2015 Americas
Altair Technology Conference

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Dear Valued Customers and Partners,

Welcome to the 2015 Americas Altair Technology Conference (ATC). We are delighted that you could join us. Bringing the Americas ATC back to Michigan, a region known for celebrating growth and innovation, allows us to provide a forum that embraces the fusion of technology, science and applied mathematics to solve real-world problems creatively. Thank you for your participation in this informative and exciting event. Over the next three days, our program agenda has been structured to provide deeper insight into Altair’s technologies and how the cloud and appliances will further enable simulation-driven design. This will include visionary keynote presentations by an esteemed group of industry thought leaders and honored guests:

Mike Whitens, Director, Vehicle and Enterprise Science, Research, Ford Motor Company;
Franck Mouriaux, General Manager, Structures, RUAG Space;
Kevin Kerrigan, Senior Vice President, Automotive Office, Michigan Economic Development Corporation;
Ken Dudley, Senior Researcher, NASA LaRC; and
Stewart (Denny) Moore, Principal Engineer, Applied Mechanics, General Dynamics Electric Boat.

This group combined with over 50 invited session speakers will share industry trends, challenges and the innovative solutions successfully applied leveraging Altair technologies. New to our ATC program agenda, be sure to catch our “What’s New” sessions which will showcase our latest technologies for electromagnetics simulation, FEKO™, and model-based systems development, VisSim™. The ATC will also host two main session presentations for, HyperWorks® Tips & Tricks – always an audience favorite! We hope that you enjoy the ATC and know that your attendance is deeply appreciated and adds a great deal to the learning, knowledge and insights shared.

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Senior Vice President - Americas
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Senior Vice President - Americas
Altair
New Powertrain Simulation Technologies

Arnaud Sohier - Powertrain Technical Leader, Altair
Dave Mason - Vice President, Global Automotive, Altair
Nirmalkumar Subbaiah - Program Mgr./Business Dev. Mgr., Altair
Manohara Mariyyapa - Application Engineer, Altair

Abstract Summary
Attendees to this workshop will learn how HyperWorks® offers a complete and efficient solution to model, simulate and optimize powertrain systems. Practical examples evaluating NVH, coolant and air flow (CFD), lubrication and thermal-mechanical durability load cases will be reviewed. Novel new optimization techniques for radiated noise, engine mount and overall crankcase light-weighting will be presented.

- Multi-disciplinary simulation for flow, lubrication, strength, NVH, thermal-mechanical and durability of powertrain systems
- Innovative new optimization techniques for powertrain design
- Advantages of a single solver environment for NVH and thermal-mechanical simulation
- Latest updates for parametric CAE template based model generation with SimLab

Jeff Wollschlager - Account Manager, Altair
Sridhar Ravikoti - Technical Director, Global Partner Programs, Altair

Abstract Summary
Attendees to this workshop will learn how to utilize the HyperWorks® and Altair Partner Alliance suite of tools to design lightweight composite parts. The first portion of the workshop will demonstrate the process for designing a lightweight composite part including draping, ply shape concept design, and laminate detailed design within HyperWorks®. The second portion of the workshop will demonstrate the simulation of an injection molded part utilizing HyperWorks® and Altair Partner Alliance solutions.

- Ply-based composite modeling in HyperWorks®
- Including draping simulation data in composite analysis and design optimization simulations
- Ply shape concept design optimization with composite free-size technology
- Laminate detailed design optimization with composite size technology
- Simulating injection molded parts utilizing HyperWorks® and Altair Partner Alliance solutions
### FEKO™

**Room: 105A**

**FEKO™**

**Martin Vogel**  
Principal Engineer  
Altair

**Workshop Summary**

The training includes in-depth instructions to the pre-processing and solver interface, CADFEKO and the post-processing interface, POSTFEKO. Following introduction to basic principles, there will be Hands-on examples demonstrating the capabilities of FEKO™ for various applications.

- Latest features in CADFEKO  
- Features available in POSTFEKO  
- How to design and analyze antennas in FEKO™  
- How to solve electromagnetic problems related to automotive industry, in FEKO™

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### SYSTEM LEVEL SIMULATION

**Room: LOOKOUT**

**System Level Simulation**

**Michael Hoffman**  
Senior Vice President Math & Systems  
Altair

**Workshop Summary**

System simulation of today’s complex products requires the integration of various physical subsystems like mechanics, hydraulics, controls and others. This workshop will demonstrate how Altair’s HyperWorks® product line can satisfy this requirement. Special emphasis will be given to the new 1d-system simulation capability allowing the combination of signal based and physical based modeling. Co-simulation with Multibody systems as well as the Functional Mock-Up Interface (FMI) will be illustrate by application examples.

- 1d-simulations  
- Modeling and simulation of mechanical, hydraulic, controls, and electrical systems  
- Co-simulation  
- Employment of the Functional Mock-Up Interface
### TRAINING/WORKSHOPS

**MECHATRONICS LAB**

**ROOM: 105B**

**Mechatronics Lab - Embedded Development 100% Graphically**

**Richard Kolk**  
*Chief Technical Specialist*  
*Altair*

**Workshop Summary**

In order to demonstrate that Model Based Development of Embedded Systems can be achieved without hand-coding a single line Altair has developed a complete Mechatronics Curriculum.

The lab will illustrate on physical experiments how VisSim™ Embedded and Texas Instruments C2000 launchpads can be employed for embedded development.

- Model based embedded Development
- Automatic code generation
- Support of chip peripherals like PWM, I/O, ...
- Model-, Processor-, Hardware-In-The-Loop

### TRAINING/WORKSHOPS

**AUTOMOTIVE/ OCCUPANT SAFETY**

**ROOM: LOOKOUT**

**Automotive/Occupant Safety**

**Ravi Kodwani**  
*Application Engineering Manager*  
*Altair*

**Workshop Summary**

Streamline the process of occupant safety systems simulation by using RADIOSS for both sled and vehicle crash models. Altair engineers will demonstrate occupant safety simulation using HyperWorks® for the complete cycle: set-up, component/sled simulation, post processing, DOE, optimization and robustness studies. In addition methods for airbag modeling (uniform pressure and FVM methods), stitching, folding, and packaging will be discussed.

- Sled system simulation and safety system components simulation in RADIOSS
- Airbag modeling and pre-simulation methods (folding, packaging etc.).
- Model set-up of occupant safety system and template generation for post processing
- DOE and optimization set-up
Tuesday Workshops

TRAINING/WORKSHOPS
VEHICLE DYNAMICS/MULTIBODY
ROOM: 103

Multibody Simulation

Keshav Sundaresh
Global Business Development Manager
Altair

Workshop Summary
In this workshop, learn how MotionSolve is used to design and evaluate new suspension systems, optimize the ride and handling characteristics of vehicles, assess system durability, simulate for low frequency vibration avoidance, design and optimize steering systems, and validate Mechatronics components

- Why Use MotionSolve For multibody Dynamics Simulation
- How customers are applying MotionSolve to solve real world applications
- Live demo: How can I use MotionSolve to improve mechanical system performance
- Hands-on training

Tuesday Workshops

TRAINING/WORKSHOPS
ADDITIVE MANUFACTURING
ROOM: 203

Design Faster and Lighter: Applications of Topology Optimization in Additive Manufacturing

Jaideep Bangal
Senior Applications Engineer
solidThinking®

Workshop Summary
When topology optimization is utilized to generate designs for additive manufacturing, many exciting new benefits present themselves (lightweight parts, stronger parts, no wasted materials, cost savings, etc.). This presentation will answer a number of questions. This presentation will include multiple real-world examples of companies using topology optimization to design for and enhance the benefits of additive manufacturing. It will also include hands on session using Inspire for additive manufacturing example.

- What is topology optimization?
- Why does topology optimization makes sense for additive manufacturing?
- Who has been applying topology optimization?
- What are the future opportunities?
TRAINING/WORKSHOPS
ADVANCEMENTS IN OPTIMIZATION
ROOM: 203

Advancements in Design Exploration and Optimization

Warren Dias - Business Development Manager, Altair
Fatma Kocer - Director of Business Development, Altair

Workshop Summary
Design innovation, competing requirements, design exploration, multiple models, compute resources and cloud computing. These are some of the key aspects and challenges that designers and engineers are faced with daily in their product development process. Join us for this workshop to learn how recent advancements in Altair OptiStruct and Altair HyperStudy® can be applied for design optimization and exploration studies respectively. The topics that will be covered include the use of OptiStruct to optimize multiple models simultaneously through the Multi Model Optimization framework, the new and innovative lattice structure optimization for additive manufacturing or 3D printing, and the use of HyperStudy® for design exploration in the cloud.

- Multi Model Optimization with OptiStruct
- How to design and optimize structures – lattice structures – manufactured by 3D printing techniques
- What is new in design exploration
- Case Study: Automotive Seat Design in the Cloud

TRAINING/WORKSHOPS
MULTIPHYSICS
ROOM: 103

Multiphysics Simulation

Jon Quigley
Director, Systems Simulation
Altair

Workshop Summary
Engineers are requiring ever more complex simulations in order to capture real world behavior of their products. One of the areas which is gaining emphasis is Multiphysics, or simulation that takes into account more than one of the traditional areas of CAE. This workshop will introduce you to this exciting and growing area of simulation.

