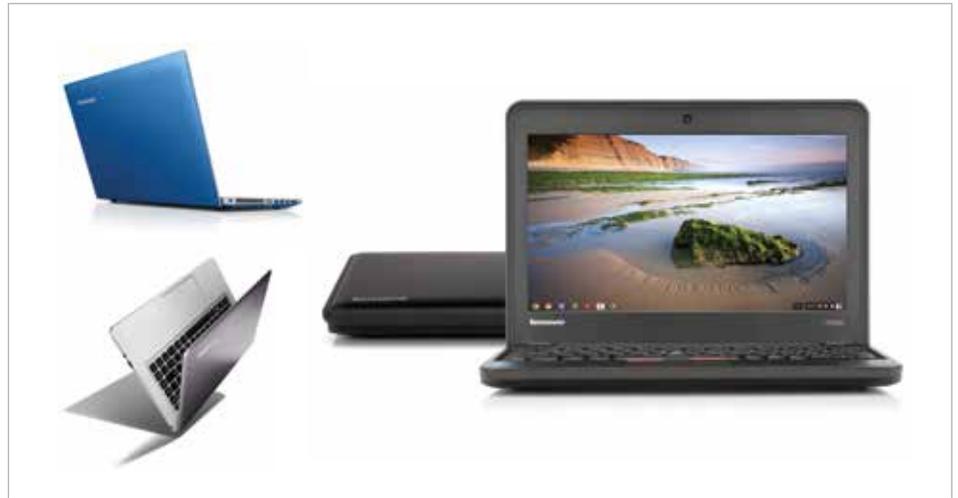
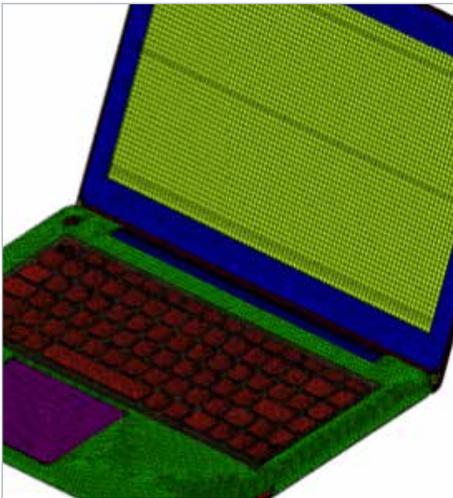


The Successful Application of HyperWorks at Lenovo



Key Highlights

Industry
Electronics

Challenge
Reduce pre-processing time and optimize performance in the initial product design phase.

Altair Solution
Improving CAE efficiency with HyperMesh and OptiStruct.

- Benefits**
- Products to market faster/shorter design cycle
 - Cost reduction
 - Improved product quality

Customer Profile

Lenovo, a Chinese multinational technology company with headquarters in Beijing, China and North Carolina, USA, has 30 years of history since founded in 1984. In 2013 Lenovo became the world's number one personal computer manufacturer. Lenovo manufactures personal computers, tablet computers, smartphones, workstations, servers, electronic storage devices, and smart televisions. Lenovo has operations in more than 60 countries and sells its products in over 160 countries.

The Challenge:

Competition in the computer industry has become increasingly intense, forcing computer manufacturers to continuously reduce cost, improve product quality

and reliability, and shorten their product development cycles. The traditional product development methodology—design, manufacture a prototype, test, modify, create another prototype, re-test—no longer meets the need for efficient product development and rapid time to market.

Lenovo, therefore, sought to use computer-aided engineering (CAE) tools for optimizing performance in the initial product design phase to simulate and evaluate its products' mechanical behavior under loads like impact and vibration. With this approach, potential quality problems can be detected early and an improvement plan developed so as to shorten the product development cycle and reduce costs. CAE technology now is playing an important role in manufacturing at Lenovo.

Lenovo Success Story



“Altair HyperMesh, as the uniform pre-processing platform for Lenovo, has been a very important tool for improving the CAE efficiency in Lenovo.”

