Automotive Simulation World Congress 2012 (ASWC 2012)

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October 30, 2012

GENERAL SESSION – MACKINAC BALLROOM

Welcome and Introduction – 9:00 to 9:15 a.m.
Sandeep Sovani, ANSYS 1
The automotive industry is a pioneer in the use of simulation and a leader in advancing the boundaries of simulation technology. Today simulation has become an essential part of automotive engineering; companies are undertaking major efforts to deploy simulation systematically and widely throughout the product development process at the enterprise level. This year's Automotive Simulation World Congress focuses on major trends that are expanding the boundaries of simulation technology, such as fuel consumption and emissions reduction, vehicle electrification and proliferation of electronics, and key initiatives for widespread deployment of simulation, such as democratization, model-based design and data management.

Keynote: Analysis Led Design: How Simulation Tools Reduce the Product Development Cycle at Cummins – 9:15 to 10:00 a.m.
Wayne Eckerle, Cummins Inc. ..... N/A
Analysis Led Design is improving and expediting product development at Cummins. This presentation discusses the company's vision of utilizing simulation with advancements such as cloud computing, highly parallel computing and system engineering for continuously growing its engineering talent's productivity and efficiency.

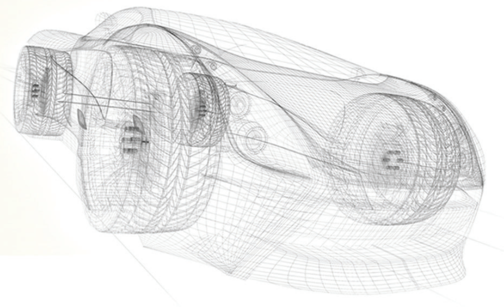
Keynote: Achieving Value Through Simulation-Driven Product Development – 10:00 to 10:30 a.m.
Sin Min Yap, ANSYS 5
While many companies recognize that product innovation is a key driver of growth and profit, not every organization gets product development right. Companies often struggle to improve product development yet are unaware of practices that matter. Furthermore, their key business initiatives are not rigorously mapped to their product development system. This presentation illustrates how companies can address these challenges and achieve value from Simulation-Driven Product Development solutions from ANSYS.

Keynote: Critical Technologies for Best-in-Class Simulation-Driven Product Development – 11:00 to 11:30 a.m.
Dipankar Choudhury, ANSYS 18
This session presents progress made in key methods and technologies underlying ANSYS products for enabling Simulation-Driven Product Development. It explores the state of the art in foundation areas such as advanced analysis, multiphysics, multiscale and systems modeling, high performance computing and emerging computing environments.

Keynote: Smarter Computing for Product Development: Transformational IT to Match Engineering Needs – 11:30 a.m. to 12:00 p.m.
David Coutts, IBM Systems and Technology Group 33
Smarter computing for product development is a transformational IT environment to support global engineering needs. As global engineering organizations look for ways to improve efficiencies at reduced costs, this presentation offers a high-level view of engineering and IT transformation strategies that synergistically combine to achieve those results. The heart of this synergy is dynamic access to critical, shared resources – skilled engineering and capital-intensive IT. This synergy unlocks opportunities for large and small organizations alike and is the basis upon which IBM is working to realize engineering solutions with cloud technology.

POWERTRAIN TRACK – RICHARD ROOM

Automotive Fluid–Structure Interaction (FSI): Concepts, Solutions and Applications – 1:00 to 1:40 p.m.
Laz Foley, ANSYS 43
Today's engineering challenges require CAE tools that can solve complex and coupled multiphysics problems in an efficient manner. In FSI, the complex, coupled response of fluid flow and structural deformation are solved. Advances in coupled solution technology and hardware technology allow multiphysics problems to be solved as an integral part of the engineering design process, instead of simplifying or ignoring the coupled effects. This session presents the technical background and approaches to solve different classes of FSI problems (one-way, two-way, rigid body). These FSI approaches are illustrated through several automotive examples, focusing on powertrain applications.



Investigation of an Injection Event Using CFD – 1:40 to 2:20 p.m.
Frank Husmeier, Cummins Fuel Systems 57
For a transient fluid–structure interaction simulation of a current injector design, the geometry includes the injector's nozzle and plunger, with the plunger being moved based on fluid forces in the axial direction. The simulation studies a full injection event, including filling of the sac via the volume of fluid (VoF) model, which allows for liquid fuel–air and liquid fuel–fuel vapor interactions. The overarching goal is to improve start-of injection (SOI) predictions and injector performance, investigate flow field inside the spray holes (studying cavitation and potential hysteresis effects), and gain a fundamental understanding of the injector process' impact on emissions.

