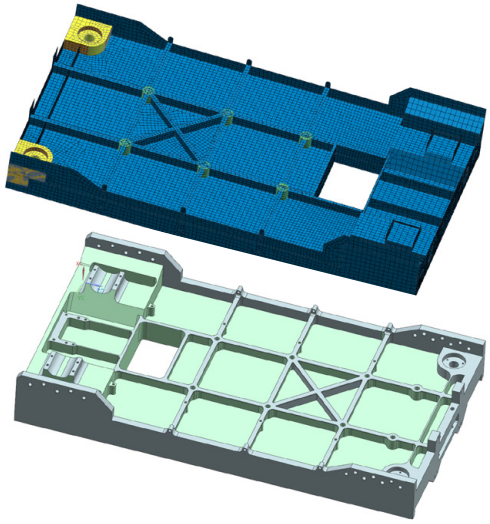
Integrated software suite supports rapid changes without having to re-create finite element models

Design and analysis technology for real-world challenges

For more than 30 years, engineers at ATA Engineering, Inc., (ATA) have been providing analysis- and test-driven design solutions for structural, mechanical, electromechanical and aerospace products. The company has worked on a wide range of projects including amusement park rides, biomedical devices, and electronics components.

The majority of ATA Engineering's work has been within the aerospace industry, for customers such as Orbital Sciences, Lockheed Martin Space Systems, Pratt & Whitney, NASA, Jet Propulsion Laboratory, Air Force Research Laboratory and General Atomics. In this work, there is no room for error: it is crucial to meet specifications precisely while facing tight deadlines. ATA engineers often also deal with short production runs, sometimes even for a single unit such as a satellite component. They absolutely must get it right the first time.

ATA staff have been using NX™ software for many years. However, they recently applied the newest version of NX computer-aided design (CAD) and computer-aided engineering (CAE) software to



real-world complex structures, using three representative cases, and found significant improvements resulting in savings in time and effort during the design, analysis and update cycles.

ATA engineer Allison Hutchings puts it this way: "Real-world structures have complex design definitions and challenging analysis requirements – and both are constantly changing. NX helps you cope with changes very efficiently and productively."

Changing model parameters without recreating geometry

The first use case involved meshing a model of an isogrid reflector like those designed to be mounted on a spacecraft. Isogrid geometry provides advantages for

Results

All geometry automatically updated

Remeshing required very little rework

"Idealized" models updated rapidly

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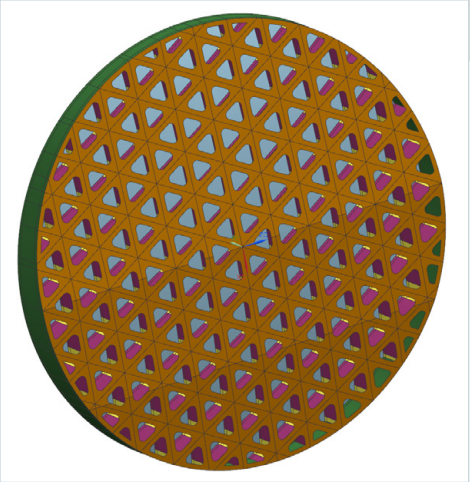
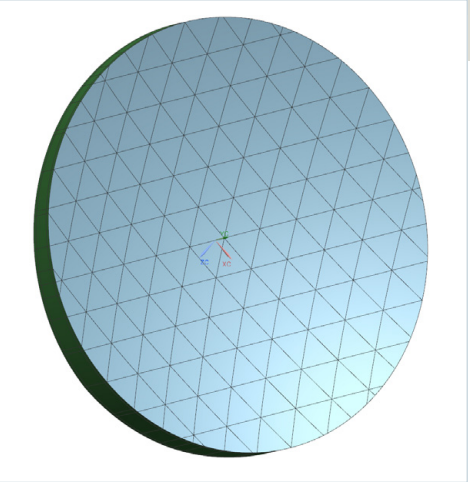
Allison Hutchings
Engineer
ATA Engineering, Inc.





space structures that need to be stiff, lightweight, and durable, but the large number of surfaces means that defining the initial geometry of the CAD model and the CAE model can be tedious. When the design must be updated, as in altering the diameter, focal length, and cell size in this case, "Such changes can cause major headaches," Hutchings notes. In many cases, the geometry may need to be completely re-created instead of simply being updated to incorporate the new dimensions.

By leveraging the synchronous technology provided by NX along with a smart approach to the original design definition, however, these problems were avoided. Several techniques, such as patterning and expressions, made it easy to directly parameterize key definitions of the geometry in NX CAD, and this capability was directly leveraged for meshing and analysis. As a result, 100 percent of the geometry was automatically updated, and 96 percent of the remeshing was done automatically when the associated finite element model (FEM) updated to the new geometry. Cleaning up the remaining 4 percent was relatively quick and easy – particularly when compared to having to re-create the entire FEM.

