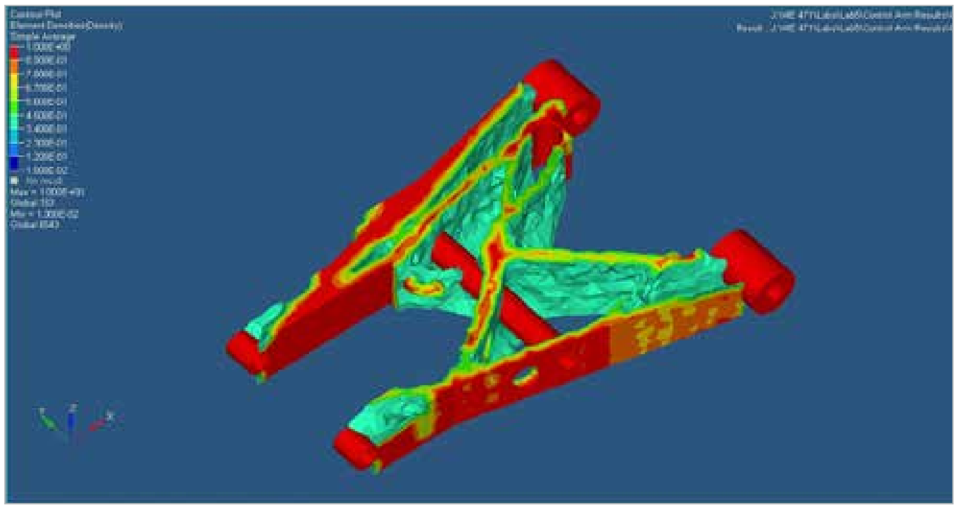
Altair | HyperWorks

Application of HyperWorks for Collaborative/Global Computer-Aided Engineering and Design Instruction at Brigham Young University



BYU | PACE

Key Highlights

Industry
University/Design

Challenge
Develop a global collaborative CAE-based engineering design course

Altair Solution
Utilize HyperMesh and OptiStruct for the course

Benefits
- Working with industry-focused CAE design tools enables undergraduate students to develop skills needed to solve real-world engineering problems
- A collaborative leaning environment motivates students to accept the task of maintaining an attitude of life-long learning as it relates to CAE design simulation

Customer Profile

The Department of Mechanical Engineering at Brigham Young University (BYU) places a strong emphasis on educating mechanical engineering students to become leaders in applying advanced design techniques to develop new and innovative products. A key component of the department curriculum to meet these objectives is providing instruction that focuses on principles and procedures of multi-physical computer-aided-engineering (CAE). Dr. Greg Jensen, Fulton College Professor of Global Engineering, has led the department to develop innovative CAE instruction.
His work has focused on the development of next generation, multi-user, collaborative cloud-based CAE tools and methods. Today a critical success factor for industrial product development is the ability of international companies to collaborate and communicate with a large network of technology providers, inventors, vendors, and manufacturers worldwide. An ability to lead multi-national teams through challenging problems and a willingness to conduct around-the-clock on-line meetings with partners from all parts of the globe is essential for company success.

The Challenge: Rework an Engineering Design Course

The specific challenge that Dr. Jensen faced at BYU was to completely rework an advanced engineering design course, ME 471, which had been taught for over 30 years. The course had consisted of classroom and laboratory components where both theoretical concepts and

Keywords: HyperWorks, HyperMesh, OptiStruct, Brigham Young University

BYU Success Story

"HyperMesh and OptiStruct were invaluable computational tools for teaching students topological optimization and the role it plays in product design"

