

HyperWorks@Uni

YOUR ACADEMIC PROGRAMME NEWSLETTER

Altair® HyperWorks® is A Platform for Innovation™

Issue 3
2010

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ALTAIR HYPERWORKS SPONSORS BLOODHOUND 1000mph CAR

In 2009, Altair became official product sponsors of BLOODHOUND SSC, a unique British based project to develop a land vehicle capable of reaching 1000mph! Under the sponsorship package, BLOODHOUND SSC engineers have free access to HyperWorks' award winning optimisation solution, OptiStruct, to aid in the development of a structurally efficient design for the car's space frame. In order to reach 1000mph, it is essential that the vehicle is as lightweight as possible while retaining the structural integrity needed to withstand the massive loads experienced during acceleration. OptiStruct is being used to perform topology optimisation on the vehicle to deliver a design solution that meets both these objectives.

But what exactly is Topology Optimisation?

In its simplest form, the topology optimisation method solves the problem of distributing a given amount of material in a design domain subject to load and support conditions, such that the stiffness of the structure is maximised. Since its introduction the method has gained widespread popularity in academia and industry and is now being applied to the design of an ever-increasing number of structures, parts and components.

OptiStruct successfully ran 100 design iterations on the car's metallic and composite space frame: at each one, the solver took some material away from the design space by reducing the elements' density, and finally delivered an optimum solution that meet all the constraints. This solution can be passed on to the design team who have now a much better knowledge of where the material is needed, so they can design a new set of structural beams along the optimised pattern that OptiStruct came up with.

Find out more about optimising BLOODHOUND SSC at:

www.bloodhoundssc.com



Visit
BLOODHOUND
on YouTube



ALTAIR HYPERWORKS SPONSORS WARWICK FORMULA STUDENT TEAM

The Warwick Formula Student team (WFS) recently completed a one day training at Altair's Royal Leamington Spa office. The training covered applications such as HyperMesh, OptiStruct and HyperView among other tools with the intention of incorporating HyperWorks to the design phase of their formula student car for the 2009/10 race. Altair is proudly sponsoring the WFS team with free licenses of HyperWorks as well as training. This sponsorship is part of the standard Altair academic programme aimed to promote CAE within the formula student community.

The team is also supported by the Warwick Manufacturing Group (WMG), part of the University of Warwick, and the Innovation Manufacturing Research Centre (IMRC). The IMRC produced the first racing car designed and made from sustainable and renewable materials. The WFS team members already have industrial experience in a number of engineering fields, including Formula One, which make them formidable competitors. Among other projects within this team, the development of next years car will be documented through YouTube.



University of Warwick students attend HyperWorks training day

To find out more about this exciting team, please visit their website at:
www2.warwick.ac.uk/fac/sci/eng/meng/formulastudent

ALTAIR HYPERWORKS AT UNIVERSITY OF LEEDS

The Faculty of Engineering, University of Leeds has recently invited Altair to participate in its Design Optimisation module. This one week, six hours a day intensive module takes place once a year and Altair have been participating for several years. Hosting this event is Professor Vassili Toropov, one of the worlds leading authorities in optimisation. Among other topics, this module takes students through real-life examples where design optimisation techniques have been applied, demonstrating design improvements whilst maintaining structural integrity. The talk provided by Altair focused on Aerospace and Civil engineering topics and is a detailed showcase of the benefits of optimisation.

In addition to the theoretical principles, the students, through a series of practical exercises, experience a hands-on approach to optimisation. The HyperWorks CAE suite is used extensively to generate FE models, perform analysis, optimisation and generate robust designs. The final outcome is a consistent and complete module with allows the students to use in their professional careers the industry standard optimisation tools.



Professor Vassili Toropov with Altair's Daniel Nieto

For more information about the Faculty of Engineering, please visit:
www.engineering.leeds.ac.uk

TRAINING COURSES

Develop Your Skills

Here are upcoming HyperWorks training courses.

