Your Essential Guide to the 2019 SIMULIA Regional User Meeting

Crowne Plaza Liverpool City

Conference Dates: October 30th – 31st

Register now

3DEXPERIENCE®

DASSAULT SYSTEMES | The 3DEXPERIENCE® Company

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Your Personal Invitation

You're invited to join the 32nd SIMULIA Regional User Meeting at the Crowne Plaza Liverpool City Centre

We have once again created this e-Book full of all the vital conference information you need to make the decision to join us on the 30th – 31st October. We hope this e-Book will help to prepare you for the RUM and we look forward to welcoming you in Liverpool.

Summary of what to expect at the conference:

- Registration to both days of the RUM will again be completely free
- Three Keynote Speakers from Novo Nordisk and Loughborough University
- Customer paper presentations
- Choose from 5 discovery sessions
    - An introduction to Fatigue and Durability Analysis
    - Expanding SolidWorks Simulation capabilities with Structural Simulation Engineer
    - Expanding simulation possibilities with Isight
    - 3DEXPERIENCE for the Traditional Analyst – Leveraging the Power of the Platform for Simulation Post-Processing
    - From FE to CHT: Revealing the Power of Multiphysics
- Choose from 5 technology sessions
    - The Fundamentals of Abaqus and Practical Finite Element Simulation
    - Electromagnetic session
    - Fluids – Computational Fluid Dynamics
    - Multibody Systems Dynamics Workshop
    - CATIA to Shape and Reveal the world we live in
- The latest updates on the SIMULIA portfolio product suite from SIMULIA R&D
- R&D Presentations including:
    - A Novel End-to-End Solution for Solving Super Large Structural Simulation Problems - Vladimir Belsky - SIMULIA R&D Technology Director
    - SIMULIA Update and Beyond - Dr. Victor Oancea, SIMULIA R&D Sr. Technology Director, CSO Structure
- Interactive exhibition area
- Free networking banquet on the evening of the 30th October

Who Should Attend?

Industry professionals, engineering teams, team leaders, managers and directors with an interest in state of the art structural, fluids and electromagnetic simulations will benefit from attendance at this conference.

Themes covered will include multiscale, multi-discipline simulation and automation, allowing organisations to leverage the maximum benefit from simulation technology.

Registration

The conference is free to attend for both days including the conference banquet. Spaces are limited and due to the high number of expected attendees, it is essential that you only reserve a place if you will be attending and please let us know as soon as possible if you are unable to attend.

Register now

Venue & Accommodation

This year the conference will be held at Crowne Plaza Liverpool City Centre. More details regarding the venue may be found at https://www.cpliverpool.com/

Crowne Plaza Liverpool City Center
2 St Nicholas Place
Princes Dock
Liverpool
L3 1QW
0151 243 800

To reserve your accommodation please contact the hotel quoting 'Dassault Systemes' in order to receive the discounted rate of £129 for bed and breakfast.

It is vital that you make your reservations as soon as possible as the discounted rate is available for a limited time only.

Accommodation is expected to sell out fast. Please ensure you book directly with the hotel on 0151 243 800.

Extend your stay

Looking for a city break? Or is it half term? Bring the family!

Why not extend your stay in Liverpool and enjoy a city break like no other.

Liverpool is an amazing city with so much to for every one of all ages! The Crowne Plaza Liverpool City would love to have you extend your stay at the hotel and is offering an extension to the discounted accommodation rate on the 31st October.

The Crowne Plaza Liverpool City is in the perfect location for all Liverpool attractions, minutes' walk from the Royal Albert Dock where you will find:

- The Walker Art Gallery
- Tate Liverpool
- Merseyside Maritime Museum
- The Beatles Story Museum
- Museum of Liverpool
- So much more!

We would also recommend:

- A visit to the historic Cavern Club
- Royal Liver Building 360 TOUR
- Liverpool Football Club tour
- Liverpool one (shopping paradise)
- St Georges Hall

All easily accessible from the hotel!

Don't just take our word for it, here are some fantastic sites that will help you plan your trip! https://www.visitliverpool.com/things-to-do/uk-city-breaks https://www.visitliverpool.com/things-to-do/attractions/family-friendly

To reserve your accommodation please contact the hotel on 0151 243 800 quoting 'Dassault Systemes' in order to receive the discounted rate of £129 for bed and breakfast.

