Computer-aided engineering (CAE) technology applicable to the aerospace industry

By

Shan Nageswaran
Senior Director
Altair HyperWorks for Aerospace

The latest version of HyperWorks® represents the most advanced evolution of computer-aided engineering (CAE) technology applicable to the aerospace industry. This solution provides a comprehensive suite of tools for every phase of aircraft innovation, from initial concept generation through the entire product lifecycle.

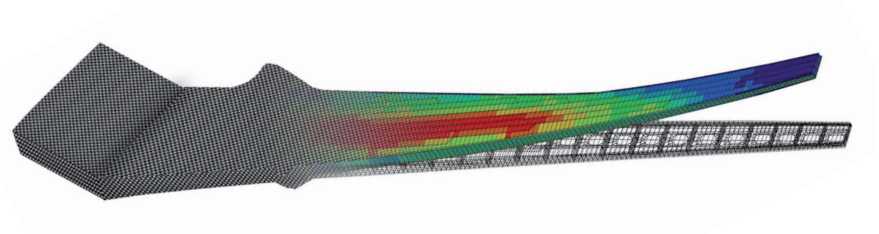
Aircraft manufacturers are using the HyperWorks suite for weight reduction and design with composites; modern structural modelling and automated design processes; and stress, mechanism and vulnerability simulation. The software tools in this integrated suite are advancing the ways in which aircrafts are designed, accelerating the adoption of advanced materials such as laminated composites to meet industry goals of reducing the weight of components and structures for greater fuel efficiency and passenger comfort.
While composites are a major focal point for HyperWorks and the aviation industry, this product suite offers much more. From automated meshing to ground-breaking optimization tools and a wide range of easily accessed partner applications, it helps the aerospace industry reach new heights in time efficiency, cost reduction and quality improvement all while meeting the strictest safety and performance requirements.

Design with composites and weight reduction

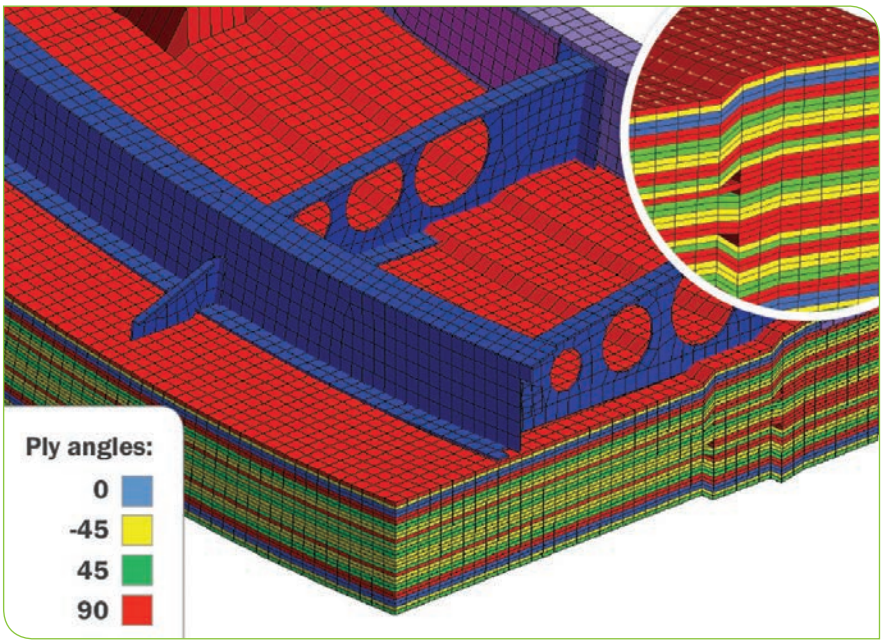
For composites, HyperMesh® saves significant time with its modelling process. Composite data may be read from the computer-aided design (CAD) model, with ply shapes and parameters comprehended and effortlessly mapped onto elements.
Its ply-based modelling approach is more intuitive and efficient than the conventional zone-based approach, matching the physical creation of composites more closely. HyperMesh also has the ability to convert from ply to zone-based modelling for solvers that do not natively support ply-based modelling.