- An introduction to Multiphysics
- How and why it applies
- Altair’s vision for Multiphysics
- Example applications
HPC & Enterprise Software

Samuel Goosen - Manager Product Specialization, Altair
Venkat Parameshwaran - VP, Enterprise Analytics, Altair
Alhad Joshi - VP, Enterprise Analytics, Altair

Workshop Summary
The workshop includes three components:
1. What’s new in PBS Professional 13.0
2. Collaborating with PBS portal products
3. Software asset optimization

Join us to understand:
• What’s new in PBS Professional 13.0, Altair’s market-leading workload manager
• How Altair portals can simplify and help with collaboration in HPC & CAE computing environments
• How Altair’s Software Asset Optimization (SAO) helps right-size your expensive software investments

What will I learn?
• What’s new in PBS Professional 13.0 – get an exclusive update on the new version!
• Overview of Altair Portals (Compute Manager, Display Manager, Simulation Manager & PBS Analytics)
• How to use SAO to improve utilization of software licenses

NVH Solutions

Jianmin Guan
Director, Vibration and Acoustic Solutions
Altair

Workshop Summary
This workshop introduce Altair full frequency and multi-physics solutions for solving the most pressing problems in the NVH field. It will provide an overview of Altair’s solutions designed to facilitate the best in class NVH design process at automotive OEMs, coupled with real-time demonstrations of key product features. The focus of the workshop is on effective NVH problem resolution.

• Altair’s full frequency, multi-physics solvers
• Advanced pre-processing for NVH engineers including full vehicle assembly and loadcase management
• Advanced post-processing for effective root cause investigation and counter measure studies
• Advanced acoustics solutions for trim modeling, noise reduction, and sound radiation
• Use of dynamics reduction techniques (CMS and CDS superelements) to reduce runtime
• Optimization and stochastics
FEATURED SPEAKER
ROOM: GRAND HALL, SUITES 2&3

Altair Company Vision

James R. Scapa
Chairman and Chief Executive Officer
Altair

James R. Scapa brings more than 35 years of engineering experience to his dual role of Chairman and CEO of Altair Engineering, Inc., a title he has held since the company’s inception.

In 1985, Mr. Scapa and two partners founded a small consulting activity in the new field of computer-aided-engineering. Today, the company employs over 2,300 employees with more than 45 offices throughout 23 countries.

Through Mr. Scapa’s leadership, the company is now a leading global provider of simulation technology and engineering services that empower client innovation and decision-making.

With over 5,000 clients, Altair serves the automotive, aerospace, government and defense, heavy equipment industry sectors as well as the consumer products, ship building, energy, electronics, life sciences, and architecture engineering and construction markets.

Prior to establishing Altair, Scapa served as an engineering consultant to the automotive industry, beginning his career with Ford Motor Company in 1978.

Scapa holds a bachelor’s degree in mechanical engineering from Columbia University and a Master of Business Administration from the University of Michigan.
Innovation Driven Mobility

**Mike Whitens**  
Director, Vehicle and Enterprise Science  
Ford Motor Company

**Abstract Summary**
Automotive manufacturers and suppliers are constantly challenged with delivering innovative vehicles that excite consumers. The automotive industry has always been a hyper-competitive environment, and companies are now forced to globally launch new, extremely more complex, products at a quicker pace than ever before to keep their competitive edge. Meanwhile, product lifecycles are getting shorter, though new technology is required to be introduced and integrated to respond to evolving consumer demand and regulatory mandates. Lightweighting achieved through the use of exotic materials such as aluminum, composites, advanced high-strength steel, and magnesium is now a standard part of most market segments and vehicle volumes. Extraordinary progress has been made regarding Vehicle connectivity. Both Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) are leading the industry towards advancements in active safety features and evolving towards autonomous and self-driving vehicles.

Motivations, Opportunities and Challenges of Additive Manufacturing for Space Application

**Franck Mouriaux**  
General Manager Structures  
RUAG Space

**Abstract Summary**
Additive manufacturing (AM) technologies have progressed rapidly in the last years. Supported by the recent developments of design optimization tools and manufacturing capabilities, components and parts produced using AM are emerging more and more into the focus of space industry.

The aim of this presentation is to show why AM can be seen a promising manufacturing technique for space industry and in particular for satellite application?

Opportunities and challenges that have to be faced to make 3D printed components “flying” on spacecraft are presented and discussed.

The re-engineering and qualification approach of the already existing Antenna Support Bracket, that is part of the Sentinel-1 spacecraft, is discussed as a case study to bring this topic into the more tangible context of an industrial project.
ALT AIR SOFTWARE VISION
ROOM: GRAND HALL, SUITES 2&3

Altair Software Vision: Inspiring the Innovators

James Dagg – CTO, Modeling/Visualization, Altair
Uwe Schramm – CTO, Solvers/Optimization, Altair
Sam (Mahalingam) Srikanth – CTO, HPC/Cloud Solutions, Altair

Abstract Summary
As the world’s largest privately held CAE software and HPC technology developer, Altair is focused on developing simulation-driven solutions to foster innovation and improve business performance. Our HyperWorks® simulation and solidThinking® design software suites impact product design from the earliest conceptual design stages through product performance optimization, with high-performance computing (HPC) as an integral part of this design strategy to enable simulation-driven design. In this presentation, Altair’s technical leaders will give you insights on how software products will evolve in the next few months and years, as well as what’s driving that evolution. Some radical, forward-thinking anticipations of upcoming software releases will be previewed, in line with Altair’s vision to radically change the way organizations design products and make decisions.

GENERAL SESSION
ROOM: GRAND HALL SUITE 2

HyperWorks® Tips & Tricks - Modeling & Visualization

Erik Larson - Training Specialist, Altair
Linus Fernandes - Application Engineer, Altair

Abstract Summary
What truly differentiates an “expert” user of HyperWorks® is often the little Tips and Tricks that they know that many other users don’t. These tricks can help a user shave off a little time from frequently used functions or even expose a brand new way of doing something. This live demonstration will highlight many of these little tricks, each of which is easy to remember and will be shown in under 3 minutes, to help you become an expert user.
GENERAL SESSION
ROOM: GRAND HALL SUITE 2

What’s New - FEKO™ Introduction

Ulrich Jakobus
Vice President-EM Solutions
Altair

Abstract Summary
Last year Altair acquired the leading high frequency electromagnetic simulation software FEKO™ to complement its portfolio of HyperWorks® solvers. This presentation will give an introduction to CEM (Computational Electromagnetics) and an overview of the FEKO™ technology. The application of FEKO™ in various industry sectors (automotive, marine, aerospace, communications, healthcare) will be demonstrated. In addition, selected examples of antenna design, antenna placement, electromagnetic compatibility including cable harness modelling, bio-electromagnetics, radar cross section analysis, and general waveguide/microstrip circuit analysis will be discussed, which will confirm the accuracy, universality (in terms of range of applications) and efficiency (in terms of memory/run-time) of FEKO™.

PERFORMANCE OPTIMIZATION
ROOM: 203

Cutting Edge Optimization Methods For The Aerospace Industry

David Bowen
Structural Analysis Engineer
Boeing

Abstract Summary
Performing optimization on structural and dynamic components is nothing new in the Aerospace industry. One particular challenge comes while attempting to run FEM-based optimization across multiple configurations. This is a time consuming process that can lead to errors if every cycle is not properly tracked. With Altair’s new Multi-Model Optimization (MMO) capabilities in OptiStruct, the tracking problem is resolved, offering the advantage of common component optimization. This presentation will discuss the application of MMO on various component, assembly, and system level optimizations.
Teaching Aerospace Design Optimization

Robert Taylor
Professor in Practice
University of Texas at Arlington

Consulting Engineer
Optimal Structures, LLC

Abstract Summary
Engineers develop design and analysis skills through application of principles, methods, and tools to the solution of complex, often ill-defined problems. Engineering training that focuses on simple, focused component-level applications teaches some portion of the skills needed to execute real world problems but is incomplete. Altair has experience both deep and broad in applying optimization technologies and has developed a training curriculum aiming to teach engineers more comprehensive design optimization skills and knowledge in aerospace applications. The Altair Aerospace Optimization Academy has been developed as a series of online modules to develop deep design and optimization knowledge and skills in engineers that have basic structural analysis and finite element experience. The training curriculum leads students through complete design cycles using Altair’s advanced optimization technologies and explores the different approaches that engineers can use to develop aerospace designs for a variety of metallic and composite components and configurations.

Optimization of Suspension Characteristics to Improve Handling Response Using HyperStudy®

Murthy Kowsika
Tech Lead
Fiat Chrysler

Abstract Summary
The ride and handling performance of the vehicle is dependent on the suspension kinematics and compliance characteristics. A process is developed to integrate a parametric vehicle dynamics model developed using CarSim within the HyperStudy® environment. Necessary scripts are developed to process the input and output files to select the design variables and to obtain the metrics that define the vehicle dynamics response. Multiple test cases are used to probe the design space systematically by following the DOE methodology to understand the sensitivity of the design variables on vehicle response. Finally, an efficient optimization algorithm available within HyperStudy® is used to derive optimized solution(s).
**Abstract Summary**

The aeronautical sector is facing many concurrent challenges since OEMs have to ensure their commitments in terms of delivery, whereas eco-responsibility, eco-efficiency and sustainable development are becoming more and more significant requirements. In this environment, competition between all players of the sector increase with new comers, offering low cost capabilities and strong investments.