Zhifeng Xin
Director - Mechanical/Thermal/Simulation/M&M
Lenovo Notebook Product Development

Initially, however, engineers were spending 80 percent of their time on pre-processing tasks in the simulation process. Some CAE software offerings have their own pre-processing tools, but with the increasing complexity of analysis and the competition for shortening development time, these pre-processing tools were not strong enough to meet the manufacturer’s requirements.

Moreover, the quality of the pre-processing mesh was not dependable with these tools. They did not provide the depth of quality for meshing that is demanded by the precise design requirements of Lenovo and other high-technology manufacturers.

To increase efficiency, improve the quality of meshing and shorten CAE simulation time, Lenovo engineers needed to own a powerful pre-processing tool, one that would really meet the demands of scientific research and engineering innovation. For this task, they chose HyperMesh, an important component of the Altair HyperWorks suite.

HyperMesh is a high-performance finite element pre-processor that provides a highly interactive and visual environment to analyze product design performance.

CAE Drives Innovation

In 2000, Lenovo set up a CAE technology platform in its Beijing Innovation Design Center, which has successfully supported the development of all the series of Lenovo products, including IdeaPad, IdeaCentre, LePhone, LePad, ThinkCentre and ThinkServer. At the same time, Lenovo adopted simulation technology to play an important role in evaluating the pre-research technology for the new model of ThinkPad, such as new material application research and high-reliability analysis. Lenovo believed that advanced simulation technology could drive product innovation to improve product quality, shorten the development cycle, optimize cost and improve other areas.

“Altair HyperMesh, as the uniform pre-processing platform for Lenovo, has been a very important tool for improving the

CAE efficiency in Lenovo,” said Zhifeng Xin, director of LBG NB. “For example, we used a pre-processing tool from another company to finish the modeling and solving process for a mobile phone in 2003. It took almost one month to proceed from the modeling to finishing the simulation. In 2006, we switched to Altair and used HyperMesh in combination with our solver. We only needed one week to complete a laptop simulation with 1.5 million elements.”

HyperMesh delivered the speed-to-quality results that Lenovo was seeking, yielding results that enabled a very fast development cycle because the mesh was highly reliable and allowed designers to move rapidly forward to complete their modeling and analysis.

Rethinking the Design Process

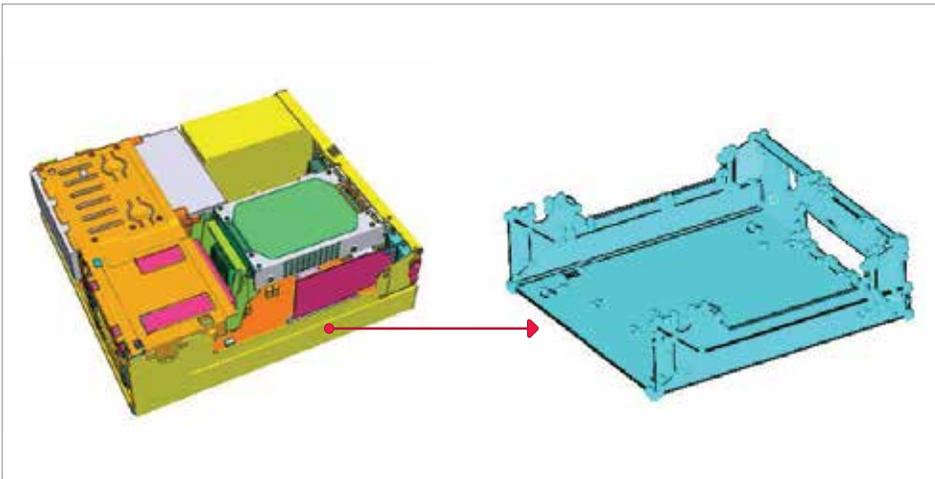
With today’s keen global competition, Electronics industry leaders must continuously innovate cutting-edge products and improve product development efficiencies.



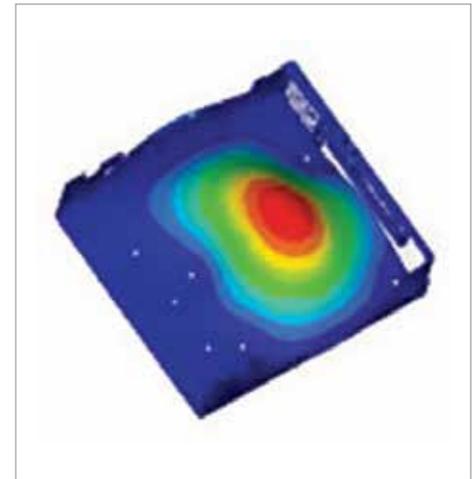
Solid CFD mesh of a computer's fan.