We can't wait to see you in Liverpool!

Discovery Sessions

Below is a description of the breakout sessions which attendees can choose to attend

An Introduction to Fatigue and Durability Analysis

A quick introduction to fatigue and durability analysis. SIMULIA fe-safe is demonstrated for the fatigue analysis capabilities. No previous knowledge of fatigue is necessary for attendees. The following topics will be covered including some practical examples:

- Introduction to fatigue
- The fe-safe user interface
- Loading methods
- Fatigue methods
- Overview- fe-safe/Verity and other plugin modules.
- SIMULIA Extended licensing
- Documentation
- Q&A

Expanding SolidWorks Simulation capabilities with Structural Simulation Engineer

In this session we will explore the capabilities of the SolidWorks Simulation tools and how they can be extended by using Structural Simulation Engineer (SSE) powered by SIMULIA. We will take some customer scenarios and demonstrate how they were successfully resolved using SolidWorks and SSE. We will also cover some best practices to create the most effective workflow when working with SolidWorks files in SSE.

Expanding simulation possibilities with Isight

In this session Technia will present on Isight. Isight adds new dimensions to simulation strategies by exploring product and design variability through automating simulation process and data flows. Technia staff will highlight how it brings new insights to product design, as well as taking a detailed look at how the program is used to link different packages together to investigate how changes across the model specification influence performance, and how this performance can be revealed.

3DEXPERIENCE for the Traditional Analyst – Leveraging the Power of the Platform for Simulation Post-Processing

In this session you will learn how 3DEXPERIENCE can bring state-of-the-art post-processing capabilities to your existing workflows. The strive for innovation sees ever increasing levels of detail and complexity in our simulation models. Deriving insight from such large and complex datasets presents a constant challenge to the analyst, especially when using traditional tools. 3DEXPERIENCE provides a step change in capability for results post-processing, with fully parallel execution, support for HPC results computations, as well as the possibility for multiple levels of automation. It also allows the entire business to leverage the value of simulation insight through capabilities such as browser-based visualization for 3D simulation results, simulation dashboards to provide metrics and KPIs, and even predefined processes to provide on-demand for non-experts.

From FE to CHT: Revealing the Power of Physics

Even from its earliest beginnings, the Abaqus solver supported physics solutions, for example a couple temperature displacement analysis where both the thermal and mechanical fields are solved simultaneously. Over time the physics embedded within the Abaqus solver grew, including

electromagnetics, etc. Whilst the loads and boundary conditions for the structural aspect are usually well understood, those of the thermal field are often abstracted from the real physics, for example, fluid flow over a surface is simplified to a film condition and an ambient temperature. Now, the portfolio of products within the SIMULIA offering has grown significantly. It is now possible to couple different physics, thus removing the need to abstract the loads from one solution to the next, for example the structural deformation in the tube of a peristaltic pump can be linked to the fluid field to predict the flow performance. The purpose of this session is to reveal the power of the SIMULIA physics offering.

Technology Sessions

The Fundamentals of Abaqus and Practical Finite Element Simulation

Stuart Nixon *Dassault Systemes* & Robert Johnson *Realistic Engineering and Analysis Limited*

From equilibrium to iterations, reduced integration to explicit, it is important for everyone to understand the fundamental building blocks of the Abaqus Solvers. This session will review all aspects of basics of the Abaqus technology on which all simulations are built. These ideas will be coupled to an introduction to practical finite element simulation – based on 40 years of expert consultancy experience. This practical overview will be based upon real world examples. Topics that will be covered include:

- Solver techniques
- Free body diagrams
- Determinate/Indeterminate
- Materials Selection
- Units

Electromagnetic session

This breakout session means to give to the audience an in depth view of the 2020 New Features for both CST Studio Suite and Opera. The topics of the session will span across hi-tech, antennas, bio-medical as well as charged particles applications.