For more details on these courses, to obtain a full schedule or to inquire about customised onsite training, call us on 01926 468 600

LEAMINGTON SPA

Basic Finite Element Analysis (FEA)

On demand

Essentials of Pre- and Post-Processing with HyperWorks

March 2 - 3

Solver Interfaces

On demand

Metal Forming Simulation using HyperForm

March 16

Extrusion, Moldfilling, Forging and Friction Stir Welding

On demand

Multi-body Dynamics with MotionView and MotionSolve

May 18 - 19

Generating Robust Designs with HyperStudy

March 11

Design Optimisation using OptiStruct

March 9 - 10

Crash and Impact Simulation Using RADIOSS & HyperCrash

April 13 - 14

RADIOSS Linear

March 18

Formability of Sheet Metal

On demand

PBS Professional for Workload Management

June 2 - 3

ADVANCED COURSES

Designing for Composite Material

On demand

Advanced Analysis with RADIOSS Linear

On demand

Noise, Vibration & Harshness

On demand

Vehicle Closures Modelling

On demand

ALTAIR ACHIEVES BREAKTHROUGH TIME SAVINGS IN CRASH SIMULATIONS

Late last year, Altair announced the implementation of a new analysis process that drastically reduces the simulation time needed for virtual crash testing. To achieve these results, Altair worked closely with Intel Corporation using the latest Intel software tools and compilers to 3 optimise communications schemes and extract the best performance using an Intel cluster based on Intel® microarchitecture, codenamed Nehalem.

Virtual crash tests are one of the most time consuming tasks in automotive development processes. Combining a new solution approach for simulating highly dynamic events, the well known scalability, quality and repeatability of Altair's crash solver RADIOSS, and Intel's expertise in high-performance computing allowed a team of research engineers to run virtual crash tests in minutes instead of hours. For the first time ever, a frontal crash simulation of a vehicle model with more than one million elements was performed in less than five minutes.

You can read the full story of this breakthrough in analysis time savings on the HyperWorks website:
www.altairhyperworks.co.uk



ALTAIR IN THE NEWS

[Altair Introduces HyperWorks Durability Simulation Management Solution](#)

December 7, 2009

[Peugeot Sport selects HyperWorks Suite to streamline development processes of LMP1 race car](#)

November 30, 2009

[Record Attendance at 2009 European HyperWorks Technology Conference](#)

November 30, 2009

REGISTER TODAY

If you are new to this site or have not registered as an Insider user, we invite you to complete a brief sign-up form. As a registered user, you will have access to other support resources, including documentation, tutorials, software updates and macros. You will also have access to the iExchange message board.



Be Part of the Altair Client Community Online

LOGIN REGISTER

Login to Altair Client Center online

ADDITIONAL HYPERWORKS MACROS

Export_each_curve_to_csv.zip:

This HyperGraph tool allows users to export each curve in the active plot window as a separate CSV file in Excel format.

[Download](#)

universalRename.zip:

Replace strings in selected collectors names.

[Download](#)

SUPPORT TIPS & TRICKS

Achieve assembly/component structure in HyperMesh to closely match CATIA part structure.

[Download](#)

Create summary of the loads applied on the model and visualize in HyperMesh.

[Download](#)

TUTORIALS

Every month, we will post a new HyperWorks tutorial, freely available for all students & teachers using the software. Each download contains an engineering task based on real world design problems and includes ready to use HyperWorks model files to explore and edit as you like.

This month's tutorial:

'Size Optimisation of a Car Frame'

[Download](#)



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OPTIMISATION OF A COMBINED HEAT & POWER DOMESTIC UNIT MOUNTING FRAME

INGO SCHULZE MÖNKING - MSC COVENTRY UNIVERSITY

Introduction

A Combined Heat & Power (CHP) unit generates electricity and heat simultaneously by using a heat engine and a power plant. This device is one of the most common and efficient forms of energy recycling.

In order to successfully introduce CHP units in the domestic environment they have to meet several requirements, especially those units destined for domestic use. In general, home appliances have to operate at a low noise levels, efficiently utilise space and be a light as possible for installation purposes.

The objective of this project was to improve the design of the power plant mounting frame within the CHP unit. The new design should be simple, easy to install and lightweight. The main constraint of the new design comes from the dynamic response of the mounting frame; vibrational frequencies must be higher than 50 Hz.