One of the most widely used post-processing tools globally, HyperView® provides layer-based post-processing for composites, yielding results for both individual layers and the aggregation of layers and identifying the maximum contributing layer. The module also includes predefined criteria, including well-known industry standard composite failure theories, and allows for invoking in-house codes for further manipulation of these results.

OptiStruct® is a state-of-the-art solver with non-linear capabilities for ply-based modelling. It offers size optimization for dimensioning of structural components, as well as topology optimization to substantially reduce weight by determining the ideal material distribution. OptiStruct simplifies the complexity of composite modelling, considering hundreds of load cases simultaneously to recommend the best approach. Its three-phase methodology first employs free-size optimization to find the location for reinforcements based on the ply angle. Then, size optimization indicates the number of plies of a particular orientation that are



The visualization of derived or calculated results on the CAE Model



Extensive model and results visualization for composite structures

needed. Finally, shuffling optimization defines which order is optimal for the results previously generated. Many additional tools of exceptional importance to the aerospace industry can be accessed through the Altair Partner Alliance (APA), which enables HyperWorks users to call on third-party software as needed at no additional cost. For example, beyond the comprehensive HyperWorks suite itself, nine different software tools for designing and analyzing composites are available through the APA. These partner products add value to the preliminary design of composites, detailed investigations of joints and other areas and micromechanics to investigate on a microscopic level the individual constituents of composites. Many other areas of the aerospace industry are addressed through the APA as well, including electromagnetic analysis, casting simulation, thermal analysis, computational fluid dynamics analysis and durability analysis, among others.

Modern structural modelling and automated design processes

HyperMesh offers proficiency in geometry editing and manipulation to automatically organize geometry for meshing and has helped aerospace developers gain major time savings. Its new aerospace profile contains tools targeted especially for the aerospace industry. The HyperView result math module is a tool which enables users to conduct analysis with their results. An average may be calculated between two stress results, for example, or a more sophisticated math function employed from the extensive library included in HyperView to derive a new result from the existing results. Users may also add their own libraries or invoke scripts and programs to be involved in the result math, such as calculating a value which is then used in the formula applied to the results. Results can be mapped back and forth to Excel to take advantage of many stress analysis tools that already exist in spreadsheets. HyperView operates with the most commonly employed solvers and can publish results in PowerPoint with just a few mouse clicks, dramatically cutting the time required for reporting.

Stress, mechanism and vulnerability simulation

OptiStruct is the most advanced optimization-driven structural solver on the market. It is used in optimization centres around the globe, where Altair engineers transfer their expertise to such customers as Airbus and Boeing. Beyond meeting all the requirements for ensuring sound structural engineering, OptiStruct analyzes acoustics, vibrations and comfort in aircraft designs. Many recent features have been added to support non-linear materials and contact analysis.

RADIOSS® is an advanced solver for highly non-linear problems under dynamic loadings, producing solutions in the study of bird-strike simulation, delamination of composites, and multi-failure crises. RADIOSS has been widely used in the aircraft seating industry, and is ideal for highly dynamic situations, including seating and occupant analysis for impact certification requirements.

MotionSolve®, a multi-body dynamics solver, is particularly valuable for the design of aircraft flaps, landing gear and seat reclining mechanisms. It can be applied to other mechanisms as well, enabling users to build highly complex, non-linear systems and study their performance.

HyperStudy® is designed to perform sensitivity analysis to find the most relevant parameters of a structure or design, and supports shape and size optimizations with any solver including Excel. ■

More information:
www.altair.com/aero

About Altair

Altair is focused on the development and broad application of simulation technology to synthesize and optimize designs, processes and decisions for improved business performance. Privately held with more than 2,000 employees, the company is headquartered in Troy, Michigan, USA and operates more than 40 offices throughout 20 countries. Today, Altair serves more than 5,000 corporate clients across broad industry segments.