Preliminary Agenda:
14:00 – 15:30 New features of CST Studio Suite 2020 and Opera 2020
15:30 – 16:00 Break
16:00 – 16.20 Simulation of THz acceleration in dielectric lined waveguide (Graeme Burt – Lancaster University)
6:20 – 16:40 Using OPERA FEA to model complex tuneable permanent magnet systems (Alex Bainbridge - STFC Daresbury Laboratory)
16:40 – 17:10 Multiphysics Simulation for Life Sciences including MRI applications 17:10 – 17:30 Overview of Charged Particle Dynamics simulation tools and applications

Fluids – Computational Fluid Dynamics

SIMULIA is pleased to introduce its computational fluid dynamics offerings for 2019 and beyond. With recent acquisitions, allied with internal developments, SIMULIA now has a comprehensive and cutting edge range of solutions in this space. There is now a solution for most CFD needs within the SIMULIA brand including the highly accurate and well-validated Lattice-Boltzmann methods (of PowerFLOW), used extensively in Automotive, Aerospace and Digital Rock. The multiphase and free surface Lattice-Boltzmann methods (of xFLOW), used in many industries for complex multiphase problems with moving geometry and the quick and efficient RANS solver embedded in the 3DEXPERIENCE platform

Multibody Systems Dynamics Workshop

The SIMULIA Multibody Systems (MBS) solution is a powerful tool to model and simulate any dynamic system. This includes wind turbines, cars, trains, engines, wing flaps and any other mechanical system. Within this workshop a brief overview and introduction to Simpack will be presented and there will be the opportunity to get hands on with the software with basic and intermediate modeling techniques. Come and join us to see how MBS could be utilized within your existing and future workflows.

CATIA to Shape and Reveal the world we live in

CATIA is the World's Leading Solution for Product Design and Experience. It is used by leading organizations in multiple industries to develop the products we see and use in our everyday lives. CATIA spans the entire product development process, from original creative design to implementation. It also integrates system-of-systems aspects as part of the Internet of Experiences.

CATIA delivers the unique ability not only to model any product, but to do so in the context of its real-life behaviour: design in the age of experience. Systems architects, engineers, designers, construction professionals and all contributors can define, imagine and shape the connected world. Also, find out in this introduction how CATIA is driving new technology developments such as Cognitive Augmented Design.

Agenda:

2.00	Introduction • CATIA to Shape and Reveal the world we live in
2.20	Why Dymola should be part of your toolset for multi-disciplinary systems modelling and analysis • Dymola 2020 update
3.00	*Networking break*
3.30	CATIA | SFE CONCEPT - Powerful tools for a simulation-driven design process • Introduction and customer stories • Application cases in aerospace and railway industries • CONCEPT STRUCTURE ENGINEER – the next generation of conceptual structure engineering on the **3D**EXPERIENCE platform
4.30	How Generative Design can increase your productivity through an integrated set of flexible process-driven capabilities

Final Agenda – 30th October

8:00	Registration & welcome coffee				
9:00	Welcome Remarks – Jonathan Carter, SIMULIA Director				
9:15	SIMULIA, Reveal the World We Live In – Dr. Victor Oancea, SIMULIA R&D Sr. Technology Director, CSO Structure				
9:45	Keynote One: Building a virtual test lab in Novo Nordisk delivering results in 1 hour - using automation and democratization - Morten Nielsen, Senior Research Scientist Engineering Analysis & Materials and Martin Ebro, Senior Manager Engineering Analysis & Materials Novo Nordisk A/S				
10:15	A Novel End-to-End Solution for Solving Super Large Structural Simulation Problems - Vladimir Belsky - SIMULIA R&D Technology Director				
11:00	Break & Exhibition				
11:30	Keynote Two: The role of simulation software in teaching and research: Current practice and future insights - Georgios Mavros, Senior Lecturer in Intelligent Mobility and Vehicle Dynamics - Loughborough University				
12:00	Discovery Sessions – choose one from the 5 below				
	An introduction to Fatigue and Durability Analysis	Expanding SolidWorks Simulation capabilities with Structural Simulation Engineer	Expanding simulation possibilities with Isight	3DEXPERIENCE for the Traditional Analyst – Leveraging the Power of the Platform for Simulation Post-Processing	From FE to CHT: Revealing the Power of Multiphysics
13:00	Lunch				
14:00	Technology Sessions – choose one from of the 5 below				
	The Fundamentals of Abaqus and Practical Finite Element Simulation	Electromagnetic session	Fluids – Computational Fluid Dynamics	CATIA to Shape and Reveal the world we live in	Multibody Systems Dynamics Workshop
15:30	Break & Exhibition				
16:00	Technology Sessions continued				
	The Fundamentals of Abaqus and Practical Finite Element Simulation	Electromagnetic session	Fluids – Computational Fluid Dynamics	CATIA to Shape and Reveal the world we live in	Multibody Systems Dynamics Workshop
17:30	Day 1 Ends				
18:30	Drinks reception				
19:00	Conference Banquet				