Introducing the ANSYS Workbench IC Engine System – 3:00 to 3:40 p.m.
Chris Wolfe and Nagendra Jaya Kumar, ANSYS 76
The ANSYS Workbench IC Engine System application is designed specifically for internal combustion engine analysis and increased user productivity. Using this application, the time from initial geometry to simulation start takes just minutes, as the tool unifies and simplifies the setup and solution of internal combustion engine simulations by automatically decomposing the engine geometry, creating the mesh, setting up a cold flow simulation, including dynamic mesh, and creating a preliminary report using information provided by the user in ICE-specific terminology. Additional insight into engine performance can be gained via parameterization studies within ANSYS Workbench.

Fuel Heating through Electromagnetic Techniques in an Engine Fuel Rail: Multiphysics FEM Analysis – 3:40 to 4:20 p.m.
Andrea Serra, Giovanni Falcitelli, Emilano D'Alessandro and Roberto Gonella, EnginSoft S.p.A. and Alfonso DiMeo and Nazario Bellato, Magneti Marelli - Powertrain ..... N/A
Most engines require ad-hoc fuel preheating. A widely used technique involves heating through thermal resistance. Its implementation is quite simple and reliable, but thermal exchange through conduction and convection could be too slow for some applications. An alternative technique resorts to electromagnetic high-frequency heating. This presentation addresses fuel heating for motor engines through microwave techniques. Dielectric heating at lower frequencies is also studied. A finite element method approach employing ANSYS software is used to investigate system performance in terms of fuel temperature transients.

Validation and Verification of ANSYS Internal Combustion Engine Software – 4:20 to 5:00 p.m.
Martin Kuntz, ANSYS 102
CFD software is regularly used to model flow inside internal combustion engines, including spray injection and injection combustion. Software verification and validation is a continual effort to ensure that the tools meet all design requirements and that computed results provide a high level of accuracy and performance. For complex simulations, various individual models are verified and validated, which can have a big impact on simulation results. The ANSYS validation and verification project for internal combustion engines includes a number of engines, both diesel and gasoline, in which simulation results are compared to experimental data.

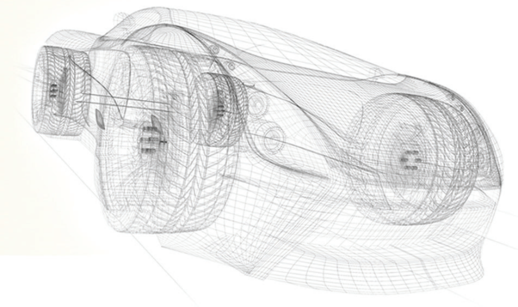
VEHICLE ELECTRIFICATION TRACK – CADILLAC ROOM

Total Battery Simulation – 1:00 to 1:40 p.m.
Scott Stanton, ANSYS ..... N/A
An advanced automotive propulsion battery is a highly multiphysical product involving electrochemistry, electromagnetic fields, thermal and flow fields, mechanical stresses, acoustics, and other physics. A complex hierarchical system, a battery comprises several levels of components: electrodes within each cell and the electrochemical transport between them; modules that comprise dozens of cells as well as cell cooling channels, coolant manifolds and other infrastructure; and modules that come together to form the battery pack at the largest scale. Battery packs are unique in that these physics are tightly coupled. The system is tightly integrated across all the various hierarchical scales, because phenomena that occur at one scale are closely dependent on those occurring at other scales. To predict a battery's performance, it is not enough to simulate one physics, or one component, at a time. All physics and all components need to be considered in a simulation that can be referred to as total battery simulation.

Accelerating Development of EV Batteries Through Computer-Aided Engineering – 1:40 to 2:20 p.m.
Ahmad Pesaran, National Renewable Energy Laboratory ..135
The U.S. Department of Energy's Vehicle Technology Program has launched the Computer-Aided Engineering for Automotive Batteries (CAEBAT) project to work with national labs, industry and software vendors to develop sophisticated software. As coordinator, NREL has teamed with a number of companies to help improve and accelerate battery design and production. This presentation provides an overview of CAEBAT, including its predictive computer simulation of li-ion batteries known as the Multi-Scale Multi-Dimensional (MSMD) model framework. MSMD's modular, flexible architecture connects the physics of battery charge/discharge processes, thermal control, safety and reliability in a computationally efficient manner. This allows independent development of submodels at the cell and pack levels.

Development of Computer-Aided Design Tools for Automotive Batteries (CAEBAT) – 3:00 to 3:40 p.m.
Taeyoung Han, General Motors; Gi-Heon Kim, National Renewable Energy Laboratory; and Lewis Collins, ANSYS 153
Lithium-ion battery packs require CAE design tools that accurately represent cell and pack multiphysics phenomena occurring across a wide range of scales. The Computer-Aided Engineering for Electric Drive Vehicle Batteries program, championed by DOE's NREL, General Motors, ANSYS and ESim LLC, is developing a flexible modeling framework that supports multiphysics models and provides process automation for robust engineering. The team will incorporate the latest advances in battery modeling research with software tools that are unsurpassed in their ease of use and workflow automation for robust design optimization. At the pack level, the state of the art will be significantly advanced by the development of innovative reduced-order models, derived and calibrated from the cell-level models and carefully validated through experiment. The aim is to accelerate battery innovation and development for future electric-drive vehicles.