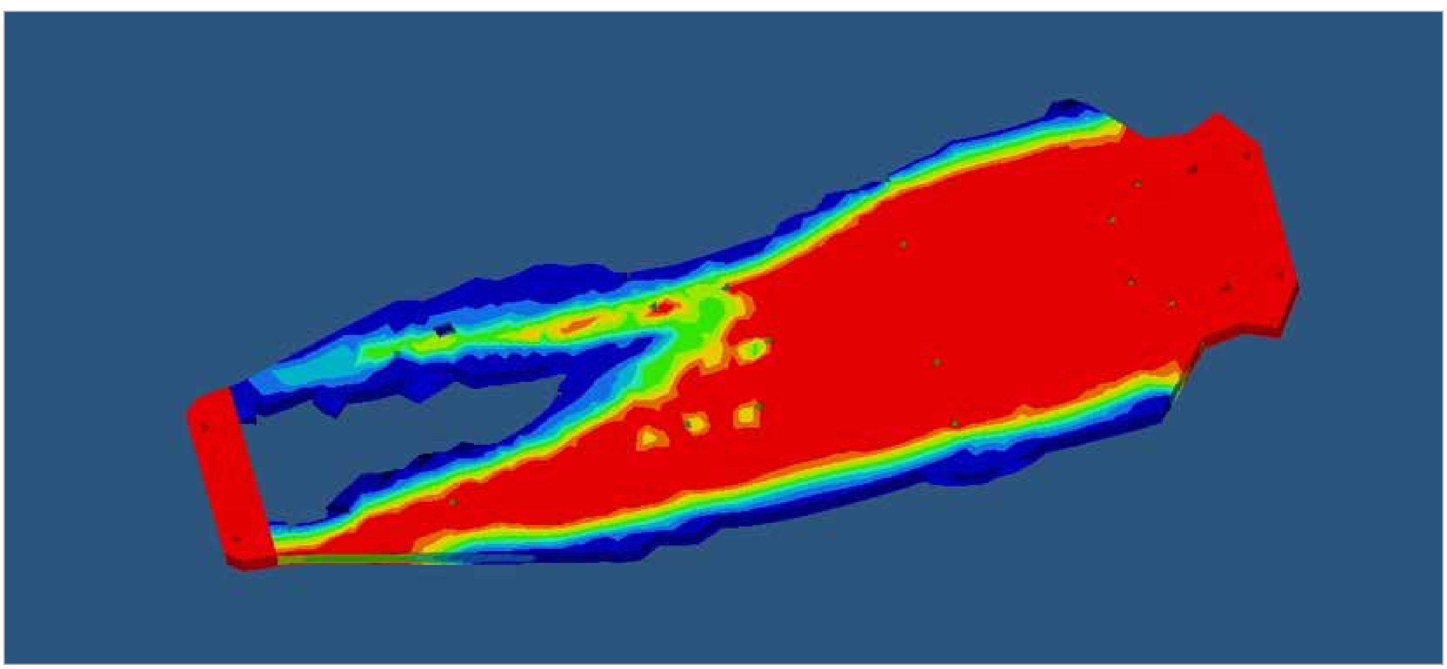
Dr. Greg Jensen
Professor
Mechanical Engineering

practical CAE skills were emphasized. These included topology optimization, surface and advanced solid modeling techniques, and parameter modeling approaches. Students were assigned a team design project to complete over a 16 week period.

A major objective for reworking the course was to add the ability to network design projects so that term projects could be completed collaboratively by teams from various global engineering universities. The main challenge in course networking was to globalize the student learning experience by adding intercultural competency requirements.
These included providing experience with working in or directing a team of ethnic or cultural diversity, understanding cultural influences on product design and manufacturing, and comprehending how cultural differences affect how engineering tasks are performed.