In order to support its customers and introduce more innovation into its products, AEROLIA invests in new fields of research & technology through radical evolutions of developing airframes. Thus, AEROLIA aims at adding topology optimization as a new technology brick to its development process, in order to increase the number of potential configurations for a given aircraft section and consequently dramatically reducing the weight and cost of an aerostructure.

Successful results have already been obtained on local components such as fittings and brackets. Further developments are achieved on larger structures such as cross beams and complete floors. Then architectures of complete sections are also considered and studied, proposing a radical step compared to conventional aircraft architectures composed by panels, stiffened with orthogonal stringers. Then, from these breakthrough results, trade-offs are defined considering existing manufacturing processes and new technologies such as additive manufacturing.

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**Optimization Based Chassis Design**

**Adrian Chapple**  
*Analysis Supervisor*  
*Gestamp*

**Abstract Summary**

Gestamp Chassis design and manufacture 25% of European passenger car chassis components and have been using optimization to drive their design process for over 10 years. This presentation will highlight some of the innovative and market leading optimization based approaches used by Gestamp to deliver class leading lightweight chassis frames for their customers.

The presentation will include some of the optimization work we have been using at Gestamp over the last 10 years. Some of this work has previously been presented at the European technology conference.
**LIGHTWEIGHT DESIGN**

**ROOM: 105**

**Design and Optimization of a High Performance C-Class Catamaran with HyperWorks®**

**Julien Chaussee**  
*Lead Design*  
*Team Rafale - ETS*

**Abstract Summary**

In September 2015 Team Rafale will be the first student team to ever take part in the Little Cup, hosted by the Société Nautique de Genève, in Switzerland. Team Rafale is regrouping aerospace engineers, faculty members and students from ETS (Ecole de Technologie Superieure, in Montreal, Canada), who have taken on the ambitious challenge to design, build and race a C-Class catamaran for this event.

For Team Rafale, the challenge is simple: build a 25ft long, 14ft wide catamaran weighting less than 400lbs in less than 18 months. And this is no mean feat! The hydrofoils are less than two square feet in surface area but they must lift the entire boat and its two-man crew out of the water. The 30ft mast at the heart of the rigid wingsail must carry almost 4000 lbf of compression but weight less than 30lbs.

To meet this objective, every components on the boat must be optimized. This is where the HyperWorks® suite has proven invaluable. Whether it is the topology optimization capability or the advanced composites modelling and optimization tool set, the Altair Suite has allowed the team to rapidly evaluate solutions and push its designs further. The step by step composite design approach, especially, has been key in helping us go through design iterations quickly to achieve our goals while taking into account the limited resources available to the team in terms of manufacture.

This presentation will give an overview of the overall project, focusing specifically on the structural optimization of the platform and the hydrofoils.

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**ACCESS TO NEW TECHNOLOGY - ELECTROMAGNETICS**

**ROOM: 106**

**Advances in EM Simulations**

**Ulrich Jakobus**  
*Vice President - EM Solutions*  
*Altair*

**Abstract Summary**

This paper introduces some of the recent extensions to the computational electromagnetics code FEKO™ as released in Suite 7.0. The FDTD (Finite Difference Time Domain) method was added to the selection of available solvers. MLFMM (Multilevel Fast Multipole Method) and PO (Physical Optics) were hybridized for electrically large applications. The RL-GO (Ray-Launching Geometrical Optics) solver was extended and improved in terms of speed and accuracy, and a new interface to import measured near-field antenna data from MVG/Starlab will be presented.
ACCESS TO NEW TECHNOLOGY - ELECTROMAGNETICS  
ROOM: 106

The Use of Simulation (FEKO™) to Investigate Antenna Performance on Mobile Platforms

Daniel Aloi  
Professor & Chair, ECE Department  
Oakland University

Abstract Summary  
Wireless technologies have proliferated onto automotive platforms as part of infotainment, telematics and active safety initiatives. These wireless solutions present engineers design challenges in the area of applied electromagnetics in terms of antenna design, antenna placement, electromagnetic compatibility and wave propagation. The Applied EMAG and Wireless Lab at Oakland University possesses an outdoor vehicle-level antenna range (80 MHz - 6,000 MHz) and full-wave electromagnetic field solvers with high end computers to solve these issues. This presentation will highlight some of the past and recent research projects conducted in my lab that relied on a full-wave electromagnetic field solver to investigate the issue and subsequently be validated with measurements.

ACCESS TO NEW TECHNOLOGY - ELECTROMAGNETICS  
ROOM: 106

Mitigation of Electromagnetic Interference Problems in Automotive and Aerospace Industries

Martin Vogel  
Principal Application Engineer  
Altair

Abstract Summary  
Both the automotive and aerospace industries face ever-increasing Electromagnetic Interference challenges. In the automotive case, new problems arise due to proliferation of electric and hybrid cars, which carry high-voltage systems, and of wireless infotainment and safety systems, which use high frequencies. The aerospace industry’s challenges are exacerbated by the use of composite materials and by the need to protect against lightning strikes.

This presentation will discuss many of the challenges and explain how they can be met with simulation. A few practical examples involving cable harnesses will be analyzed in more depth.
Creation of Solver Decks from CAD Geometry

David Downing
Principal Scientist
AMCOR Rigid Plastics

Abstract Summary
The objective of this tool, is to guide the analyst through the process and create solver decks from CAD geometry for typical analyses including Empty Vented Top Load where the empty bottle is analyzed for a buckling load, Filled Capped Top Load where the bottle is analyzed for buckling load assuming its filled and capped, vacuum response of the container to see if the container is able to absorb vacuum and filling pressure response to see if the container is able to withstand the filling pressure. This Amcor automation tool is robust and easy to use specially if you want to finalize a design and if there are many design iterations on a daily basis. With the help of this tailored automation tool, we are able to save preprocessing time and improve efficiency.

Solid Hex Meshing the Human Lumbar Spine

Sundar Gopalan for Jeff Harris, NuVasive
Senior Application Engineer
Altair

Abstract Summary
HyperWorks® customer Jeff Harris from NuVasive has used HyperMesh to solid hybrid mesh consecutive human vertebrae and discs from a patient bone scan. The meshing, set up in HyperMesh, is simulated using Ansys for motion limits, stiffness, and disc material correlation. Once a model is correlated, disc implants are modeled and simulated with the goal of replacing degenerate discs.

Currently, the highly contoured, non-symmetric, one-off geometry is meshed with hexahedral elements for the body and disc; tetrahedral elements are used for the posterior bone section but the customer plans to hex mesh this portion as well.

Shown below are images of one vertebra hybrid meshed. The final product contains a section of the spinal column with 5-7 unique vertebrae and their corresponding discs.

The final presentation will include success stories of the process implementation for customers of NuVasive.
LEAD TIME REDUCTION
ROOM: 103

An Automated Head Impact Process Setup for Automobile Instrument Panel Application

Vali Farahani
CAE Technical Specialist
CalsonicKansei

Abstract Summary
Since the beginning of law rolled out 1968 by Federal Motor Vehicle Safety Administration to protect automobile occupants from fatal injury during a crash, the automobile interior safety has become considerably more challenging for manufacturers to meet FMVSS 201 standard criteria.

In our current process, the Head Form (HF) is set manually for each individual target points by CAE engineer to replicate the actual physical test based on known pivot point, target point, and angle of rotation using angular velocity. In a typical instrument panel engineering development, substantial number of critical points is chosen within the IP head impact target zone. This process becomes not only costly but also may be prone to user mistakes of HF set up. In order to reduce HF setup timing and remove any operator error possibility, CalsonicKansei North America (CKNA) CAE group consulted with Altair Engineering Inc. to develop an advance algorithm to automate the HF setup using current commercial available software HyperMesh®. Currently, Altair’s HyperMesh has a process manager setup to position HF based on the target point using linear velocity. Since our HF positioning is based on Hip Point (HP) and angular velocity, Altair Engineering team enhanced the current process manager to add another option to include HP and angular velocity. The process automation will generate HF from a user prepared input excel file in .csv format. The advanced algorithm positions each HF with proper angle based on the Hip Point (HP) global XYZ coordinates, which have been arranged in the .csv file. The surface contact between HF and IP surface is created automatically for all generated HF points. Finally the script creates FEA files for each HF with IP model ready for analysis by LS-Dyna CAE solver. Correlation of the results between manual and automated HF setup will be discussed in this paper.

PERFORMANCE OPTIMIZATION - FLUID DYNAMICS
ROOM: 203AB

CFD Shape Optimization with HyperWorks®

Marc Ratzel
Director CFD Solutions
Altair

Abstract Summary
Computational Fluid Dynamics (CFD) is used during the product development process to understand the occurring flow phenomena and to optimize the product’s performance. The optimization study can be performed in a manual manner by trial and error or by leveraging an automated optimization process.