Model-Order Reduction for Thermal Management in Battery and Power Electronics – 3:40 to 4:20 p.m.
Xiao Hu, ANSYS 171
For cooling systems in battery and power electronics, CFD models have been used successfully, but transient CFD simulations are time consuming. When a systems-level simulation is desired, you need a thermal model that runs in a fraction of a second. To accommodate this, model-order reduction (MOR) can create a fast and accurate thermal model. This presentation is based on transfer function matching MOR. The transfer function of the thermal system is calculated numerically based on CFD results. Then a MOR is created such that it has the same transfer function. This can then be used to replace the original CFD model for fast transient thermal analysis and system-level thermal analysis.



Li-Ion Electrochemical Model – 4:20 to 5:00 p.m.
Xiao Guang Yang, T. Miller and P. Yu, Ford Motor Company....186
The li-ion electrochemical model concurrently addresses interface reaction kinetics, species diffusion, thermal effect and geometrical factors by using commercial CFD tools. This session demonstrates extensive attributes, such as species concentration, overpotential and temperature along with their spatial and temporal distributions across large-format li-ion batteries. Detailed descriptions of electrochemical-physical processes improve understanding of the limiting characteristics related to battery performance and cell life estimation.

CHASSIS AND BODY TRACK – LASALLE ROOM

Higher Quality and Efficiency in Brake Squeal Simulations – 1:00 to 1:40 p.m.
Matthias Alberts, CADFEM US and Theo Kaster, TRW Automotive 198
Brake squeal simulations are part of the noise, vibration and harshness (NVH) analyses performed on cars and trucks. An increasing number of brake systems and higher complexity require simple and fast solutions to simulate brake squeal. Brake systems are highly engineered and complex assemblies. Simulation should allow engineers to analyze the effect of different brake pressure, friction, contact condition and material data and to answer questions about details of the assembly. This presentation shows how R&D requires both a quick and efficient way to analyze brake squeal with detailed simulations introducing reliability and design optimization.

White Body ED Verification by CAE with Acura TL Trialed – 1:40 to 2:20 p.m.
Ray Hughes, Honda R&D Americas, Inc. and Gerhard Zelder, CADFEM 209
Electrodeposition coating methods provide corrosion protection to metal surfaces. Until recently, there was no simple way to predict the thickness of paint deposited on white body surfaces. With electrodepostion simulation, you can virtually predict the coating thickness of internal structures without processing white bodies through electrodepostion coating tanks or by conducting physical thickness measurements. This presentation discusses a study to confirm the accuracy of this technology; the simulation results were compared against paint thickness measurements.

Seal Evaluation Using ANSYS Workbench – 3:00 to 3:40 p.m.
Hua Wang and Li-Jun Zeng, TRW Automotive 219
Robust sealing of the electric motor case is important to avoid corrosion and function failures. This study investigated an actuator case made from fiber-filled polyphenylene sulfide (PPS) or polybutylene terephthalate, bolted to an aluminum foundation housing. To evaluate the actuator case-to-foundation housing seal, CAE analyses were conducted using ANSYS Workbench. The analyses included evaluation of the rubber seal between the electric park brake and foundation brake housing subject to different temperatures in the installed condition.

A Continuous Virtual Product Development from Forming to Design Assessments – 3:40 to 4:20 p.m.
Matthias Alberts, CADFEM US ..... N/A
Ideally, simulations should follow a continuous process from part production to its later use. Simulation can start with forming and lead to structural design analyses. In reality, simulations are performed separately for forming processes and strength, fatigue, NVH or crash. The influence of plastic deformation or thinning of sheet metal due to forming is usually not included in structural design analyses. This presentation shows an integrated workflow for forming simulations and structural design analyses and its influence on structural and NVH behavior or fatigue assessment. Validation was performed by comparing the simulation process with a three-point bending test of a center pillar.

Simulation of Fatigue in Composite Components Using ANSYS nCode DesignLife – 4:20 to 5:00 p.m.
Peter Heyes, HBM nCode 231
Composite materials have many advantages for different classes of automotive components; however, they present challenges in that parts manufactured from composite materials are generally inhomogeneous and anisotropic. This presentation describes how ANSYS nCode DesignLife can model the durability of such composite components, particularly those made from short-fiber reinforced-injection molded thermoplastics.

MODEL-BASED SYSTEM ENGINEERING TRACK – MARQUETTE ROOM

ANSYS - Esterel Technologies
– 1:00 to 1:40 p.m.
Todd McDevitt, ANSYS 247
Today's automobiles increasingly incorporate software content to monitor and control the complex architecture of mechanical and electrical systems. Systems engineering, multidomain simulation and model-based embedded software development are becoming central for vehicle design and development. ANSYS has expanded into the systems engineering space by leveraging its strength and continued investments in 3-D physics. This presentation covers a number of systems engineering best practices and the unique capabilities of the ANSYS product portfolio to support these practices. This session includes moderated dialogue, during which participants can share their views on systems engineering and the requirements for simulation, model-based design and embedded code generation.

