SIEMENS

Space systems

Japan Aerospace Exploration Agency

Use of versatile pre- and postprocessor enables space agency to notably reduce training costs and increase R&D efficiency

Product

Femap

Business challenges

Use CAE modeling tool of choice

Reduce training workload

Create environment for efficient analysis

Keys to success

Use a pre- and postprocessor that works with various CAE solvers

Employ intuitive user interface

Generate and directly edit meshes

Results

One pre- and postprocessing tool for all CAE projects

Significantly reduced training costs

Substantially more time for R&D

Quick editing

Easily generated custom analysis models

JAXA employs Femap to address a wide range of analysis tasks

Femap addresses a wide range of solvers

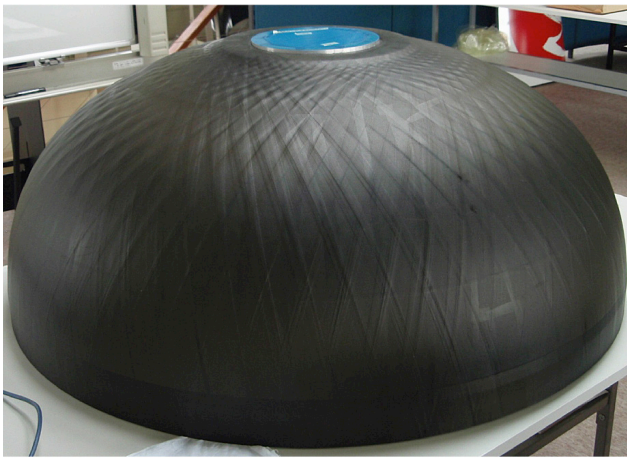
The Chofu Aerospace Center (CAC) Aerodrome Branch of the Japan Aerospace Exploration Agency (JAXA) develops advanced engineering technologies for future applications. The Advanced Composite Research Center at the Institute of Aeronautic Technology (IAT) works with materials that can withstand temperatures ranging from 3000 degrees Celsius to 4 degrees Kelvin.

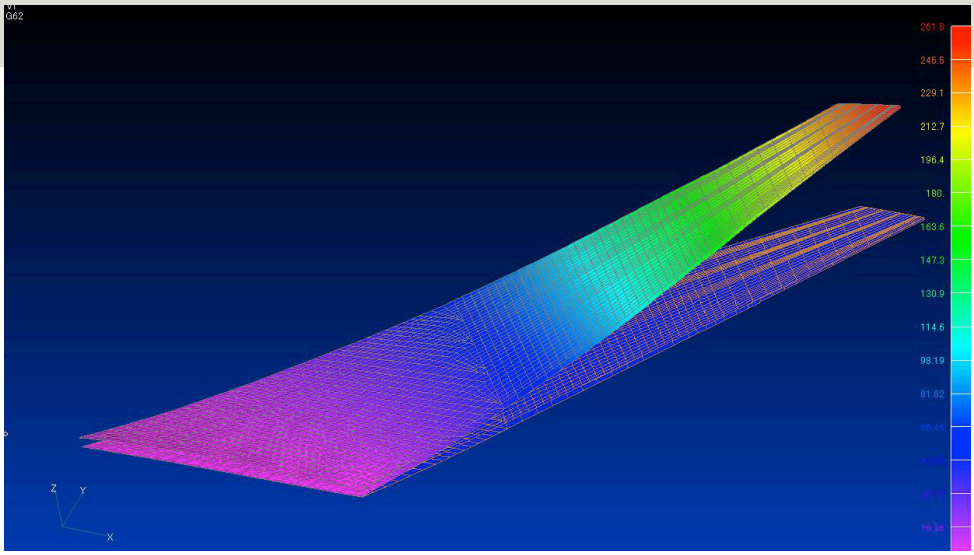
The scale of research ranges across structures, such as the main wing of an airplane, the fuel tank of a spacecraft and causes of carbon fiber delamination. In each case, the finite element analysis (FEA) solvers used for those analyses vary considerably.

"We select FEA solvers based on the size of the analysis model and the problems we want to solve," says Dr. Akinori Yoshimura, a researcher at the Advanced Composite Research Center. "Although we work on a large number of research programs, there are fewer than 20 researchers in our section. So we wanted to avoid having to learn how to use a new pre- and postprocessor every single time we use a different CAE (computer-aided engineering) solver."

The Advanced Composite Research Center solved this issue by selecting product lifecycle management (PLM) technology, deploying Siemens PLM Software's Femap™ software, a pre- and postprocessor that is used to generate input data for most industry standard solvers. Once the researchers learned how to use Femap, they could generate FEA input data for many of their preferred solvers. This eliminates their concerns about learning new software and reduces the workload of creating an FEA model, enabling them to spend more time solving research problems.