This presentation discusses the new CFD optimization workflow within HyperWorks®13.0 combining the morphing technology and HyperStudy’s® optimization engine to a smooth process. Real-world applications, including an exhaust system and a Fluid-Structure Interaction (FSI) use case, are discussed.
**Performance Optimization - Fluid Dynamics**

**Room: 203AB**

**Detailed CFD Analysis of a Plate Heat-exchanger Using HyperWorks**

**Stuart Walker for Procter & Gamble (P&G)**  
Application Engineer  
Altair

**Abstract Summary**

Plate heat exchangers encourage the transfer of energy from one fluid to another by passing the fluids over a series of thin corrugated plates forming flow channels. This method of heat exchange allows for a compact design at the expense of requiring high operating pressures to drive the flow through thin flow passages. The plate heat exchanger that was studied has chevron corrugations to increase heat transfer efficiency at lower operating pressures. To analyze the performance of these systems engineers rely on CFD simulations to predict flow characteristics such as velocity, pressure, turbulent mixing, heat transfer rates, temperature etc. This paper will present the results of a CFD simulation performed on a single plate of a plate heat exchanger assembly modeled in HyperMesh and simulated in AcuSolve, Altair’s CFD solution software. AcuTrace is used to analyze particle residence times. A qualitative understanding of the corrugated plate heat exchanger performance is the ultimate outcome.

**PERFORMANCE OPTIMIZATION - FLUID DYNAMICS**  
**Room: 203AB**

**CFD Simulation of an Automotive HVAC System Using AcuSolve**

**Shi-ing Chang**  
Senior CAE Engineer  
CalsonicKansei

**Abstract Summary**

Heating, Ventilation, and Air Conditioning (HVAC) Modules are integrated units designed to filter and deliver air in support of vehicle interior comfort and convenience. The HVAC unit sets the internal temperature and air outlet to the user’s preference under any climate change and creates a comfortable environment throughout the year. To develop these systems Engineers rely on the CFD simulations to predict the flow characteristics like velocity, pressure, temperature etc. This paper will present the results of a CFD simulation performed on a HVAC system using AcuSolve, Altair’s CFD solution software. The comparison of results with the experimental data and results obtained using a general purpose FVM solver are presented for the validation purpose.
Combustion Modeling in Internal Combustion Engines with LOGEengine

Fabian Mauß
Dr. -Ing. and CEO
LOGE AB

Abstract Summary
LOGEengine is an integrated simulation method for the prediction and optimization of engine in-cylinder performance parameters and studies of fuel effects on exhaust emissions. It contains a stochastic reactor model for 0D modelling (0d-SRM) with local effects in gas-phase space, direct fuel injection, temperature and species concentrations as random variables, detailed chemical kinetics, prediction of engine exhaust emissions (Soot, NOx, uHC), turbulence consideration via mixing modeling and self-calibration. LOGEengine can also model soot formation for diesel engines using detailed kinetic soot models, with gas phase chemistry, soot particle inception, condensation, coagulation, surface growth and oxidation. It can run equivalence ratio - Temperature (f-T) diagnostics maps for analysis of regimes of emission formation in diesel engines using zero-dimensional methods with low CPU cost. It analyses local inhomogeneities in gas-phase space for species concentration and temperature due to mixing, fuel injection and heat transfer to cylinder walls, and their influence on soot and NOx formation from different fuels and in individual combustion cycles.
LIGHTWEIGHT DESIGN - 3D PRINTING/AM
ROOM: 105

Manufacturable Axle Design Directly from Inspire
Optimization Result

Jerry Chung
Senior Manager - Analytical Engineering
American Axle & Manufacturing

Abstract Summary
Use Inspire to form optimization from the packaging space, performance loading and manufacturing constraints to design an axle close to production ready design. The model setup requires careful setting of axle internal component design and oil flow consideration. Since Inspire does not provide weighting for different load cases, the author was able to gain from trial run to determine the balanced load application, mass target and meshing size requirement to obtain realistic design.

The proposed design was able to reduce more than 20% of mass and keep the same product performance.

LIGHTWEIGHT DESIGN - 3D PRINTING/AM
ROOM: 105

Affordable Composite to Reduce Mass in Automotive

Issmail Meskin
Advanced Development / FEA Manager
Valeo

Abstract Summary
In the context of the challenging CO2 emissions legislation and a communization of the safety legislation, one of the key driver becomes the mass reduction of the vehicle structure.

Valeo has focused its innovation effort in developing an affordable composite Front end structure which contributes to reduce the weight while keeping a high level of performances.

Valeo has engineered a bolster made of Organosheet panel formed and overmolded with resin. Compared to the famous Hybrid-Steel Design, Valeo is able to reduce the mass by 30% at same performance.

A characterization of the model has been initiated for the MAT8 in OptiStruct Solver and using the LAW25 in RADIOSS Block. The mass and orientation of the fibers have been optimized using HyperMesh and OptiStruct.

Correlations of the Finite Elements models have been performed after product testing validation.
Optimize for Additive Manufacturing/3D Printing

Jaideep Bangal
Senior Applications Engineer
solidThinking®

Workshop Summary
The use of 3D printing makes it possible to produce very complex structures, which were hitherto either impossible to make or required tremendous effort and significant cost using traditional production methods. To fully exploit the potential of 3D printing, it is important to optimize component designs for the freedom of the additive manufacturing process in the earliest concept development stages.

When topology optimization is utilized to generate designs for additive manufacturing, many exciting new benefits present themselves (lightweight parts, stronger parts, no wasted materials, cost savings, etc.). This demonstration will present a live demo of the process to optimize structural parts for 3D printing/additive manufacturing in solidThinking Inspire and then refine and prepare for manufacturing in Evolve.

Kilohertz Magnetic Field Manipulation for Automotive Applications

Debasish Banerjee
Principal Scientist
Toyota

Abstract Summary
Subwavelength focusing of electromagnetic fields is a key technique, used in both optical and microwave regimes, that has been extensively studied to overcome the diffraction limit in a variety of applications. In this talk, we will discuss the focusing scheme based on radiationless interface that is extended to magnetic field spatial manipulation in the low frequency (KHz) regime. Analytical models based on Maxwell’s equations are supported by numerical simulations based on FEKO™ and experimental demonstration. Applications of this work include efficient magnetic field management for motors or actuators. We will also discuss extension of this work for controlling electromagnetic interference in MHz regime.

Debasish Banerjee, Eric M. Dede¹, Hideo Iizuka²
¹Toyota Research Institute, Toyota Motor Engineering & Manufacturing North America, Ann Arbor, Michigan 48105, USA
²Toyota Central Research and Development Labs, Nagakute, Aichi 480 1192, Japan
**Design and Analysis of FSS Radomes**

CJ Reddy for Gopinath Gampala  
**VP - Business Development Electromagnetics**  
**Altair**

**Abstract Summary**

A radome (radar dome) is a structural, weatherproof enclosure that protects a radar system or antenna from its physical environment with minimal impact to the electrical performance of the antenna. The proper selection of a radome for a given antenna can help improve the overall system performance through maintaining alignment by eliminating wind loading, allowing for all-weather operation, providing shelter for installation and maintenance, etc. Radomes find use in a wide variety of applications like satellite, broadcast, weather, communications, telemetry, tracking, surveillance, and radio astronomy. The choice of radome wall construction configuration, like the Monolithic, A-Sandwich, Multi-layered Dielectric Wall, etc., depends on the type of application. More specifically, radomes constructed with Frequency Selective Surface (FSS) layers are used for out-of-band Radar Cross Section (RCS) reduction.

The state-of-the-art commercial 3D electromagnetic simulation software, FEKO™, offers several numerical methods and utilities to analyze the radomes. The special features like the Periodic Boundary Conditions (PBC) and planar multi-layered substrates are employed to characterize the radome material and the numerical methods like the multilevel fast multipole method (MLFMM) and ray-launching geometrical optics (RL-GO) are employed to analyze electrically large radomes of different shapes. Radomes constructed with multiple thin dielectric layers can be analyzed efficiently with the thin dielectric sheet (TDS) approximation technique.

FEKO™ offers the impedance sheet utility for realizing an FSS radome. One can extract the transmission and reflection coefficient parameters of the layered FSS configuration using the PBC utility, which can be transformed into frequency-dependent impedance.

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**Modeling the Dynamic Radar Signatures of Wind Turbines Using FEKO™**

Chenchen Li  
**Graduate Research Assistant**  
**The University of Texas at Austin**

**Abstract Summary**

The interference from wind farms on radar systems is a rising concern for the radar community. The radar scattering from the rotating blades of large turbine structures results in dynamic radar clutter, which could interfere with moving target detection. Significant efforts have gone into the assessment and mitigation of wind turbine induced clutter. In this presentation, we report on our work to model the dynamic radar signatures of wind turbines using FEKO™. The physical optics (PO) solver in FEKO™ is employed to capture the high-frequency radar signatures of a wind turbine. In order to generate the time-varying signatures, the backscattered fields are calculated one blade orientation at a time as the CAD model is rotated. Simplified CAD models of the turbine are created within FEKO™ while more complex turbines are imported from existing models. The large element PO solver is used in order to generate results for full-size wind turbines in the microwave frequency range, which have electrical sizes on the order of several thousand wavelengths.