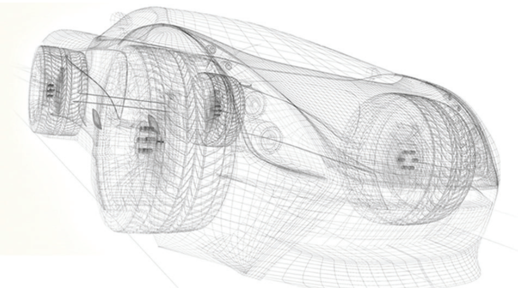
Automotive Needs for Model-Based Systems Engineering
– 1:40 to 2:20 p.m.
Todd McDevitt, ANSYS ..... N/A
This perspective is presented by members of the AGeSys Automotive Group Workshop. AGeSys is a European consortium for open, integrated tools for embedded systems and software design coupled with multiphysics models. The session discusses three automotive AGeSys subprojects along with recommendations for model-based systems engineering.

DEMOCRATIZATION TRACK – MARQUETTE ROOM

Panel Session: Democratizing Engineering Simulation Across the Product Development Organization
– 3:00 to 5:00 p.m.
Moderator: Greg Fallon, ANSYS ..... N/A
Panelists: Nand Kochar, Ford Motor Company, Jon Riley, National Center for Manufacturing Services, Alan Chalker, Ohio Supercomputer Center, Wayne Eckerle, Cummins, Inc.
What is driving leading product creation firms to expand engineering simulation beyond traditional, dedicated functional teams? How can engineering simulation be harnessed early in the design cycle with assurance that the predictions are credible? This panel discussion reviews prevailing software utilization trends through concrete examples from the automotive sector, with contributions from experts on the benefits and pitfalls of mainstream simulation tool adoption.

POSTER SESSION AND RECEPTION – AMBASSADOR BALLROOM

Automotive Simulation World Congress Poster Session
– 5:00 to 7:00 p.m.



October 31, 2012

POWERTRAIN TRACK – RICHARD ROOM

Confidence in Modeling SCR Aftertreatment Systems – 8:30 to 9:10 a.m.
Rana Faltsi and Jayesh Mutyal, ANSYS 280
Complete SCR system calculations require modeling of liquid spray atomization and decomposition, spray/wall interaction, and catalytic reactions inside the monolithic SCR catalyst. Detailed validation studies of urea/water spray decomposition and wall film formation are performed in ANSYS Fluent to establish the suitability of alternative modeling approaches. The SCR porous structure and detailed chemistry are computed in an aftertreatment modeling software, axisuite®, and coupled to ANSYS Fluent through user-defined functions. In contrast to CFD efforts that calculate inlet flow and NH3 uniformity, this approach evaluates complete system performance in terms of NOx emissions. The results demonstrate that NOx conversion efficiency in SCR catalyst channels is a complex function of local temperature, flow rate and species availability. With advanced UWS modeling and surface reaction UDFs, the use of CFD can be extended from traditional uniformity index calculations to emissions-oriented SCR system design optimization.

3-D Simulation of Filter Elements with Pleated Porous Media – 9:10 to 9:50 a.m.
Martin Lehmann, Mann+Hummel 300
In designing cars, filter elements are often overlooked; consequently, there is not much design space left in the engine compartment. Today's cars would not function without innovative fibrous filters. Replacing used filters with new ones that incorporate trusted original-equipment quality is essential for maintaining driving performance and a clean environment. Simulation is becoming an indispensible tool for filter development. With increased computational power, 2-D models are replaced by detailed 3-D modeling of the filter element. Engineers model local representations of single pleats of the filter media, rather than pleated media as a porous zone. This presentation discusses CFD simulation of filter elements with ANSYS Workbench, team collaboration via ANSYS EKM, and 3-D simulation of pleated filter media.

Advances in Turbulence Modeling at ANSYS – 9:50 to 10:30 a.m.
Paul Galpin, ANSYS 322
Turbulence modeling significantly impacts accuracy and cost of industrial CFD simulation. While virtual simulation is based mainly on Reynolds-averaged Navier–Stokes (RANS) turbulence models, certain classes of flows are better covered by models in which all or part of the turbulence spectrum is resolved in at least a portion of the numerical domain, called scale-resolving simulation (SRS). This session presents an overview of turbulence modeling techniques along with key aspects of RANS and SRS modeling, including the strengths and issues of each. It also reviews SRS advances through a series of validation and industrial cases.

