Finite Element Analysis Speeds Up Your Design Tempo

Finite Element Analysis (FEA) is now a well-proven and accepted technique to predict the structural response of a design. Major producers from aerospace, automotive, maritime and civil engineering sectors, to name just a few, include FEA in their design, manufacture, and build process. The traditional positioning of FEA was as a safety check in the post design phase. However, over the last 15 years or so, the emphasis has switched to performance prediction and an integral role in the design process. In the automotive industry, both the design to manufacture time span and the number of design cycles has dropped dramatically. Typical targets are now six to 12 months to production. Physical tests are carried out in full collaboration with FEA in pre test and post test phases. This means less testing and more FEA-based simulation of problem rectification and trade-off design studies. The disciplines involved are widespread, including noise, vibration and harshness (NVH), fatigue, handling, and crash.

Nonlinear structural analysis on the rocket motor bulkhead for SpaceShipOne performed by SpaceDev, Inc. using NeiNastran FEA software.

Figures courtesy of Noran Engineering.

by tony abbey

IN THE CIVIL AEROSPACE INDUSTRY, one of the most safety-critical new airliners from Boeing and Airbus is being designed in a virtual environment. All computer-aided disciplines are being brought together to achieve this with FEA providing a vital role. Our experience at Noran Engineering underlines this trend. Some case studies illustrate this.

SpaceDev

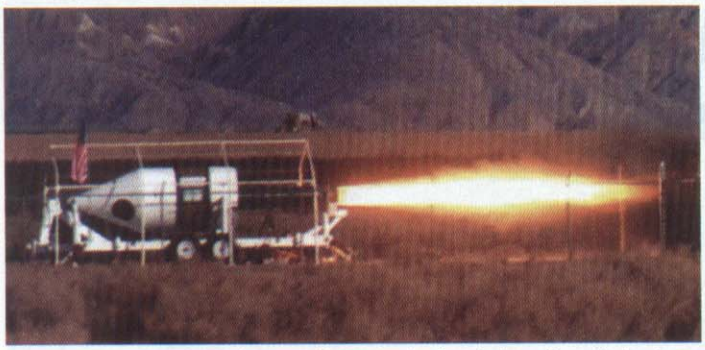
SpaceDev uses NEiNastran FEA software to analyze its satellites and avionics for launch survivability, and to optimize rocket components for various critical structural functions while meeting weight targets. FEA is essential, because the short development periods, stringent budgets, and high cost of prototypes and testing do not allow for prolonged or highly iterative design and test cycles.

SpaceDev provided the rocket motor for scaled composites and the highly publicized first commercial suborbital flight of SpaceShipOne. NEiNastran FE software was applied on a number of rocket motor components to optimize and verify several aspects of the design, such as shape, thickness, rib profile, and location. The motor bulkhead successfully passed its initial qualification test.

Minardi Formula 1 Team

The Minardi team uses Noran Engineering NEiNastran in an effort to improve the analysis and simulation of the design and cut down the huge investments they were making in physical composite chassis prototypes. They now create everything within the digital environment—even down to the smallest fiber in the materials.

It is important that the FEA software is flexible enough to manage the existing model, able to solve the problems thrown at it, and able to give accurate and detailed post processing information,



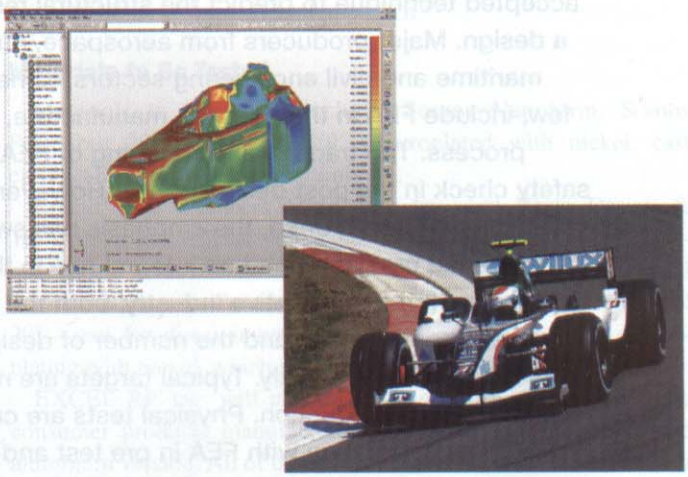
NEiNastran was used to conduct a nonlinear structural analysis on the rocket motor bulkhead for SpaceShipOne by SpaceDev. Multiple test firings have proven out the design. High testing costs and tight design schedules make passing the initial qualification tests a must in the design process.

so that effective modifications on material choice, lay-up sequences, local reinforcements, foams, bulkheads, and inserts can be easily tested and understood by the engineers.

Minardi reports that the NEiNastran implementation has given them an advantage by having the new chassis designed and tested with minimal cost and at high accuracy. They were confident that this allowed Minardi to gain an advantage in the 2005 Formula 1 season.

Conclusion

The future for FEA simulation is broadening as many more companies and industries embrace the clear advantages of FEA, and the technology is being used by a greater proportion of non-specialists. The challenges for the FEA software companies are to provide tools for the engineering designer as well as the specialist analyst to give robust solutions and to keep pace with the



Minardi Formula 1 Team uses NEiNastran to analyze its monocoque chassis. Composed of high performance carbon-epoxy composites with aluminum or aramidic honeycomb core, It's critical to get the right orientation on the fibers within the material while minimizing the ply overlapping and cuts.. Getting any of these aspects wrong, affects performance.

simulation requirements as they become more sophisticated in modeling real world events. **TCT**

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