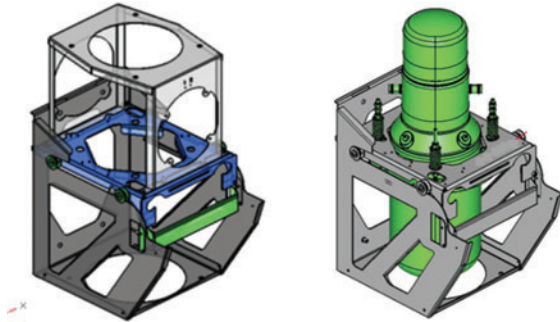


Fig 1: Full power plant structural assembly (left) & mounting frame with power plant incorporated (right)

Approach

Prior to optimisation, a validated Finite Element (FE) model of the mounting frame was generated and two sets of tests were used for this purpose. HyperMesh was used extensively to generate the FE models and then RADIOSS to perform the appropriate analysis. First, a physical displacement test was performed to understand the displacement of the mounting frame during static loading and unloading of the power plant. The frame displacement was measured with a DTI (Dial Test Indicator) at a pre-defined location.

Later, static and dynamic loading tests were performed to understand the response of the mounting frame structure during these types of loading conditions. The FE model was optimised using OptiStruct, part of the HyperWorks suite of software, in order to reduce weight whilst maintaining the same structural integrity. The final designs underwent direct frequency response analysis to investigate the vibrational characteristics of the mounting frame.

Multi-discipline Optimisation - OptiStruct

Initially, topology optimisation was performed on the mounting frame. The topology optimisation starts with a design envelope which encloses the mounting frame material. The reduction

of weight is achieved by varying the density of the material in response to the loads experienced by the mounting frame. A minimum member size constraint was added to ensure manufacturability. This manufacturing constraint stops OptiStruct generating member sections with unattainable dimensions

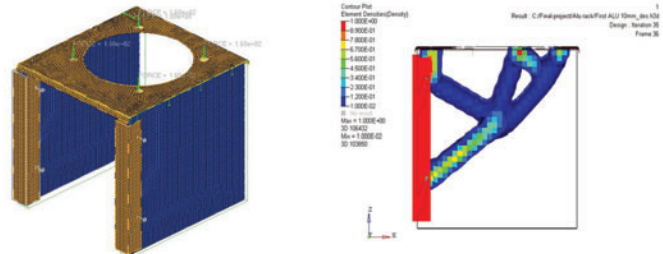


Fig 2: Design Envelope (left) & an initial optimisation result (right)

Once the material distribution was established by topology optimisation, free-shape optimisation was employed to reduce local stress concentrations. Shape optimisation varies the shape of the model in defined areas in order to improve the design performance; the 'free' term comes from the fact that the shape is free to change unconstrained in every direction. Aluminium and steel were considered throughout the entire optimisation process.

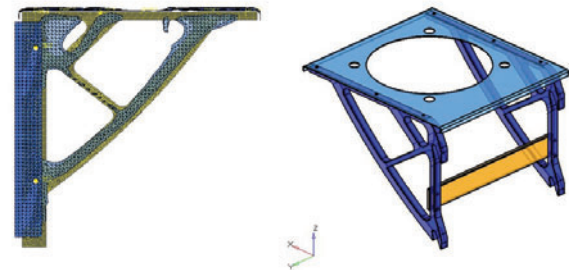


Fig 3: Optimisation result (left) & final design interpretation (right)

Results

The results obtained from OptiStruct demonstrated that the aluminium mounting frame was 38% lighter than its steel counterpart. Also, the steel frames are prone to greater noise radiation. Furthermore, the aluminium solution compared to the original design is 70% lighter. Further analysis of the optimised model proved that vibrational frequencies were away from the critical frequency of 50 Hz.

Conclusion

The optimisation results from OptiStruct demonstrated that the weight of the mounting frame can be reduced by a significant amounts whilst maintaining structural integrity and dynamic characteristics. The OptiStruct results also demonstrated that incorporating optimisation schemes during the design cycle of structural components in CHP units will further improve efficiency of this type home appliance.

Have a support question? Unable to access the web links in this email? We can help. Please email support@uk.altair.com or call 01926 468 600 for assistance.

We want to know what you think about the Insider. Please share your opinion at info-update@altair.com.

To learn more about Altair Engineering, visit us at www.uk.altair.com.

CASE STUDY