The second use case was a lightweight bracket model. Because weight is at a premium in aerospace designs, the engineer must wrestle with competing objectives of keeping the bracket as lightweight as possible while still meeting stiffness requirements and maintaining the ability to handle the necessary loads. This process often results in brackets with complex geometry.

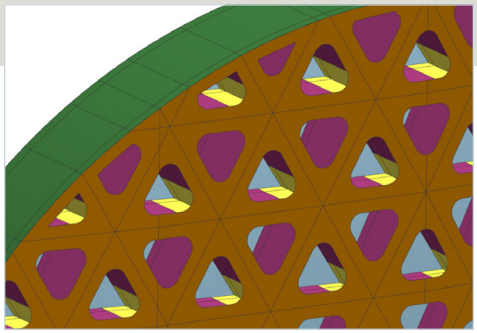
For finite element analysis (FEA), the standard practice is to "idealize" the geometry – removing details and features that will not affect the analysis. This is done to save computing time, but ordinarily it is necessary to repeat the idealization process whenever the part is updated.

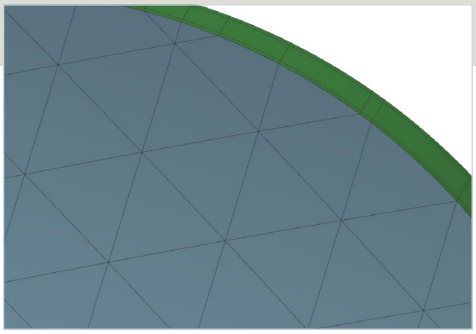
With NX, this extra step can be avoided. For this task, after the part's dimensions were changed, 93 percent of the faces were idealized and updated automatically. Although the changes carried out on the bracket were relatively simple, the savings in time and effort were notable: the automated idealization of the update was more than 100 times faster than the manual process, and the meshing of the updated model was at least 3 times faster.

Updating geometry in minutes

The third use case focused on a model of an existing air brake – an assembly that helps an airplane slow down for landing by generating a swirling outflow from a fan bypass nozzle and also makes it easier to land the plane more slowly from a steeper angle, reducing the overall noise.

The angles of the vanes inside the air brake can have a dramatic effect on the performance of the air brake under different conditions. By altering these angles in the model, the analyst can evaluate these effects. In this case, the prismatic vanes





Solutions/Services

NX CAD
NX CAE
www.siemens.com/nx

Customer's primary business

ATA Engineering, Inc. provides analysis- and test-driven design solutions for structural, mechanical, electromechanical and aerospace products.
www.ata-engineering.com

Customer location

San Diego, California
United States

"If you are working with constantly changing design specifications, it is very quick and easy to modify dimensions and change parameters with NX without having to re-create your finite element model. This saves a lot of time and drudgery and gives you confidence that your model is updated to the correct design definition."

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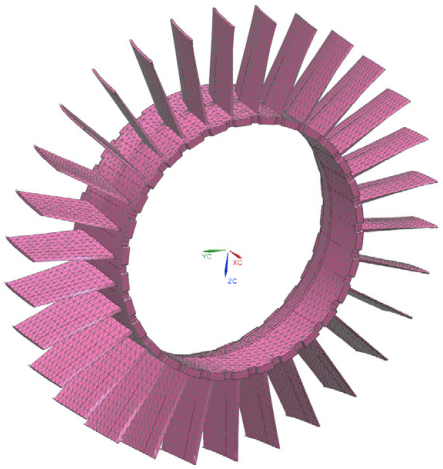
were rotated to analyze configurations between the angles of 0 and 25 degrees. With NX, instead of carrying out a tedious, manual process of remodeling the entire system, Hutchings simply changed the vane angle parameter and was able to update the geometry within minutes, as the idealized part automatically adjusted to the new angle. Hutchings notes, "Map meshing is preserved, creating an identical mesh on the surfaces of the vanes among all angles; the CAD model then propagates to the FEM, and the mesh updates in minutes."

In all three cases, the new features of NX made it possible to carry out geometry updates quickly, Hutchings says. "We were able to parameterize the design definition, create a structural analysis model leveraging the design for specific analysis requirements, update the design parameters, and propagate the changes to the analysis model much faster than it could be remodeled."

More efficient engineering with integrated design and analysis

"These are all problems that we previously found difficult to successfully model and analyze," Hutchings says. In the past, updating the finite element model due to geometry changes would require either remodeling the changes in CAD, re-idealizing the model and remeshing to create the FEM or some very complex manual meshing changes, both of which were very time-intensive. "Recent additions to NX have made these efforts a lot easier. The degree of connection NX allows between the design and analysis supports more efficient engineering compared to using non-integrated finite element processes," she says.

The problems Hutchings examined illustrate the advantages of working with the integrated suite of NX. Not only is the speed of updating improved, but the possibility for error between the CAD model and the finite element model is also less because of how they are linked. "If you are working with constantly changing design specifications, it is very quick and easy to modify dimensions and change parameters with NX, without having to re-create your finite element model," she says. "This saves a lot of time and drudgery and gives you confidence that your model is updated to the correct design definition."



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