The simulation methodology is first validated against in-situ measurements of two small wind turbines. The simulated and measured radar data are post-processed and compared in the form of sinograms, spectrograms, and inverse synthetic aperture radar (ISAR) imagery. Next, large element PO is used to predict the signatures of a large wind turbine and the results are compared to in-situ measurement of a utility-class wind turbine in Goldthwaite, TX. Additionally, the radar signature of a vertical-axis wind turbine, which is being considered as a candidate for off-shore wind power generation, is examined. PO simulation results of a small, simplified model is validated against laboratory measurement. Subsequently, large element PO is used to predict the dynamic signatures of a full-size turbine.
ACCESS TO NEW TECHNOLOGY - ELECTROMAGNETICS
ROOM: 106

Modeling Cellular/Wi-Fi Transmission Through Patterned Low-E Coated Window Glass

CJ Reddy for Eritek
VP - Business Development Electromagnetics
Altair

Abstract Summary
Commercial office buildings with Low-E coated windows pose a number of problems for radio devices. The Low-E coatings contain metal and are therefore very effective at reflecting radio waves, allowing very little energy to pass through. Typical attenuation levels are in the 25-30 dB range. qBeam has developed a method for modifying the low-E coating, by carving patterns in the coating, which greatly reduce the RF insertion loss through the window to less than 5dB. We present a method for modeling the patterned low-E coated window using FEKO™ and corresponding simulation results. A rigorous model for the window and coating geometry can be thought of as a frequency selective surface (FSS) applied to a dielectric substrate. In addition to the model for the FSS, we also discuss techniques for utilizing simpler FEKO™ models that can be solved at much faster speeds, and still provide meaningful results. We compare and contrast the results of these model types to show their utility and help understand the underlying phenomenology. The resulting frequency response data can then be used in the VisSim™/Comm physical layer simulation tool to model the effects of the FSS on specific RF modulated signals.

LEAD TIME REDUCTION
ROOM: 103

Enablers in FE Processors for Modularization and Simulation Data Management

Cong Wang
Technology Manager, Structures, CAE Strategy and Operations
General Motors Company

Abstract Summary
Virtual vehicle engineering and CAE are integral part of GM’s vehicle development process. To fulfill its role, CAE needs to implement a strategy to systematically manage its simulation data, models, workflow, and assessments/proposals for meeting the challenges brought by:

· More stringent vehicle mass integration and performance targets that require accelerated/coordinated assessment with better quality and more insight to facilitate product innovation
· Further emphasis on up-front CAE synthesis and simulation to lead the vehicle design and development
· Increased bandwidth to share vehicle architectural component sets and commodity components
· Global execution and work sharing

This presentation will discuss a few key enablers that are needed in FE preprocessors for modularization of CAE models and integration with simulation data management.
LEAD TIME REDUCTION
ROOM: 103

Lead Time Reduction Using Altair’s Packaged Solutions for Automotive Lighting

Avinash Reddy Tadi
FEA Simulation Engineer
Automotive Lighting Corporation

Abstract Summary
Automotive Lighting belongs to the international leading companies in the area of automotive exterior lighting. Focusing on professional projects and process expertise, efficient and innovative lighting technology as well as in the delivery of reliable quality products, we use CAE tools extensively to perform various types of analyses like structural, thermal, CFD, etc. in order to replicate the actual physical scenario.

This presentation will look at the collaborative work between Automotive Lighting and the Altair Product Design (PD) team to perform pre and post processing automations using Altair’s packaged solutions (Model Mesher Director, Automated Reporting Director and Model Verification Director), with which Automotive Lighting is better utilizing the engineers time to analyze the model rather than performing the repetitive tasks associated with model setup and post processed report generation.

LEAD TIME REDUCTION
ROOM: 103

Subsystem Squeak & Rattle Analysis Using Altair’s SnRD Director

Pei Guo
Senior CAE Engineer (Interior/N&V CAE)
General Motors Company

Abstract Summary
Squeak and Rattle (S&R) problems are costly to fix during physical validation testing. Being able to predict S&R problems upfront in the design process is essential, leading to reduced development costs while ensuring better quality products. A CAE-driven validation tool can be used to direct designs towards minimizing squeak and rattle issues by identifying S&R problem areas, thereby helping engineers develop solutions iteratively before physical validation.

Altair’s Squeak and Rattle Director (SnRD) is a tool embedded in the HyperWorks® software environment. It provides a modeling, analysis and evaluation CAE framework to determine the relative displacement between parts ensuring the identification of points and locations causing S&R noises.

This presentation summarizes:
• Criteria taken into consideration when selecting SnRD as a tool of choice,
• The squeak and rattle analytical prediction process in the subsystem level using Altair’s SnRD, and
• How the analysis-testing correlation will be done.
FEATURED SPEAKER
ROOM: GRAND HALL, SUITES 2&3

Michigan; We Run On Brainpower

Kevin Kerrigan
Senior Vice President, Automotive Office
Michigan Economic Development Corporation

Abstract Summary
A presentation on Michigan’s automotive industry. An overview of the automotive strategy that was developed by the Michigan Economic Development Corporations automotive office and the continued work in the area of talent development including the new “We run on brainpower” campaign.
FEATURED SPEAKER
ROOM: GRAND HALL, SUITES 2&3

A Multifunctional Aerospace Smart Skin Emerges from Computational Models and Physical Experiments

Kenneth Dudley
Senior Researcher
NASA LaRC

Abstract Summary
NASA Langley Research Center (LaRC) is developing a composite aircraft skin damage detection method and system based on open circuit SansEC (Sans Electric Connection) sensor technology. Composite materials are increasingly used in modern aircraft for reducing weight, improving fuel efficiency, and enhancing the overall design, performance, and manufacturability of airborne vehicles. Materials such as fiberglass reinforced composites (FRC) and carbon-fiber-reinforced polymers (CFRP) are being used to great advantage in airframes, wings, engine nacelles, turbine blades, fairings, fuselage structures, empennage structures, control surfaces and aircraft skins. SansEC sensor technology is a new technical framework for designing, powering, and interrogating sensors to detect various types of damage in composite materials. The source cause of the in-service damage (lightning strike, impact damage, material fatigue, etc.) to the aircraft composite is not of issue to the sensor. SansEC will detect damage independent of the cause. Damage in composite material is generally associated with a localized change in material permittivity and/or conductivity. These changes are sensed using SansEC. The unique electrical signatures (amplitude, frequency, bandwidth, and phase) are used for damage detection and diagnosis. An operational system and method would incorporate a SansEC sensor array on select areas of the aircraft exterior surfaces to form a “Smart skin” sensing surface.

In this conference a new method and system for aircraft in-situ health state sensing is presented. Experimental test results and computational modeling simulations depicting lightning protection, damage detection, and shielding effectiveness of a conceptual “Smart Skin” are described. The speaker will also speculate on the multiplicative power of using computational electromagnetic tools in conjunction with experiments for 21st Century Research.

FEATURED SPEAKER
ROOM: GRAND HALL, SUITES 2&3

Shipbuilding Success in a Shrinking Defense Budget Era

Stewart (Denny) Moore
Principal Engineer, Applied Mechanics
General Dynamics Electric Boat

Abstract Summary
Large-scale full-ship analyses and simulations are performed today in various disciplines. Such analyses typically involve multiple computer based tools and data sets. Much of the analysis and simulation flow is a manual activity. There is a need to improve upon the time and cost required to execute such large-scale, full-ship simulation flows. Furthermore, solely expanding use of modeling and simulation tools, without accompanying changes in the model generation, analysis, and simulation approach, will not deliver significant savings. Model generation, analysis, simulation, and results interpretation are complex efforts and often are the major cost of full ship analysis.

The author presents an overview of several National Shipbuilding Research Program (NSRP) efforts which support process design and analysis automation from the early concept to the detailed stages. These unique approaches focus on supporting multilevel modeling fidelity within a flexible design environment at the earliest stages of ship concept formulation by implementing a more computer-aided engineering (CAE) data centric approach. The CAE data is used in automated simulation flows to significantly reduce the time required to perform various ship analyses. Reducing the time required to perform the analyses enables the results to be available at the beginning of the ship design cycle, thus having the most cost effective impact as ship design progresses through the ship’s lifecycle.
General Session
Room: Grand Hall Suite 2&3

HyperWorks® Tips & Tricks - Solvers

Andrew Barr - Senior Solver & Hardware Specialist, Altair
Manohara Mariyappa - Application Engineer, Altair

Abstract Summary
Optistruct 13.0 is yet another exciting new release of Altair’s solver, especially in non linear static analysis and domain decomposition. Large Displacement Nonlinear Static Analysis is now available for the solution of problems in which the load-response relationship is nonlinear and large displacements are involved.

OptiStruct 13.0 features number of additions and enhancements. This session will focus on NLSTAT capabilities of Optistruct. Attend this session to learn about contact definitions in Optistruct, pretension manager, gasket element modeling and new contact results in OptiStruct 13.0. This presentation will also include benefits of using domain decomposition technology to run OptiStruct.

