SIMULIA Americas Users Conference – Suburban Collection Showplace
Advanced Seminars – Tuesday, May 2, 2023
Agenda

8:30 AM	**Registration, Coffee & Breakfast**
9:00 AM	Session 1
10:30 AM	**Morning Break**
10:45 AM	Session 2
12:15 PM	**Lunch**
1:15 PM	Session 3
2:45 PM	**Afternoon Break**
3:00 PM	Session 4
4:30 PM	Wrap-Up

Topic: Structures ***Room: GOLD***

- Session 1: **Contact and Convergence in Abaqus/Standard**, Randy Marlow, *Dassault Systèmes*
- Session 2: **SIMULIA Portfolio for Advanced Fatigue Topics**, Jaewon Choi, *Dassault Systèmes*
- Session 3: **Fast Iterations for Structural Design & Simulation**, Matthew Pais, *Dassault Systèmes*
- Session 4: **Material Calibration Essentials**, Tod Dalrymple, *Dassault Systèmes*

Topic: Electromagnetics ***Room: BRONZE***

- Session 1: **CST Studio Suite and OPERA: Model Creation and Solver Basics**, Derek Campbell, Yuriy Zhilichev, *Dassault Systèmes*
- Session 2: **Antenna Simulations for 5G and IOT**, Apra Pandey, *Dassault Systèmes*
- Session 3: **EMC/EMI Simulations to Improve Your Pass Rate**, Frank Scharf, *Dassault Systèmes*
- Session 4: **Guide to Simulating Electrical Machines with Opera**, Yuriy Zhilichev, *Dassault Systèmes*

Topic: Multiphysics/Multiscale/Fluids ***Room: COPPER***

- Session 1: **Vibro-Acoustics with wave6**, Phil Shorter, *Dassault Systèmes*
- Session 2: **Advanced Seminar in Li-Ion Battery Multiphysics/Multiscale Modeling and Simulation,** Matias Zielonka, *Dassault Systèmes*
- Session 3: **Digital Solutions to Achieve Desired Aeroacoustic Comfort without Compromising Performance**, Sivapalan Senthooran, *Dassault Systèmes*
- Session 4: **SIMULIA Fluid Solutions on 3DEXPERIENCE Cloud**, Nicolas Fougere, Anirudh Rajagopal, *Dassault Systèmes*

Topic: Model-Based Systems Engineering, Design Exploration & Multibody Systems ***Room: SILVER***

- Session 1: **Democratizing Simulation Methods to Enable Analysts, Designers and Systems Engineering**, Dominick Lauzon, Chris Olson, Gopi Lanka, *Dassault Systèmes*
- Session 2: **Design Exploration Methods and Applications**, Christina Fiest, David Kokan *Dassault Systèmes*
- Session 3 & 4: **Multibody Dynamics with Simpack**, Wulf Roever, Prasad Kodali, *Dassault Systèmes*

Abstracts

Topics: Structures

Session 1: Contact and Convergence in Abaqus/Standard

Presented by Randy Marlow, *SIMULIA Structures Industry Process Consultant Senior Expert*

Convergence of the nonlinear solution method in Abaqus/Standard is of interest to everyone who uses the code. Nonlinear simulations very often include contact. Convergence and contact are therefore closely connected. This seminar is an overview of the nonlinear solution method in Abaqus/Standard and a discussion of its contact modeling technology. Attendees will learn how Abaqus/Standard produces results for nonlinear models and they will also learn about the latest recommended contact methods. Attendees will be able to use the knowledge to build more robust and more realistic simulations. Those who wish to learn more about the Newton-Raphson nonlinear solution method and contact in Abaqus/Standard are invited to attend. A working knowledge of the code will be beneficial.

Session 2: SIMULIA Portfolio for Advanced Fatigue Topics

Presented by Jaehwan Choi, *SIMULIA Structures Industry Process Consultant Senior Expert*

This half-day training focuses on the vibration fatigue and the fatigue of elastomer by using SIMULIA products, Abaqus, fe-safe and fe-safe/Rubber. More fundamental fatigue topics were discussed in the last year's pre-user-meeting training session. If you are interested in base-line fatigue assessment by using Abaqus and fe-safe, then please refer to the half day training material of the last year.
It will discuss about possible scenarios of dynamic fatigue calculation and demonstrate with real-world examples. fe-safe can handle both time- and frequency-domain vibration fatigue calculations. Time-domain vibration fatigue functionality can use any length of time signal excitation as duty cycle. Frequency-domain vibration fatigue functionality can use various PSD based fatigue algorithm in addition to the original Dirlik's algorithm. fe-safe also be able to use SIMPACK generated dynamic stress history for the fatigue life calculation. The first half of this training will cover all of these vibration fatigue topics. The second half of the training will discuss the fatigue of elastomers by using Abaqus and fe-safe/Rubber. It will discuss topics such as what differentiates the elastomer fatigue from the traditional metal fatigue and how to get the fatigue properties of elastomers, etc. This training will also provide demonstration and the current user's use cases based on the publications.