Oil Sloshing Simulation for No-Leak Tank Design – 11:00 a.m. to 11:40 a.m.
Wenyan Ni, NACCO Materials Handling Group 342
In fork-lifting truck operations, hydraulic oil may leak from the air breather when simultaneously performing hard braking and quick lowering actions on the truck. To avoid leakage, NACCO routinely uses ANSYS CFD in its hydraulic tank design process. CFD simulations are run for different design concepts to evaluate and compare concepts. The results provide guidelines and direction for design changes to achieve the goal of zero leakage. This presentation discusses tank sloshing simulations.

Turbocharger Design and Analysis Solutions – 1:30 to 2:10 p.m.
Brad Hutchinson and Bill Holmes, ANSYS 349
With recent growing interest in turbocharger design and analysis, ANSYS has developed a suite of application-specific, high-fidelity, productivity-enhancing tools. These provide geometric definition, enable complete physics simulation (including thermal, structural and fluid dynamics), and offer full-spectrum 1-D/2-D/3-D steady and unsteady analysis and optimization. This presentation discusses the full range of tools available, their relative utility and advantages, and recent developments. Examples include the broad range of physics and analysis types on realistic turbocharger geometries.

Accelerating the Evolution of Turbochargers via Numerical Optimization and Advanced Simulation Techniques – 2:10 to 2:50 p.m.
Chris Robinson, PCA Engineers ..... N/A
For automotive turbochargers, challenges include higher compressor and turbine efficiency, with broader operating range and minimal inertia, as well as package size limitations and low-cost solutions. This session illustrates the implementation of a design-by-analysis approach in a fully integrated design environment, illustrated by examples of compressor and turbine designs for small gasoline engines. Automated numerical optimization is an emerging technology that can be deployed on several levels to minimize manual iteration.

Simulation of Multiphase Flows in Design of Gerotor Pumps – 3:15 to 3:55 p.m.
Srinivas Swaroop Kolla, Pricol Technologies 393
Computer modeling can improve pump design, specifically gerotor pumps, for which CFD has been widely used to enhance and optimize flow performance apart from addressing design specifications, such as position of inlets, outlets and internal components. Gerotor pumps are complex, as the rotor's intricate shape creates micron-level spacings and discretizing for pre-processing; solving N–S equations is a challenge. This session illustrates multiphase simulations capturing gravity and suction effects in a CFD-integrated development process for gerotor pump design with components such as suction pipe, strainer and rotors.

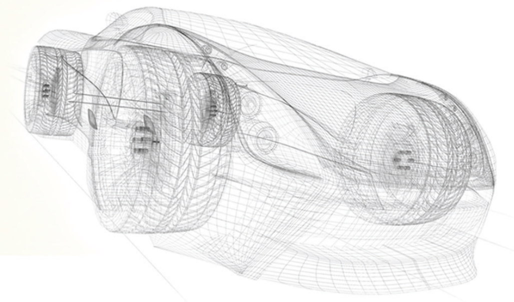
Numerical Simulation of FSI in the Design Process for a New Axial Hydraulic Pump – 3:55 to 4:30 p.m.
Bettina Landvogt, Fraunhofer SCAI 410
Gdansk University used numerical simulation to develop a high-pressure hydraulic axial pump for applications that demand high power. Its unique feature is the total independence of a pressure-switching mechanism, which saves weight and enables control by computer. Researchers found that when the pressure changes from high to low via a commutative bushing, harmful pressure peaks occurred. A compensation chamber between the high- and low-pressure areas was introduced. Interdisciplinary numerical simulation was used to find the optimal layout of the chamber and pump. The hydraulic oil and the piston movement were modeled in ANSYS Fluent.

VEHICLE ELECTRIFICATION TRACK – CADILLAC ROOM

Efficient Electrothermal Battery Pack Simulation with Model-Order Reduction – 8:30 to 9:10 a.m.
Lucas Koestetzer, ESSS 426
Battery electrothermal behavior can affect safety, performance and life, especially in the case of lithium-ion batteries. Numerical simulation using CFD/FEM in 3-D models is suitable for investigating and locally optimizing thermal management, but too expensive computationally for highly dynamic loads or coupled simulations with control systems. This session proposes a method using projection techniques in which FEM thermal models of battery packs are reduced to a solvable dimension for system simulation tools. The 3-D-based thermal model is then coupled with nonlinear electrical cell models for electrothermal simulation of battery packs.

Designing Six-Sigma Quality into HEV Power Electronics – 9:10 to 9:50 a.m.
Andreas Vlahinos, Advanced Engineering Solutions 438
This session presents a user perspective of state of the art modeling processes to automatically create optimum robust designs. Advanced Engineering Solutions preformed a probabilistic thermal–structural–fatigue FEA analysis to obtain optimum robust design that is insensitive to variations in noise parameters, such as manufacturing tolerances, material properties, process capability, heat loading, etc. The performance requirements included maximum IGBT temperature and minimum cycles to failure; these were compared to the probabilistic performance of the design and the sigma-quality level for each performance attribute.