Lenovo uses HyperMesh to build complex FE models of laptops with up to 1.5 million elements.



OptiStruct has been used to optimize the structure of a computer case panel and eliminate resonance



Modal analysis performed on the optimized case

Electronics industry engineers are challenged to add more advanced features in ever smaller or thinner packaging, all while constantly reducing costs. Optimization technology now plays a critical role in the electronics industry to quickly deliver the best products to the market and to stay technologically ahead.

Many world-leading electronics companies leverage optimization technology to empower their engineers to quickly find creative and optimum designs for increasingly complex products. The benefits yielding from optimization technology are tremendous and it gives the designer and engineers a wider range of options than ever before.

At Lenovo, having realized the dramatic time savings and quality improvement that HyperMesh brought to their products, engineers expanded their use of the HyperWorks suite to apply OptiStruct to the design of hard-disk drives. One of the difficulties of hard-disk design is that the operating disk drive and the remainder of the computer system may resonate harmonically, leading to noise, vibration and wear on the disk. The computer system consists mainly of sheet metal and is prone to vibration from the parts it houses. In the structural design process, Lenovo's goal was to optimize the structure of a metal side panel to increase stiffness, thereby changing the natural frequency of the system so that it did not match the operating frequency of the hard-disk drive.

"In the traditional design process, we can't know whether the design will have resonance until the completion of prototype testing," said Xin. "If there is a resonance effect,

we can only add remedial treatments, such as rubber packing, to solve it. This does not fundamentally resolve the resonance problem, which requires us to constantly experiment. This approach significantly increases the design cycle."

By using OptiStruct to optimize the system, however, Lenovo is able to overcome many of the frustrations inherent in the trial and error method. "By using OptiStruct in the product's initial design period to carry out topography optimization for several major parts, our products can effectively avoid the constant experimenting," Xin observed "avoid the occurrence of resonance, shorten design cycles and improve product quality."

Lenovo's engineers conducted modal analysis with OptiStruct to optimize the fixed side of the computer system, averting resonance with the 120 Hz natural frequency of the spinning hard-disk.

"Optimization analysis during the computer product design can improve the product quality and shorten the design cycle," Xin reported. "The optimized results have a huge impact in relation to the modal analysis of the whole system. This method has vital significance in our product design."

"Utilizing optimization technology to quickly identify direction is absolutely a very important trend in electronics industry. It is imperative for the decision makers to quickly identify the right direction in a scientific, objective and quantifiable way when comparing different plans in the early stages." Xin points out.

Faster Design & Better Quality

HyperMesh has been a powerful CAE modeling platform for Lenovo, meeting nearly all engineering requirements. In addition, Lenovo is capitalizing on the user-friendly HyperMesh interface with CFD software and powerful geometric processing that can help quickly generate high-quality CFD elements while setting the boundary layer and fluid boundary conditions. The company is using HyperMesh in CFD areas to generate the fluid mesh accurately.

"CAE technology has developed rapidly in the past 10 years at Lenovo, and it impacts new product development and helps innovation greatly," said Zhifeng. "In my opinion, in these 10 years, Altair's pre- and post-processing technology has been a tremendous development. It fits more and more computing meshing demands, attains greater precision and achieves better efficiency. Altair provides us both strong software and professional technical support; and with this platform, our efficiency has improved rapidly."

Altair's HyperWorks-powered CAE platform has become a very important technology platform for the entire Lenovo organization, furnishing extraordinary improvements in pre- and post-processing capabilities, as well as design process and results optimization, that address a growing demand for faster time to market while improving product quality.

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Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 2,000 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 28-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

About HyperWorks®

Performance Simulation Technology

HyperWorks is an enterprise simulation solution for rapid design exploration and decision-making. As one of the most comprehensive, open-architecture CAE solutions in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications.

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