Using only one pre- and postprocessor means reduced training costs for student research assistants. "If we have to use dif-





"There are two types of preprocessors: those that are good at generating a mesh top-down from CAD (computer-aided design) geometry or those that are good at generating a mesh from the bottom-up. Most preprocessors are strong in either one capability or the other. Having both capabilities in one package – as Femap does – is pretty rare. We actually need both, so Femap works very well for us."

Dr. Akinori Yoshimura
Researcher
Japan Aerospace
Exploration Agency

ferent pre- and postprocessors for different solvers, it means that we can only assign a limited range of research topics to each student," says Yoshimura. "But if we only have to learn to use Femap, we can assign many different types of topics to them."

Combining ease of use with direct editing of FEA models

According to Yoshimura, the flexibility of Femap enables a one-size-fits-all solution for the Advanced Composite Research Center.

"There are two types of preprocessors: those that are good at generating a mesh top-down from CAD (computer-aided design) geometry or those that are good at generating a mesh from the bottom-up," says Yoshimura. "Most preprocessors are strong in either one capability or the other. Having both capabilities in one package – as Femap does – is pretty rare. We actually need both, so Femap works very well for us. For example, after we import geometry from CAD software, we generate shell elements or beam elements, as appropriate. But that's not the end. Let's say we want to look into propagation of cracks in skin stringers. We have to detach certain nodes of the mesh from the rest. But most postprocessors are not designed to allow us to do that, at least not easily. Femap is the only tool that allows us to choose the operation we need."

Many of JAXA's FEA analyses are performed for advanced research purposes. So after generating the FEA mesh from CAD geometry, engineers have to directly edit the mesh most of the time. But some preprocessors do not allow them to do that.

"...Having both capabilities in one package – as Femap does – is pretty rare. We actually need both, so Femap works very well for us."

Dr. Akinori Yoshimura
Researcher
Japan Aerospace Exploration Agency

Solutions/Services

Femap
www.siemens.com/plm/femap

Customer's primary business

Japan Aerospace Exploration Agency (JAXA) was founded in 2003 by the merger of the Institute of Space and Astronautical Science (ISAS), the National Aerospace Laboratory of Japan (NAL) and the National Space Development Agency of Japan (NASDA). The JAXA Institute of Aeronautical Technology (IAT), which is located at Mitaka-shi in Tokyo, is in charge of research in advanced aerospace engineering.
www.jaxa.jp

Customer location

Mitaka, Tokyo
Japan

"If we have to use different pre- and postprocessors for different solvers, it means that we can only assign a limited range of research topics to each student. But if we only have to learn to use Femap, we can assign many different types of topics to them."

Dr. Akinori Yoshimura
Researcher
Japan Aerospace
Exploration Agency

"Based on my experience with Femap, the software will be up to the task."

Dr. Akinori Yoshimura
Researcher
Japan Aerospace Exploration Agency

"Femap can be used to easily edit the mesh as required for each research project," says Yoshimura.

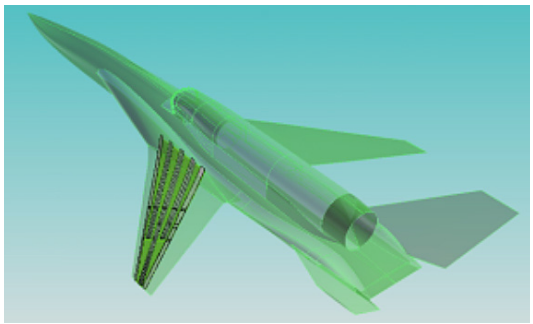
Facilitating research

Most manufacturers use FEA to verify designs. But what Yoshimura and his colleagues are doing often goes beyond that; they are looking into the methodology of FEA itself. In other applications, once they develop a new FEA model, they have to bring their customized FEA model into the existing model. For example, the researchers use a macro to import the FEA model (developed using Microsoft's Excel® spreadsheet software) into Femap. The models are then sent to solvers for computation. The results are received using Femap, and they are then sent back for verification using Excel. This can easily be done with the Visual Basic for Applications (VBA) macro of Femap.

"We develop an FEA model from mathematical formulas, perform analyses with solvers, verify the results and optimize the model," says Yoshimura. "So the functionality of Femap enables us to reflect what we computed and developed using Excel directly into FEA models, which greatly helps our research."

Yoshimura expects that analysis will soon involve much larger models with many more degrees of freedom, even for fundamental research. For example, he notes that the analysis of a main wing made of composite materials not only requires analysis of the behavior of the entire wing, but it also requires micro-level analysis, such as identifying the delamination of composite materials at specific points. Therefore, every detail, including the layup of composite materials, must be considered for generating an FEA mesh with a very large number of solid elements.

Yoshimura concludes, "In the future, JAXA will need to perform more advanced and large-scale analyses. Based on my experience with Femap, the software will be up to the task."



Siemens Industry Software

Americas	+1 314 264 8499
Europe	+44 (0) 1276 413200
Asia-Pacific	+852 2230 3308

www.siemens.com/plm

Z9 35043 8/13 A