Bidirectional Coupling of Electromagnetic and Thermal Simulation for E-Motor Design Using ANSYS CFX – 9:50 a.m. to 10:30 a.m.
Gereon Pusch, Magna Powertrain and Leon Voss, ANSYS 459
Magna Powertrain's HEV and EV applications focus on maximum system efficiency within a minimum package at the lowest weight. This leads to very dense and compact traction motor designs. To increase simulation accuracy, electromagnetic analysis using ANSYS Maxwell is bidirectionally coupled to the thermal simulation using ANSYS CFX to account for thermal material characteristics. This presentation outlines the importance of considering thermal feedback in motor design.



Effects of Manufacturing Process on IPM Motor Loss – 11:00 a.m. to 11:40 a.m.
Anand Sathyan, Chrysler Group LLC 487
Finite element analysis is widely used for motor design and performance evaluation. Most FEA tools accurately predict the torque, power and back emf values. However, loss measurement varies widely between simulation and experimental results. Manufacturing processes can have a major role in determining how much this loss variation is. This presentation discusses the various losses in an interior permanent magnet machine and how the manufacturing process can affect these losses.

Wireless Power Transfer – 11:40 to 12:20 p.m.
Zed Tang, ANSYS 500
Wireless power transfer is of special interest to electronics engineers who need to address usability and safety in designing charging technology. This technology started with small mobile devices such as cell phones and laptop PCs; it is now applied to automotive EV charging systems, which require larger power capacities in a very limited space. The key component is a loosely coupled transformer with large air gap needing coupled electromagnetic field analysis and circuit simulation for its design. The full solution of the wireless power transfer problem requires a systems-level approach with dynamically linked parameters between the circuit and 3-D magnetic FEA model. This presentation introduces wireless power transfer simulation using ANSYS Maxwell and ANSYS Simplorer, including a specific example of the magnetic resonance type used in electric vehicles.

AUTOMOTIVE ELECTRONICS TRACK – CADILLAC ROOM

Electromagnetic Simulation of Antennas Installed Inside Vehicles: An Automotive EMC Approach – 1:30 to 2:10 p.m.
Juliano Mologni, ESSS 514
Electronics has become a large part of a vehicle, for infotainment (multimedia, audio, Bluetooth, WiFi, GPS) as well as onboard diagnostics (OBD). Proper installment of antennas is a challenge not only due to antenna performance, but also to EMI between components and systems. This presentation illustrates how electromagnetic simulation can help address all of these issues, with details on evaluating performance of antennas inside the vehicle and performing certification tests of automotive EMC standards (like ISO 11451-2) using ANSYS tools.

Development of KSR's Next-Generation Inductive Sensor Technology – 2:10 to 2:50 p.m.
Lingmin Shao, KSR International 524
ANSYS systems-level simulation helped first-pass success in developing KSR's next-generation inductive sensor technology. The characteristic of the electromagnetic structure is extracted for the new ASIC design; the system behavior including EM structure and circuitry is fully simulated when the ASIC is developed. This presentation covers the working principle of the new sensor, ANSYS systems-level simulation methodology and correlation between simulation and measurement.

Power, Noise and Reliability Analysis for Automotive Electronic Systems – 3:15 to 3:55 p.m.
Margaret Schmitt, ANSYS 534
Advanced automotive safety and assist systems call for integrating complex electronics. Since they affect safety, the systems must meet strict reliability requirements. In addition, the number of systems integrated into an automobile requires power dissipation optimization. The onboard power supply system shared between high-current electrical systems and sensitive electronics systems is noisy, and the thermal environment can vary widely. Interference occurring from noise generated on the shared supply system, or through wireless EMI, poses major reliability threats. To help address key power and reliability challenges in these systems, utilizing a system-aware design approach early in the IC design process helps to meet safety and reliability requirements while reducing overall development time and cost.

Simulating Fabrication of an All-Silicon Pressure Sensor – 3:55 to 4:30 p.m.
Fereydoon Dadkhah, Delphi Automotive Systems 549
All-silicon pressure sensors for automotive applications use a thin silicon diaphragm that deforms under applied pressure. The diaphragm is fabricated in steps in which material is either removed or bonded to a volume of silicon. These processes take place at different temperatures; they can be accomplished by physical means, such as grinding, or by chemical etching. To determine the final product's stress state, the engineering team simulated the process by applying element birth and death and substructuring techniques to the finite element model of sensor and substrate.