Fast Iterations for Structural Design & Simulation

Session 3: Presented by Matt Pais, *NAM MODSIM Industry Process Consult - Mgt Director*

Today most products are engineered with disconnected design and simulation tools which limits the ease with which data-driven decisions can be made. With the 3DEXPERIENCE platform simulations automatically react to design changes enabling rapid design and simulation iterations throughout the product development process. Several topics will be addressed primarily through live demonstration including:

1. Concept Structure Engineering
2. Multiple interoperable simulation abstractions and representations
3. Robust parametric exploration & optimization
4. Automated modelling for rapid mesh, property and connection creation

Session 4: Material Calibration Essentials
Presented by Tod Dalrymple, SIMULIA R&D Application Director
A key ingredient to successful and accurate advanced FE simulation is an accurate material model. This course will introduce the 3DEXPERIENCE Material Calibration app used to determine material parameter values, in an optimization-based framework.
Upon completion, you will be able to:

1. Import and plot material test data, configure optimization controls.
2. Calibrate material models with the numerical and analytical execution modes.
3. Create materials for physics simulation or export an Abaqus material for legacy simulation.
4. Use FE-based calibration with a physics simulation or an imported Abaqus input file.
5. Delete simulations, calibration data, or created materials.

Topics: Electromagnetics

Session 1: CST Studio Suite: Model Creation and Solver Basics
Presented by Derek Campbell, *SIMULIA Industry Process Consultant*
This seminar introduces Engineers to the basic processes required to simulate Electromagnetic (EM) performance with CST Studio Suite, which offers a complete technology. Attendees will initially learn about the available high frequency EM numerical methods. This overview helps Engineers minimize computational resource requirements through efficient solver selection. Attendees will also learn how to build a model, define excitations, and post-process results within a single, intuitive interface.

Session 1 (cont.): Opera Model Creation and Solver Basics
Presented by Yuriy Zhilichev, *SIMULIA User Success Engineering Manager*
Opera (an Operating environment for Electromagnetic Research and Analysis) is a suite of multiphysics analysis programs that includes electromagnetics, stress and thermal solvers. Opera provides accurate numerical solutions to real-world problems in many areas of Electromagnetics and Multiphysics including Electrostatics, Magnetostatics, Low and High frequency Electromagnetics, Space Charge, Thermal and Structural problems.

Opera is also capable of examining specific problems such as quench of superconductors, magnetization and demagnetization of hard and soft magnetic materials, magnetostriction and other coupled multiphysics problems. Opera has a wide range of supporting capability to simulate moving parts, transient fields, non-linear and hysteretic magnetic materials, lossy dielectrics, external circuits, system engineering and device optimization.

This presentation covers a general description of Opera software, main solvers, and an example of model building with some major steps on how to create the geometry of a magnet and conductor, set up the model and analysis parameters, solve the model and visualize the results.

Session 2: Antenna Simulations for 5G and IOT
Presented by Apra Pandey, *SIMULIA Industry Process Consultant Senior Manager*
Electromagnetic simulations enable rapid design and placement of antennas so that they meet compliance and certification specifications. This seminar introduces the method to virtually construct and simulate antennas efficiently using SIMULIA CST Studio Suite. We will also talk about high frequency solvers used to simulate different type of antennas, visualizing primary results and advanced results using post- processing techniques.

Session 3: EMC/EMI Simulations to Improve Your Pass Rate
Presented by Frank Scharf, *SIMULIA Electromagnetics Industry Process Consultant Director*
Electromagnetic Compatibility/Interference (EMC/EMI) are crucial topics for any device containing electronic components, such as cars, phones, laptops, or medical devices. Simulation is of great help here and can provide insights that are impossible to obtain from measurement. However, the setup and simulation runs can be challenging due to the complexity of the models. This presentation provides guidance on how to set up simulations for common workflows, such as radiated and conducted emissions. General knowledge of how to use Dassault Systèmes SIMULIA CST Studio Suite(R) is a prerequisite for this presentation."