What’s New - VisSim™ Introduction
Model Based Development with VisSim™ Embedded

Richard Kolk - Chief Technical Specialist, Altair
Peter Darnell - Vice President of Software Development, Altair

Abstract Summary
This session will provide an overview of the Model Based Design philosophy used to develop embedded control systems and demonstrate why the VisSim™ Embedded product, combined with the Texas Instruments C2000 LaunchPad family of microcontrollers, makes VisSim™ the winning choice for model based embedded development. Supplementing the VisSim™ product, Altair has developed a Mechatronics curriculum, complete with experiments; several of which will be presented during this session.
PERFORMANCE OPTIMIZATION
ROOM: 203AB

Implementation of Global Platforms in Automotive Industry

Guilherme Carneiro
Structural CAE Engineer
FIAT Brasil

Abstract Summary
The implementation of global platforms in the automotive industry has increased the competitiveness, enabling the development of new models on a common structure. The development of a family of vehicles using a single platform requires the adaptation of each project, taking into account the different sizes, load capacities, dynamic and structural targets for each vehicle. The development of the suspension system includes durability and also kinematics and compliance (K&C) targets like roll center height, stiffness and toe-in and camber variations. Each new vehicle project has specific K&C targets that ensure the desired dynamic performance. Therefore each suspension must meet several specific targets which often leads to different components for each vehicle. This study consists of creating four optimized projects of twist beam rear suspensions. They will be identical with the exception of the central elastic beam that will be optimized with the aid of Altair HyperWorks® tools to meet the Durability and K&C targets of each of the proposed vehicles of a single family (Hatch, Sport Hatch, Sedan and Minivan). DOE analyses will be conducted to help determine the sensitivity of each response (Fatigue and K&C parameters) to changes in the design variables. Also in this step will be possible to see the interdependence relations between the responses. Using these results, optimization techniques will be used to achieve the predetermined targets for each vehicle.

PERFORMANCE OPTIMIZATION
ROOM: 203AB

Composite Material Characterization to Design Structures for non Linear Material Conditions

Fabio Bressan
Lead Structural Engineer
Cytec Industries Inc.

Abstract Summary
Corporations are making significant investments in innovative composite materials manufacturing technology for new product development processes and virtual prototyping for design and structural analysis. An effective virtual material (or material cards) for a numerical structural analysis method requires an accurate post-processing method from a complete mechanical characterization database to ensure a good correlation between the simulation and the real event.

Cytec has extensive experience in mechanical tests with our laboratories in the US and Europe and has developed a substantial material database as a result. The purpose of this presentation is to describe the critical process points to develop material cards for linear and non-linear simulations starting from the laboratory test and ending with the FE model simulation.

Cytec currently uses HyperMesh coupled with RADIOSS and OptiStruct to develop the material database based on test results and Altair provides the flexibility to work with a wide range of partner products specializing in composites.
PERFORMANCE OPTIMIZATION
ROOM: 203AB

Jean Michel Terrier
Senior Director - RADIOSS
Altair

Abstract Summary
In collaboration with PSA a B-pillar model was built using a very fine mesh to study fracture according to PSA knowledge and recommendations.

Altair implemented a specific material law in RADIOSS in collaboration with PSA and Ecole Polytechnique to study fracture. This new law is based on the research on rupture mechanics done at MIT and Ecole Polytechnique thru the fracture consortium. In parallel, Altair ported and optimized RADIOSS under Bullxmpi using Curie HPC machine. The performances have been improved significantly. Then, the performance and the scalability of the RADIOSS code on Curie supercomputer using several models chronologically have been tested and improved based on the following scenarios:

- a car crash of 1 million elements to verify the performance achieved with Bullxmpi;
- a car crash of 10 million elements to check the scalability of the code on an industrial model and large number of cores;
- The B-pillard component models, first the one from Altair and secondly the one from PSA with and without the new material law which includes rupture The zone in which rupture will be analyzed required very small solid elements.

The AMS has been tested to speed up the simulations. The results of these tests showed a huge interest in such speed up solution. The run of a complete crash on the B pillar (10 million of elements model) will stay in one night using 4096 cores.

Moldex3D and HyperWorks® for Effective Design Validation, Optimization of Plastic Parts and Molds

Srikar Vallury
Applications Engineer
CoreTech System Co., Ltd. (Moldex3D)

Abstract Summary
Widened the range of application in every field of industry, stronger mechanic properties and better appearance has been demanded of plastic part. To meet the high standard, the optimizations of both design validation and manufacturing processes play important roles. In the past, it relies on engineers with years of experience to ensure and improve outcome, which, however for lots of the cases, is expensive, time consuming and can still result in failure.

Moldex3D, a competitive molding analysis tools, is more reliable and cost saving in optimization of plastic products by using systematic and scientific approach. Moldex3D Expert provides fluent workflow to optimize molding process on multiple key factors, while Moldex3D FEA Interface, as well as Micromechanics Interface, enables to cooperate with lots types of stress solver, preprocessing tools, and material modeling software as well. The intuitive UI design makes in Moldex3D for the user’s less effort with powerful functionality, as well as the great capability in cooperating with products including many of those in Altair Partner Alliance. The aim is to provide pivotal assistance for user’s value on optimized efficiency and performance when delivering a major contribution to the product life cycle.

In this session, we will demonstrate a multi-step approach with increasing complexity to improve design and optimization of plastic parts and molds. Starting with Moldex3D Expert, a simple workflow based module for setting up DOE and Optimization, we introduce some important quality indexes and design variables for optimizing the molding process parameters. Next, Moldex3D is combined with HyperStudy® and RADIOSS/ OptiStruct to not only improve the manufacturing process parameters, but also the structural performance of the design. In general, HyperStudy® will be managing the workflow, control variables, and output data. On the other hand, Moldex3D together with RADIOSS & OptiStruct, interfacing through Moldex3D Micromechanics Interface by Digimat/Converse, performs the analysis considering both flow and structure behavior with great accuracy. And finally, advanced optimization procedures are explored in the extended application of HyperStudy-Moldex3D cycle by considering user driven design operations like shape changes in HyperMorph, as well as OptiStruct.
**LIGHTWEIGHT DESIGN - COMPOSITES**  
**ROOM: 105**

**Accurate Simulation of Short-Fiber-Reinforced Automotive Parts**

_Sascha Pazour_  
_FEA Engineer_  
_PART Engineering GmbH_

**Abstract Summary**

For fiber reinforced automotive parts the consideration of anisotropic material behavior is required to receive reliable results. In the scope of this fact a procedure is described how to consider these effects in terms of process-structure interaction and how to achieve possible benefits such as weight reduction and shorter development cycles. The procedure is outlined with practical applications from company Valeo Lighting Systems and another industrial partner project that is currently still in progress.

**Bullet Points:**

- More accurate simulation of part stiffness and strength assessment compared to isotropic approaches (shown with industrial examples, see Co-Author)
- Consideration of the influence of gate positions onto the mechanical behavior (position of weld lines)
- Consideration of the influence of residual stresses onto the mechanical behavior
- Taking into account the real part shape by using shrinkage and warpage results
- Time saving due to less development cycles

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**LIGHTWEIGHT DESIGN - COMPOSITES**  
**ROOM: 105**

**Forming Simulation of Woven Composite Fibers and its Influence on Crash Performance**

_Subir Roy_  
_Senior Director, Industry Solutions_  
_Altair_

**Abstract Summary**

The automotive industry, in its constant quest for weight reduction, is increasingly considering composite materials as a substitute for sheet metal components to meet future fuel consumption standards. However, composite forming processes are expensive and difficult to control because of the complexity of the material behavior with fiber and matrix layers or plies and its dependency on many parameters, such as non-linearity of tensile stiffness, effect of shear rate, temperature and friction. Hence, numerical simulation could be a viable approach to predict material behavior during composite forming. The objective of this study is to highlight capabilities of RADIOSS® to simulate forming simulation of composite plies made from woven fibers, each ply modeled as a layer of woven fibers along two directions of anisotropy, warp and weft. For validation the well-known double dome model published in NUMISHEET’05 proceedings is used. The compared result is the shear angle after stamping that is, the final angle between warp and weft fibers, at several prescribed points on the ply. The variation of this angle has a strong impact on material characteristics which severely deteriorates when a critical value is reached. Hence, a study on crash simulations is performed, after mapping fibers angles from stamping simulation.
LIGHTWEIGHT DESIGN - COMPOSITES
ROOM: 105

GENOA and HyperWorks® Integrated Advance Composite Product

Frank Abdi
CTO
AlphaSTAR Corporation

Abstract Summary
The increased demand for carbon fiber product in the form of reinforced polymers (CFRP); chopped fiber (elastomer, thermoplastic, thermoset) accelerates the GENOA software integration with Altair HyperWorks® solutions. The integrated package responds to greater need for more advanced and durable product development in automotive and aerospace industry. The presentation in details discusses to material modeling of composite type, analysis of laser fusion 3D printing, crush and impact of composite, and finally quest for optimization of shape and material including effect of defects, and uncertainties in manufacturing processes. In this regard the GENOA durability and damage tolerance software is integrated with Radioss, and OptiStruct to evaluate the structural integrity. The presentation will show case: a) Crush and impact of chopped fiber using Multi-scale progressive failure dynamic analysis (MS-PFDA) utilizing GENOA+RADIOSS solution; b) manufacturing automation of composite 3-D printing of composite structure; c) shape optimization of ceramic fracture toughness DCB/ENF (Double Cantilever Beam, End Notched Flexure) ASTM specimen; and d) Robust optimization of material modeling and to predict the fiber architecture effect on performance of material modeling to predict (i.e., woven, 5 Harness satin weave (5-HS), triaxial, stitched architecture).

