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

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.

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“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.

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

“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.”

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Researcher
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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.”