Session 4: Guide to Simulating Electrical Machines with Opera
Presented by Yuriy Zhilichev, *SIMULIA User Success Engineering Manager*
Whether designing a motor or a generator, an axial or radial flux topology, rotating or linear motion, Opera provides a wide range of tools for electromagnetic design and multiphysics study such as thermal and structural analysis of electrical machines. Any machine topology can be modelled and solved. Opera motional solvers comprise mechanical coupling and coupled electrical circuits, power supply control including soft, switching, PWM, current and position feedback. Opera allows users to simulate skewed structures, eccentricities and fault operation, demagnetization of permanent magnets and loss calculation including hysteresis effects. Opera can be linked directly to the industry-standard Simulink® software to co-simulate the transient performance of the complete drive or electromechanical system.

The integrated Machines Environment with the help of parameterized templates gives users the possibility to quickly and easily setup and analyze their customized machine designs using the static, transient or motional solvers. The Machine Environment also comprises multi-physics capabilities, optimization and standard design calculations such as back-EMF, cogging torque, load torque, open and short-circuit curves.

This presentation gives an overview of Opera 2D and 3D for the design and modeling of electrical machines. The talk will also cover an example of building the model of PM electrical machine, running the solution and post processing the results to determine the machine's characteristics. A brief introduction to Opera Machine Designer Tool and 3D Machine Environment will be given.

Topic: Multiphysics/Multiscale/Fluids

Session 1: Vibro-Acoustics with wave6

Presented by Phil Shorter, *SIMULIA R&D Vibroacoustics Application Senior Director*

Noise and vibration are becoming increasingly important in virtually every industry. Typical applications include; designing for interior noise in cars, aircraft, trains, ships, cabs and buildings; designing for exterior noise in wind turbines, Urban Air Mobility, tires and pass-by noise; designing for dynamic environments and shock in spacecraft and launch vehicles; designing for stealth in ships, submarines and UAVs; designing for sound quality and speech intelligibility in mobile phones, loudspeakers and public address systems. In many of these applications, it is important to consider noise and vibration across the entire audible frequency range. This requires the use of a combination of simulation methods including both low frequency mesh based methods and mid/high frequency statistical wave based methods. SIMULIA's vibro-acoustic simulation software 'wave6' includes the full spectrum of vibro-acoustic analysis methods in order to efficiently simulate noise and vibration across a broad frequency range. This presentation will provide an overview of wave6. A number of new methods will be discussed along with recent application examples.

Session 2: Li-Ion Battery Multiphysics/Multiscale Modeling and Simulation

Presented by Matias Zielonka, *SIMULIA Structures Industry Process Consultant Expert*

This advanced seminar will focus on the use of Abaqus Standard, Simulia's flagship implicit FEA solver, for modeling and simulating the fundamental multi-scale and multi-physics processes that occur in the electrodes and electrolyte of Li-Ion batteries. These processes include electrochemical reactions, diffusion and absorption of lithium into the structure of electrode particles, transport of charged species in the electrolyte, conduction of currents through the solid and liquid phases of porous electrodes, its associated heating and heat transfer, and the poro-mechanical deformation induced by lithiation swelling.
Through a series of case studies, participants will gain insights into using Abaqus Standard to simulate and investigate the electrochemical, thermal, and poro-mechanical behavior of Li-Ion batteries under various operating conditions, including charging and discharging cycles, abusive mechanical and thermal loading, as well as the mechanisms behind battery aging and its impact on performance. The seminar will also cover parametric modeling workflows for standard Li-Ion battery cell geometries and reduced-order techniques that significantly reduce the computational cost of simulating complex Li-Ion battery systems.

Session 3: Digital Solutions to Achieve Desired Aeroacoustic Comfort without Compromising Performance

Presented by Sivapalan Senthooran, *SIMULIA AEC and Acoustics Industry Process Director*

JD Power ranks noise comfort among consumers' top 10 complaints in studies of initial vehicle quality. Excessive noise inside the cabin greatly reduces passenger comfort, causes noise fatigue and affects accuracy of infotainment systems. Therefore, reducing vehicle's interior noise is a top priority for engineers due to its impact on customer experience, brand loyalty, and sales.