LIGHTWEIGHT DESIGN - COMPOSITES
ROOM: 105

Composite Optimization Manufacturing Process Link for Ply Book Output

Greg Harte
Account Manager
Altair

Abstract Summary
I would like to present the process for deriving flattened ply shapes as an output from the Altair OptiStruct composite optimization process. Previously this has required the assistance of programs such as FiberSim or Laminate Tools. In development as of November 2014, this feature will allow the customer to print out an image file of the flattened ply shape with global coordinates, local material orientation, ply count, material name, and unique ply ID. This process is something that I helped outline after talking with customers. It will affect the advanced composite FEA industry in that it is the first time a single-source software will offer the optimizations of ply shape, size, and shuffle with a way to output those flattened plies automatically. This closes the link between FEA analyst and CAD designer.
**LEAD TIME REDUCTION**  
**ROOM: 103**

**Pedestrian Impact Simulation Process with HyperWorks®**

**Youn Park**  
*Crash Safety Engineer*  
*Ford Motor Company*

**Abstract Summary**
Analyzing pedestrian impact with an automobile using CAE simulation has become part of automotive vehicle research and new vehicle design process. While new and innovative design ideas address active pedestrian safety, regulatory and safety protocol like GTR and ECE require solving the passive safety aspect in an automotive collision scenario. Continuous revisions to regulations challenge design engineers to address the conflict between design stiffness requirements for every day load cases versus the necessary compliance of hood and bumper to fulfill pedestrian safety aspects too. All this of course need to fit in the tight automotive product development schedule, meeting requirements of styling, packaging, aerodynamics, testing and other cross functional teams. This signifies the importance of a well-defined process for pedestrian impact simulation and the effect it has on lead time.

This paper describes the process adopted to assess head injury to pedestrian using CAE for impact simulation using RADIOSS (explicit). The advantage of using tools from the HyperWorks® software suite are also discussed. Altair HyperMesh and HyperCrash were used for flexible preprocessing of pedestrian impact set up. HyperView and HyperGraph were used for quick post processing from large amount of solver results. Considering the multiple analyses needed to be run due to the large number of target points at each design stage of program, the HyperWorks® approach to pedestrian impact simulation, is much efficient than manual or semi-automatic methods.

**LEAD TIME REDUCTION**  
**ROOM: 103**

**Lead Time Reduction Using Automatic Reporting Director (ARD) for MAHLE**

**Scott Janowiak**  
*Numerical Simulation Engineer*  
*Mahle*

**Abstract Summary**
Mahle is one of the top automotive suppliers and one of the top 3 piston suppliers worldwide. With the recent advancements in numerical simulation and computing power, the FEA process has become a major tool to look at the reliability of different design variants. With these advancements, the reporting aspect remained a relatively unchanged process of manually creating pictures and tables with all of the different results. This presentation will look at the collaboration work between Mahle and the Altair Product Development (PD) team to customize the Automatic Reporting Director (ARD) for Mahle’s requirements. The goal was to use to better utilize the engineers time by automatically generating a report with standard formats, pictures, and tables. By using the ARD tool, Mahle was able to reduce the lead time for a report from over 4 hours down to less than 1 hour.
**Abstract Summary**

In this paper, a collaborative work between Calsonic Kansei North America (CKNA) and Altair Engineering Inc. to automate rigidity testing using CAE simulation is presented using the commercially available software HyperMesh®. Rigidity testing is a vital part of modern cockpit module (CPM) design. A CPM that is too soft could lead the end customer to conclude that the cockpit module is poorly designed. This could cause the end user to become dissatisfied with the entire vehicle. An overly soft cockpit module will also have potential squeak and rattle issues. Due to these concerns, creating a CPM that satisfies the customer's rigidity specifications is vital to modern vehicle design.

Our current rigidity analysis setup involves creating circular rigid elements with their independent nodes placed at each load test coordinate on the CPM. These rigid elements represent the test cylinders used in the actual test. Each rigid element has a force placed on its independent node. Each test element is then run independently with only the current rigidity element active in the model. This process is time consuming and potentially adds artificial rigidity to the structure due to the presence of the rigid elements.

The new process uses an automated script. This script replaces the rigid elements with cylinders represented by solid elements and creates a contact surface for interaction between the cylinders and the CPM. The script also sizes the cylinders to the user's specifications and applies the specified test forces. The script then creates the necessary input files to run the analysis and submits the input files for analysis in OptiStruct®. A correlation of results between the automatic rigidity analysis method, the manual rigid element based method, and physical test results will also be presented.
PERFORMANCE OPTIMIZATION
ROOM: 203AB

Passenger Side Occupant Safety Simulation Using RADIOSS

Edward Abramski
Occupant Safety and CAE Technical Specialist
Ford Motor Company

Abstract Summary
Current design and development cycles of occupant safety system development call for integration of full vehicle model and semi rigid sled models. Use of RADIOSS for both types of model has improved the accuracy and efficiency of this methods. Validation of passenger airbags requires the consideration of both in-position and out of position occupants.

In-position (FMVSS, NCAP) analysis are typically done with uniform pressure method where the airbags are scaled down initially with referenced mesh. However the out of position (FMVSS 208) analysis needs the variation of pressure capture over the airbag as well as affected by the folding pattern. Creating the passenger airbag folding has been traditionally very time consuming and specialized task.

This study shows the simplified methods of folding and fitting of passenger airbag using RADIOSS pre-simulation created by HyperWorks® scripts. FVM analysis of folded and fitted airbag is performed for out of position analysis using RADIOSS with FTSS 6 year old dummy. This airbag is also added to the sled model to review the occupant system evaluation.

PERFORMANCE OPTIMIZATION
ROOM: 203AB

Driver Occupant Safety Simulation Using RADIOSS

Pardeep Jindal
Occupant Safety Engineer
Ford Motor Company

Abstract Summary
A Knee Airbag (KAB) is one countermeasure being used by automobile manufacturers to reduce crash dummy lower leg responses in the new Small Offset Rigid Barrier (SORB) crash test introduced by the Insurance Institute for Highway Safety (IIHS). Currently, design and development cycles of occupant safety systems calls for integration of full vehicle models and semi rigid sled models. In order to robustly predict occupant performance in such crash tests, use of RADIOSS for both types of models has improved the accuracy and efficiency of these methods. The full system model used for SORB gives a robust prediction for this crash test.

In the current study, the morphing techniques available in HyperMesh were utilized to perform design changes to the KAB in a Full System Model (FSM). Several different morphed configurations of KAB were analyzed and dummy lower leg responses were monitored. Morphed technique helped us in achieving a more robust KAB design and reducing the dummy lower leg responses in the SORB crash test.
PERFORMANCE OPTIMIZATION
ROOM: 203AB

Latest HyperWorks® Developments for Automotive Safety Analysis

Francis Arnaudeau
CTO, FE Solvers
Altair

Abstract Summary
Safety developments must adapt to new regulations and evolutions of public domain NCAP star rating. Future side impact tests will include World-SID and child dummies Q6 and Q10, thus numerical models of them must be developed and validated. Out of position frontal crash simulation requires to take into account gas flow during airbag deployment. The complexity of numerical finite element model is thus continuously increasing and so does the computation time.

This paper will present the current trends for safety numerical simulation, the latest dummy, barrier and airbag developments from the model setting to the final efficient calculation. Various illustrations using RADIOSS solver will be shown.

PERFORMANCE OPTIMIZATION
ROOM: 203AB

Performance Evaluation, Scalability Analysis, and Optimization Tuning of Altair HyperWorks® Solvers on a Modern HPC Compute Cluster

Pak Lui
Application Performance Manager
HPC Advisory Council

Abstract Summary
Engineers from wide ranges of industries face ever increasing needs for complex, realistic models to analyze the most challenging industrial problems; AcuSolve is designed to tackle these finite element-based Computational Fluid Dynamics (CFD) simulations with superior robustness, speed, and accuracy. AcuSolve simulations are designed to carry out on large-scale computational systems effectively. The breakthrough in HPC parallel computing that allows such complex analyses to be performed that generate the high-quality results, while reducing simulation time from days to just hours. Behind this type of computational improvement that makes AcuSolve perform, it involves complex calculations and data exchanges among computational systems. The more complex simulations are being performed, the higher demands from the cluster performance are. In this analysis, the HPC Advisory Council has performed a deep investigation and profiling for the AcuSolve CFD solver to evaluate its performance and scaling capabilities and to explore potential optimizations. This study presents the optimization techniques and networking profiling results to further understand AcuSolve dependencies on the CPUs, communication networks, IO subsystems and the underlying hardware. The paper will review the effects by comparing various hardware using different simulation models.
ACCESS TO NEW TECHNOLOGY
ROOM: 105

Fatigue Life from Sine-on-Random Excitation

Jeff Mentley
Application Engineer
HBM nCode

Abstract Summary
Fatigue life prediction of structures whose natural frequencies lie near the frequencies of the input loading requires the stress results from dynamic analyses. These analyses can be performed in either the time or the frequency domains depending on the nature or the loading. This presentation will outline the approaches available for fatigue life prediction using Altair OptiStruct and APA product, nCode DesignLife for both time and frequency based dynamic analyses. The strengths, weaknesses and assumptions of each approach will be presented, along with typical applications enabling the user to select the proper technique for their particular use case.

ACCESS TO NEW TECHNOLOGY
ROOM: 105

Materials Gateway for HyperMesh – Enabling CAE to Build On Enterprise Materials Knowledge

Arthur Fairfull
Director, Strategic Product Initiatives
Granta Design Ltd.