Final Agenda – 31st October

8:30	Welcome remarks – Yves Lombard Senior Director, Sales, SIMULIA
8:40	Keynote Three – ~~Rapid Prototyping~~ Rapid Products: The Power of Simulation, Artificial Intelligence and Additive Manufacturing - Dr. Robin Tuluie, Founder and CEO - MotoDynamics, Chief Scientist - Keselowski Advanced Manufacturing (KAM) and Technical Consultant - Ducati MotoGP
9:10	User Papers Session One - Fluids, Structures and Electromagnetics: 1. An Overview of Computational Aeroacoustics Research at TU Delft with PowerFLOW - Francesco Avallone - Delft University of Technology 2. Dynamic FSI impact simulation and verification for rubber mount with fluid using Abaqus - Robert Luo - Trelleborg 3. Increasing the efficiency of TWT by increasing from 2 to 4 stage collector - Ben Hall - TMD Technologies 4. Active Millimeter Wave Beam-Steering Array Antennas for 5G - Aakash Bansal - Loughborough University
10:30	Break & Exhibition
11:00	User Paper Session Two - Simulation Workflows 1. Democratisation of CAE within Jaguar Land Rover - Mike Brown JLR 2. Topology optimization including parametrization of joint positions and characteristics: Application to a rear wheel suspension assembly - Andreas Mattiasson, Aliki Berndtsson, Robin Larsson - Volvo Car Corporation & Anton Jurinic - Dassault Systemes Sweden 3. Predicting the Microstructure of Additively Manufactured Parts using Cellular Automata and Abaqus -Tyler London - TWI 4. Piloting 3DEXPERIENCE for End-to-End Body NVH & Durability Analyses at JLR – Part 2 - Tayeb Zeguer - JLR
12:20	Cloud 3DEXPERIENCE - Pieter Degelin EuroNorth Cloud Advocacy Expert & John William Senior Solution Consultant SIMULIA
13:05	Lunch
14:00	User Paper Session Three – Structural Mechanics 1. Development of a wear algorithm using finite element analysis to investigate design variations on the wear rates in total hip replacements - Shawn Toh - Liverpool John Moores 2. BV Hydrogen-Diffusion Coupled Cohesive-Zone Modelling of Crack Propagation in Steel Structures - Vincent Bouwman, Dr. Nils Götzen & Gaëtan van den Berg - 4RealSim 3. Characterisation of an energy absorbing component in dynamic analysis - Poppy Harrison - Atkins 4. Replenishment at Sea: Simulating the release of tensioned wire rope systems - Bill Austen – QinetiQ
15:20	SIMULIA Update and Beyond - Dr. Victor Oancea, SIMULIA R&D Sr. Technology Director, CSO Structure
16:20	Q&A
16:30	Conference close

Keynotes

Building a virtual test lab in Novo Nordisk delivering results in 1 hour - using automation and democratization

Martin Ebro Senior Manager – Engineering Analysis & Materials

Martin is leaing Novo Nordisk's aspirations towards a Virtual Development environment in which fast design iterations will significantly reduce the lead time of new medical devices. Prior to this, Martin was co-founder and partner in Valcon Design, defining an industrial application of Robust Design and deploying this in Danish industry.

Morten Nielsen, Senior Research Scientist – Engineering Analysis & Materials

Morten is technical lead in Novo Nordisk's aspirations towards a Virtual Development environment in which fast design iterations will significantly reduce the lead time of new medical devices. Morten has 18 years' experience working with FEA, in the mobile phones industry and the medical device industry, and has over the years been involved in numerous efforts focusing on extended use of simulations in product development, and democratization of simulation tools.

Abstract:

A complex medical device requires 10.000 design iterations from idea to production. Reducing the cycle time of each design iteration can therefore dramatically reduce the development lead time for new devices. Using virtual simulations instead of physical prototypes to test the performance of each design iteration reduces the typical lead time of each design iteration from weeks to hours. However, using virtual simulations requires access to advanced software, computation power and specialists. The presentation focuses on how Novo Nordisk is using 'automation' and 'democratization' to overcome these barriers.