SIMULIA provides several best in class solutions to help vehicle OEMs design quieter & comfortable vehicles while reducing cost and development time. This talk will provide an overview of the aeroacoustic solutions from SIMULIA and the end to end vehicle development process management for aeroacoustic comfort in the 3DExperience platform through SIMULIA's MODSIM approach. It will also cover the integration of the simulation results from MODSIM into NVH simulators to enable the

assessment of human experiences in realistic environments and move the vehicle development process closer to virtual sign-off without the need for prototypes.

Session 4: SIMULIA fluid solutions on 3DEXPERIENCE Cloud
Presented by Nicolas Fougere, *Worldwide SIMULIA Fluids, Industry Process Consultant Manager*
Anirudh Rajagopal, *Worldwide SIMULIA Fluids, Industry Process Consultant*
This session will present a step by step demonstration of our fluid solutions PowerFLOW and Fluid Dynamic Engineer role. The end to end demo will highlight the functionalities and latest process automation improvements and how it can accelerate evaluation and improvement of product performance, reliability and safety. An aerodynamic PowerFLOW workflow will be demonstrated on the 3DEXPERIENCE Cloud and a brake cooling example will be demonstrated using Fluid Dynamics Engineer on the 3DEXPERIENCE Cloud. By performing these demos the 3DEXPERIENCE Cloud we are also able to illustrate the resulting additional benefits of the cloud environment in the context of Dassault Systemes CFD solutions.

Topics: Model-Based Systems Engineering, Design Exploration & Multibody Systems

Session 1: Democratizing Simulation Methods to enable Analysts, Designers and Systems Engineering
Presented by Dominick, *CATIA Industry Process Consultant Expert,* **Chris Olson,** *SIMULIA Industry Process Consultant*, **Gopi Lanka,** *SIMULIA Industry Process Consultant*
In this session, attendees will gain an understanding of how 3DEXPERIENCE process applications can be utilized to build and democratize simple to increasingly more complex simulation workflows to significantly increase throughput of design, simulation and systems engineers. Several sample use cases will be presented in order to provide explicit industrial examples driving execution of platform native, home grown applications and third party solvers. The session will also show how web-based user interfaces can be developed to better support democratization and collaborative reviews from directly dashboards. In conclusion, an example of how the recently released CATIA Magic (Cameo) Process Composer plugin will be showcased along with a discussion of how it provides significant value to systems engineering.

Session 2: Design Exploration Applications and Methods
Presented by David Kokan, *R&D Technologies MODSIM Exploration Application Director,*
Christina Feist, *R&D Technologies MODSIM Exploration Apps Portfolio Director*
Enabled by the integration of modeling and simulation, Dassault Systèmes is revolutionizing the efficient use of design exploration to facilitate discovery, innovation, and decision making. Removing the barrier of entry due to stitched-up solutions that prevent wide adoption and require deep skills and experience empowers efficient design exploration throughout the entire product lifecycle.
Key topics that will be addressed in this webinar include:

- Overview of design exploration concepts and benefits
- Product demonstrations showcasing exploration studies through a scalable portfolio of 3DEXPERIENCE applications

Session 3 &4: Multibody Dynamics with Simpack

Presented by Wulf Roever, *SIMULIA Multibody Industry Process Consultant Director*, **Prasad Kodali,** *SIMULIA Multibody Systems Industry Process Consultant*

Multi-body system (MBS) analyses are applied throughout many different industries and applications on many different levels in the product life cycle. MBS can be deployed at very early stages in the product development process during design concept studies, during any stage of the product development process, but also after the product is released to the market. MBS can even be used for trouble shooting complex error states of subsystem interactions, evaluate possible design counter measures and design changes to avoid or mitigate very specific physical system phenomena that occur during normal operations or under extreme and rare system boundary conditions.

The attendee will learn during this seminar about the wide range of applications where the multi-body system software SIMULIA/Simpack provides value to users worldwide. It contains a view of the software architecture and technology inside the tool, which is the basis to provide significant advantages over other commercially available MBS-tools. It is followed-up by an in-depth exploration of processes and workflows in two specific application areas.

The first one is the system environment of the electric powertrain and how to address some of its requirements with the help of the SIMULIA software portfolio inside the SIMULIA/Simpack centered industry process experiences (IPEs).

The second application is the complex field of vehicle dynamics, which will be presented in a customizable graphical user interface, which allows the efficient and error free use of SIMULIA/Simpack technology for vehicle dynamics experts and application specialist.

This example will show how to support and enable the trend in the industry, not only in automotive, to democratize simulation and deploy it throughout an organization.