Abstract Summary
High quality, representative simulations need high quality, representative materials property data. Obtaining this data is a challenge, especially for complex non-linear or high strain-rate analyses. CAE and materials testing are often poorly-integrated with each other, and with the wider engineering software infrastructure. This talk will introduce a collaboration of leading engineering enterprises (Material Data Management Consortium – www/mdmc.net), with members including Boeing, Honeywell, Lockheed-Martin, NASA, and Rolls-Royce. It will describe how this project has addressed the challenges of managing complex materials data, with case study examples of the benefits realized. In particular, it will present new integrating technology that enables the data needed for simulation to be accessed from a central knowledge-base, directly from within the HyperMesh CAE pre-processor.

Solution
Developed under the guidance of the MDMC, the GRANTA MI data management technology enables companies to capture all of their materials data, analyze and manage that data, and deploy it to the engineers that need it in product design and simulation. In-house data can be augmented by a wide range of reference information from authoritative materials data providers, handbooks, and Standards organizations. The latest development provides a Materials Gateway module to access and apply this powerful resource from within HyperMesh.

Results
HyperMesh users can now quickly access their in-house materials knowledge, and published materials reference data, assured that this data is approved for their use and up-to-date, and based on a proven system managing its lifecycle from laboratory test to run-ready simulation input card. Individual users no longer need to spend hours looking for, and assessing, suitable information – while their organization benefits from the confidence and traceability of consistent information used across all simulation teams.
ACCESS TO NEW TECHNOLOGY
ROOM: 105

Development of Reliability Analysis and Multidisciplinary Design Optimization (RAMDO) Software

Kyung K. Choi
Chief Science Advisor
RAMDO Solutions, LLC

Abstract Summary
In manufacturing industry and DoD, developing and producing optimized and reliable products is the primary goal for success of business, reduction of warranty cost, and success of military operations. As the CAD and CAE tools are advancing, the simulation-based design process is often used to obtain an optimum design, prior to prototype development, to reduce the product development cost. However, a design that is deterministically optimized without inclusion of input uncertainty will be most likely only 50% reliable. Basic reliability-based design optimization (RBDO) theories and numerical methods have been developed at the University of Iowa over a number of years in collaboration with the Automotive Research Center (ARC), which is funded by the U.S. Army Tank Automotive Research, Development & Engineering Center (TARDEC). In this area of research at Iowa, 9 Ph.D. students were successfully advised to completion; and 48 archived journal papers and 72 conference papers were published. The University of Iowa research team has integrated a number of numerical methods that they have developed to create the Iowa RBDO (I-RBDO) software, including a user interface. Both the sensitivity-based and sampling-based methods for reliability analysis and design optimization methods are implemented in I-RBDO for broader multidisciplinary applications. I-RBDO has comprehensive capabilities that include input distribution modeling for both independent and correlated variables; a variable screening method; local and global window surrogate modeling method; statistical analysis; interval analysis; reliability analysis; stochastic design sensitivity analyses; RBDO, and confidence-based RBDO. I-RBDO can be readily integrated with any CAE solvers for broader multidisciplinary applications. I-RBDO has been successfully applied by users at various academia, industry, and TARDEC to optimize design of passenger vehicles for noise, vibration and safety; durability; casting process design; ship hydrodynamics; fluid structure interaction; welding design; superconducting magnetic energy storage system; electro-thermal polysilicon actuator; etc. With the success of I-RBDO, the Iowa team established a start-up company, RAMDO Solutions, LLC, in fall 2013. Based on the I-RBDO software, the company is developing a commercial software Reliability Analysis & Multidisciplinary Design Optimization (RAMDO). The company successfully obtained an Army SBIR funding in June 2014. For multidisciplinary analysis and reliability-based design optimization (RBDO), a Process Integration and Design Optimization (PIDO) capability needs to be developed. There are two key capabilities in PIDO: (1) Process Integration (PI) for seamless integration of diverse CAD/CAE tools for multidisciplinary analyses; and (2) Design Optimization (DO) for multidisciplinary RBDO. The RAMDO software is focused on the second capability. The RAMDO Solutions, LLC will partner with Altair to have RAMDO integrated with HyperStudy®.

ACCESS TO NEW TECHNOLOGY
ROOM: 105

Time v Frequency Domain Analysis For Large Automotive Systems Using CAEfatigue VIBRATION in Combination with OptiStruct and HyperView

Neil Bishop
CEO
CAEfatigue Limited

Abstract Summary
It has been recognized since the 1960’s that the frequency domain method for structural analysis offers superior qualitative information about structural response; But computational and technological issues have held back the implementation for fatigue calculation until now. Recent technological developments have now enabled the practical implementation of the frequency domain approach and this paper will demonstrate this, with particular reference to the technology limitations that have been overcome, the resultant performance advantages, and accuracy. These techniques are of relevance to all the large automotive OEM’s as well as aerospace T1 suppliers and example case studies from these companies will be included.
LEAD TIME REDUCTION - VERTICAL APPLICATIONS
ROOM: 103

Cranktrain Components CAE Analysis Automation Using SimLab

Diwakar Krishnaiah Jeeda
Senior Project Engineer
GM Powertrain

Abstract Summary
CAE work on the crank train components in the initial design phase is repetitive, time consuming and laborious. This involves analyzing multiple designs for refining basic design requirements such as stiffness, buckling, bending and torsion. Here is an effort to automate Connecting Rod Stiffness and Buckling calculation, Crankbay Bending and Torsional stresses without manual intervention on multiple designs.

This paper discusses how SimLab was used in the automation of different phases in the CAE work on cranktrain components. SimLab scripts were developed to automate preprocessing tasks which involves Meshing, RBE creation, assigning material properties, creating loads and BCs, defining contacts and analysis load steps. Additional scripts were developed for job submission, post processing, calculation of bore distortion etc. to complete the analysis from beginning to end.

SimLab Automatic scripting capability helps user to analyze and compare multiple design variants quickly.

LEAD TIME REDUCTION - VERTICAL APPLICATIONS
ROOM: 103

Ensuring Extrusion Product Quality at Die Design Stage

Jeff Skinner
Simulation Tech/Sales and Technical Representative
Thumb Tool & Engineering

Abstract Summary
Extrusion of metals is a commercially important mass production process and extruded part are used in a wide variety of applications in aerospace, automotive, railway, medical, electronics, consumer products and nuclear industries. The key to successful extrusion is the die design and it affects the entire gamut of production process from feasibility to product quality. A die designer faces a complex challenge of delivering a working die and often, problem dies are returned for rework. This directly affect the cost and profitability. Hence, it is critical for a die designer to ensure that the die designed produces the desired profile within acceptable quality and in addition, die is strong enough to withstand multiple extrusion cycles.
LEAD TIME REDUCTION - VERTICAL APPLICATIONS
ROOM: 103

Hot Stamping Process Simulation Using Integrated Structural and CFD Analyses

Hariharasudhan Palaniswamy
Program Manager, HyperForm
Altair

Abstract Summary
Hot stamped steel parts are being increasingly used in automotive structures for their higher strength to meet safety standards while reducing vehicle weight to improve fuel consumption. However, manufacturing of sheet metal parts by hot stamping to achieve desired properties is extremely challenging as it involves complex interaction of plastic deformation, metallurgical change, thermal distribution, and fluid flow. Numerical simulation is critical for successful design of the process and to understand the interaction among the numerous process parameters. In this study, an innovative methodology to simulate the complete hot stamping process has been developed based on Altair HyperWorks® product suite utilizing RADIOSS®, a non-linear finite element based structural analysis solver and AcuSolve® an incompressible fluid flow solver. RADIOSS® is used to handle the plastic deformation, heat transfer between the blank and tool, and microstructure evolution in the blank during cooling. While AcuSolve® is used to efficiently model heat loss from tool to the fluid that flows through water channels in the tools. The approach is demonstrated through some case studies.
nCode products are provided by HBM, a world-wide technology and market leader of solutions that enable engineers to understand product performance, accelerate product development and improve design. The nCode software suite is backed by over 30 years of experience in fatigue analysis software for both test data applications and FE-based fatigue analysis.

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Figure 1: MCQ-Chopped typical input and capabilities

Figure 2: Simulated Stress-Strain Vs. Test (PBT-GF20) [1]

Figure 3: Orientation Distribution Vs. Test (PBT-GF20) [1]

Figure 4: Three point Bending Coupon Analysis [2]

Figure 5: Simulated L-D curve vs. Test [2]

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NAFEMS is the International Association for the Engineering Modelling, Analysis and Simulation Community. We are a not-for-profit organization which was established in 1983. We focus on the practical application of numerical engineering simulation techniques such the Finite Element Method for Structural Analysis, Computational Fluid Dynamics, and Multibody Simulation. In addition to end users from all industry sectors, our stakeholders include technology providers, researchers and academics. Our mission is to promote the safe and reliable use of finite element and related technology, through education, professional development, knowledge exchange and collaboration.

PART Engineering provides CAE services and develops software tools in the scope of FEA. Our mission is to enable our customers to gain more value from their FE simulations and to make their CAE processes more efficient. With regard to that from our years of experience in CAE we have developed software products, such as CONVERSE to meet the needs of CAE engineers – creating reliable results by using simple and robust applications.
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CONVERSE is an easy-to-use software tool that bridges the gap between injection molding simulation and mechanical simulation by importing the results from a third-party injection molding software, processing them, and then exporting the results into a third-party mechanical FEM software.

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*Source: December 2014 BPA Circulation Statement
A Shared Vision

To radically change the way organizations design products and make decisions.

James R. Scapa, Chairman & CEO, Altair