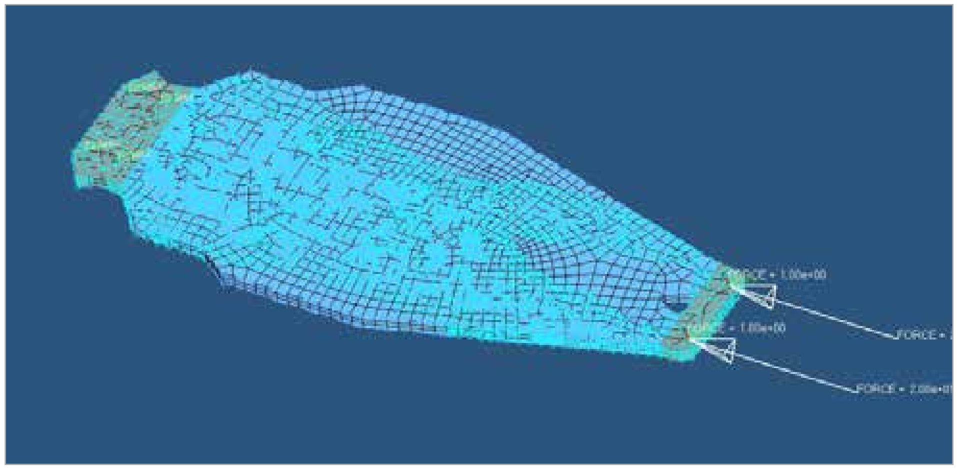
The Solution: Utilization of HyperWorks in Course Globalization

The ME 471 course was globalized by forming international teams representing universities that were members of the PACE (Partners for the Advancement of Collaborative Engineering Education) Program. Each team was typically comprised of members from 5 PACE universities. In addition to the international team formation, the course was



Topology optimization result for Chassis

CAD rendering of Camero body shell re-design



Chassis finite element model.

modified by integrating new technologies (HyperWorks, Teamcenter Community, Google Docs, Video Conferencing Hardware) to support the work of the virtual student teams. New laboratory exercises were also developed to teach the new virtual collaboration technologies and design simulation methods. In addition to the course modifications, logistical infrastructure upgrades at BYU and partner universities were also completed. These included integration of classroom, CAE lab, and team meeting room video conferencing hardware. Extensive course planning, coordination, and calendaring were also required, along with the establishment of consistent course institutional credit at the collaborative universities.

A term project assignment given to each team consisted of the architecture/chassis of an actual vehicle, which the team was directed re-design. Project tasks included CAD/CAE modeling of all vehicle components, subsystems, and final assembly based on the team engineering analysis. Analyses required for each team included topology optimization to guide the preliminary design, mass properties, finite element analysis, computational fluid dynamic analysis, and motion body dynamics analysis. Each team was also required to create their own car body as a surface only part.

The Results: Team Course Design Presented to PACE Program Representatives and Partners

For a recent ME 471 class, a team of five students re-engineered the chassis/suspension platform for a 1969 Chevrolet Camero. At the conclusion of the project, the team presented a comprehensive review of their re-design vehicle to a panel of PACE program representatives and partners. Key to arriving at an efficient design was the early application of Altair topology optimization to the chassis, suspension, and wheel design of the vehicle. Altair HyperMesh was applied to generate finite element models that formed the basis for the topology optimization studies. During their project presentation, the team clearly demonstrated a fundamental understanding of the underlying concepts of topology optimization and the key role it plays in conceptual, preliminary, and detailed product design. More specifically, the team results showed that

- The chassis mass was reduced by 34% through the application of topology optimization.
- The suspension control arm mass was reduced by 28%.

The team was able to apply the Altair HyperWorks simulation tools in a seamless manner with the Catia-based CAD data that was generated for the vehicle re-design.

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Success Stories

at www.altairhyperworks.com

About Altair

Altair's vision is to radically change the way organizations design products and make decisions. We take a collaborative approach to solving diverse and challenging problems through the strategic application of technology and engineering expertise. Developing and applying simulation technology to synthesize and optimize product development processes for improved business performance is our specialty.

From computer-aided engineering to high performance computing, from industrial design to cloud analytics, for the past 30 years Altair has been leading the charge to advance the frontiers of knowledge, delivering innovation to more than 5,000 corporate clients representing the automotive, aerospace, government and defense industries and 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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