ROBUST DESIGN, OPTIMIZATION TRACK – LASALLE ROOM

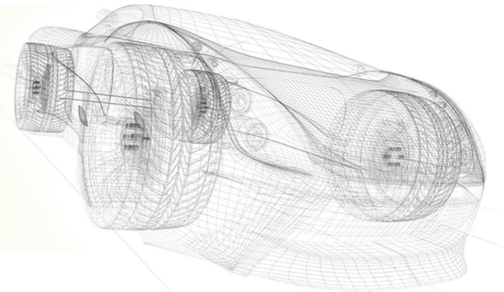
High-Performance Computing for Mechanical Simulations Using ANSYS – 8:30 to 9:10 a.m.
Jeff Beisheim, ANSYS 566
FEA simulations continue to increase in complexity. For faster turnaround times, especially for complex simulations involving models with complicated physics and highly refined meshes, engineers must consider high-performance computing (HPC). HPC involves understanding both leading-edge hardware solutions and how FEA software can leverage such hardware. For mechanical simulations, ANSYS technologies allow users to take full advantage of multiple-core processors, graphics cards (GPUs), solid-state hard drives (SSDs), clusters, etc., all in an effort to minimize time to solution.

Design Optimization and Safety in Simulation in the Automotive Industry – 9:10 to 9:50 a.m.
Matthias Alberts, CADFEM US 583
To achieve high quality standards, reliability, safety and cost effectiveness, a product must retain its reliability and safety in an environment with less-than-perfect conditions. In virtual product development, this can be considered by using stochastic simulations, which introduce uncertainties like manufacturing tolerances, environmental effects or operating conditions into a product's simulation and a designs assessment. Combining this with optimization techniques and integrating it into the development process lead to robust design optimization (RDO). optiSLang inside ANSYS Workbench enables RDO. This presentation shows various applications, from brake squeal simulations to micro relays, connectors, pneumatic valves and truck wheel components, highlighting the benefits of introducing uncertainties into simulations.

An Integrated Optimization System for ANSYS Workbench Based on ACT – 9:50 to 10:30 a.m.
Manfred Fritsch, FE-Design Optimization Inc. 594
Nonparametric structural optimization software coupled with commercial FEA solvers offers many benefits. FE-Design has integrated its advanced structural optimization software with ANSYS Workbench, using the ANSYS Application Customization Toolkit. Topology optimization software automatically generates new design proposals for structures within a defined design space. Material is removed from low-stress areas and retained in areas with higher stress. Nonlinear analysis, including large deformations, material plasticity and contact, is supported.

Topology Optimization-Driven Design Development for Automotive Components – 11:00 to 11:40 a.m.
Ron Banchak, FE-Design, GmbH 606
Automatic CFD optimization methods can integrate analysis and design issues. Conventional optimization techniques like CAD parameter-based schemes are often limited due to extensive computing time and intrinsic limited solution space. This disadvantage can be overcome by an optimality criteria (OC)-based topology optimization method for ANSYS Fluent. With this approach for channel flow problems, CFD emerges from an analysis tool to a design tool: topology optimization generates design proposals for channels with low pressure drop automatically within a given design space.

Design of a Zero-Voltage-Switching Large Air Gap Wireless Charger for Plug-in HEVs – 11:40 a.m. to 12:20 p.m.
Kevin Bai, Kettering University 626
Most wireless chargers today are based on the resonance between two coils with a high air gap. The critical issue is designing the coils with appropriate self-inductance and mutual inductance. Advanced Power Electronics Lab (APEL) designed a 1 kW wireless charging system with an air gap of 15 cm to 50 cm. The team used ANSYS Maxwell to extract the coil parameters. A soft-switching technique increases system efficiency; an extra LC network compensates for the reactive power in the system caused by low mutual inductance, which gives the system low current stress.



AERODYNAMICS, UNDERHOOD AND HVAC TRACK – LASALLE ROOM

Utilizing ANSYS Workbench Based Customized Tool for HVAC Design and Development – 1:30 to 2:10 p.m.
Steven Guzy, Shamsuddin Noorani, Steven Zielinski and Debangshu Majumdar, Delphi Thermal Systems 640
Delphi has developed an easy-to-use, automated CFD tool for automotive HVAC applications that functions within ANSYS Workbench. This tool is targeted primarily for non-expert CFD users who need to quickly analyze the impact of design changes on performance. In practice, the tool has significantly expedited product development. With minimal user input, the tool sets up the solution of HVAC simulations by manipulating geometry, creating mesh, setting up a simulation and creating a preliminary report.

Tire Water Splash – 2:10 to 2:50 p.m.
Andreas Blixt and Dragos Moroianu, Volvo Cars 648
Limiting the amount of contaminated water in a car's engine bay can reduce maintenance costs. R&D teams must accurately predict the direction and amount of water splashed by a tire in a wheel house. Volvo analyzed an isolated tire with water splash, identifying the splashing mechanism and its effects. The study incorporated multiphase flows through a volume of fluid model, and for turbulence through different Reynolds-averaged Navier–Stokes models and a large-eddy simulation approach.

50:50:50 Aero Optimization – 3:15 to 3:55 p.m.
Sandeep Sovani, ANSYS ..... N/A
CFD is widely used in vehicle aerodynamics development, typically to study one vehicle shape at a time. To leverage CFD for aerodynamic shape exploration and optimization, simulation must study a large set of design alternatives (vehicle shape variants) within the short time available in overall aerodynamics development. A new process, the 50:50:50 method, studies a large set of design alternatives in a highly automated way, while ensuring that each design alternative is simulated with high-fidelity CFD simulation. The process leverages morphing, advanced CFD solver numerics, high-performance computing and process automaters to simulate 50 shape variants of a vehicle, with high-fidelity CFD simulations that use a computational mesh of 50 million cells for simulating each design point, in a total elapsed time of 50 hours after initial case setup.

Cosimulation for Thermal Management and Vehicle Dynamics Applications – 3:55 to 4:30 p.m.
Klaus Wolf, Fraunhofer SCAI 658
MpCCI provides a vendor-independent software interface for cosimulation, and this presentation discusses recent automotive applications: thermal behavior including convection, radiation and conduction in fluids and solid bodies. A coupled MBS-FEA-simulation approach is presented. One example is passing a road hole by the left front wheel. The corresponding tire is modeled with the FEA approach. The position as boundary condition is provided by the multibody model in MSC Adams. Both programs simulate in parallel and communicate through MpCCI. Another example outlines the benefits of coupling 1-D system codes with full 3-D CFD codes like ANSYS Fluent for HVAC circuits with detailed models of passenger cabins to get a more realistic feeling for the thermal comfort.

Optimization of Front-End Cooling Module for a Commercial Vehicle Using a CFD Approach – Available on Provided Memory Stick
Ashok Patidar, Umashanker Gupta and Nitin Marathe, Volvo Trucks India 677
This presentation describes the effects of design actions using ANSYS Fluent on engine cooling performance of a commercial vehicle. The resistance of heat exchangers is considered using a porous modeling technique. The outlet temperature of intercooler charged air and radiator coolant is predicted along with amount of heat rejected by the intercooler and radiator. Air flow rate and air temperature at the entry and exit faces of intercooler and radiator are also predicted. This analysis helps to identify the air flow pattern in underhood and underbody regions for three vehicle conditions: idling, max torque and max power.

OPTIMIZING THE IT ENVIRONMENT FOR SIMULATION TRACK – MARQUETTE ROOM

Panel Session: Optimizing the IT Environment for Simulation – 8:30 to 10:30 a.m.
Moderator:
Barbara Hutchings, ANSYS
Panelists:
John Irons, Cummins, Inc., Dennis Strader, Delphi
Vinod Gollapudi, General Motors, Daniel Persson,
Gridcore AB, Karl Kuehlert, ANSYS ..... N/A
Product innovation in the automotive industry relies on expanded high-performance computing capacity to support simulation. But simply scaling up computational capacity is not enough. Equally important is a focus on an IT environment that minimizes operational and capital costs, while enhancing end-user productivity, enabling collaboration and protecting an organization's intellectual property. This session, which includes presentations and panel discussion with industry leaders, explores important trends related to data center consolidation, private clouds, mobile and remote access, work-in-progress data management, and other keys to optimizing enterprise access to HPC resources.

MODEL-BASED SYSTEM ENGINEERING TRACK – MARQUETTE ROOM

Systems Integration of a Complete Electrical Vehicle Powertrain – 11:00 to 11:40 a.m.
Scott Stanton, ANSYS ..... N/A
Accurate high-level systems simulation is difficult to obtain without capturing individual component behavior. This accuracy is often compromised early in the design cycle by creating models based on constitutive relationships. Component-level simulators provide high-fidelity details about the component. However, having an accurate multiphysics virtual model of a system at the 3-D level and at the system 0-D level remains a challenge. This presentation introduces a methodology to apply simulation at every step of the design cycle. It involves systems simulation, component-level multiphysics analysis using numerical methods, reduced-order model techniques and embedded software import. The example used is a hybrid vehicle fuel consumption analysis.

ANSYS and Esterel: Combining Hardware, Electronic and Embedded Software Simulation for Smart Product Development – 11:40 to 12:20 p.m.
Todd McDevitt, ANSYS ..... N/A
A combined systems and software approach is especially important in smart product design. By combining systems functional engineering, software development and detailed design with 3-D multiphysics, ANSYS and Esterel Technologies provide a complete cosimulation environment for automotive, aerospace, rail and defense industries. This presentation introduces Esterel and the SCADE product family for embedded systems and software development. It demonstrates cosimulation capabilities with tools such as ANSYS Simplorer.

DATA MANAGEMENT TRACK – MARQUETTE ROOM

Panel Session: Simulation Knowledge Management – 1:30 to 4:30 p.m.
Moderator:
Sanjay Angadi, ANSYS
Panelists:
Pat Prescott, Owens Corning
Prashad Mandava, VCollab
Prashant Avashia, IBM
Keith Meintjes, CIMdata ..... N/A
Knowledge management session reviews various aspects of addressing engineering simulation process and data management (SPDM) challenges, such as productivity, collaboration and perspective.

ADDITIONAL PAPERS