The role of simulation software in teaching and research: Current practice and future insights

Georgios Mavros, Senior Lecturer in Intelligent Mobility and Vehicle Dynamics, Loughborough University

Dr Georgios Mavros received his master's degree in mechanical Engineering from the National Technical University of Athens in 2000 and a PhD in tyre modelling from Loughborough University in 2005. George is currently a senior lecturer in Intelligent Mobility and Vehicle Dynamics in the Aeronautical and Automotive Engineering Department at Loughborough University and has also served as technical manager for Simpack UK – Dassault Systemes. He has led numerous projects funded by UK research councils and the industry and is author of more than 30 publications on vehicle dynamics and tyre modelling. He has taught more than 700 undergraduate and post graduate students, supervised 10 PhD researchers and delivered talks, training courses and workshops in academia and the industry.

Abstract:

The presentation discusses the use of Multi-Body (SIMPACK) and Finite Element (Abaqus) software in academia. First, some examples of projects are provided from the automotive and aeronautical spaces, including tyre-soil interaction, landing gear deployment, Formula Student car simulation, bicycle/rider simulations and others. While the use of finite-element analysis software has long become mainstream in Academia and Industry, the role of multi body dynamics is somewhat less appreciated and not as well defined. SIMPACK is used further as a paradigm, to illustrate where, how and with what benefits multi-body dynamics simulation can be used in research and teaching. From this standpoint, an attempt is made to address the question of what the optimum balance might be between teaching fundamental science, programming and commercial software, in the context of operational constraints within UK Universities and the demands of modern Industry. It is argued that following a few decades of mass adoption of simulation software, mature representatives of the Industry have recently entered a new phase – that of exploring the limits of the software and even exceeding them, using extensions offered through scripting and other opportunities. Then, it appears that fundamental understanding of the physics together with strong programming skills are more pivotal in unlocking the potential of modern software, rather than mechanistic learning of a software package. Such skills will also allow future simulation ambassadors to reap the benefits offered by co-simulation, multi-scale/multi-domain simulation, the use of HPC/cloud computing and multi-physics simulation platforms.

~~Rapid Prototyping~~ Rapid Products: The Power of Simulation, Artificial Intelligence and Additive Manufacturing

Dr. Robin Tuluie - Founder and CEO of MotoDynamics, Chief Scientist at Keselowski Advanced Manufacturing (KAM) and Technical Consultant - Ducati MotoGP

Dr. Robin Tuluie's career began at Berkeley University in Theoretical Physics, simulating the large-scale gravitational evolution of the universe. Here Robin first realized that the path to understanding complex systems runs through simulation. This led to the discovery of a new effect in gravitational dipole distortions in the microwave background radiation.

His passion for racing led him to Formula One, with his first role as Head of Research and Development for Renault F1 during the championship years with Fernando Alonso. Robin's R&D team developed the tuned mass damper, interconnected suspension and the fluid inerter. Robin and his team created these innovations with the help of multi-physics simulation, pushing the boundaries of what was possible at the time.

A move to the newly founded Mercedes F1 team in 2010 as Chief Scientist and Head of R&D was followed by another two world championships with Lewis Hamilton. Robin's R&D team developed FRIC, air spring suspension and other platform support systems, along with innovative brake-by-wire, steering, starts and cooling systems. These innovations would not have been successful without a significant investment in multi-physics simulation.

After 12 years in F1, Dr. Tuluie joined Bentley Motors as Director of Vehicle Technology, where he was responsible for engineering simulation strategy and capability, while also delivering innovation projects, including Additive Manufacturing, through his dual role as Director of Bentley Design and Engineering Services.

MotoDynamics Ltd was founded by Robin to bring new methods and innovation to motorsports. As of Oct. 2019 he is supporting clients in the areas of Motorsports and OEM simulation and innovation, Metal Additive product simulation and AI/ML applications. He holds patents in Formula One, MotoGP and within the automotive space and is the creator of the Tul-aris MotoGP bike.

Meet SIMULIA HQ Attendees

Vladimir Belsky, SIMULIA R&D Technology Director

Vladimir Belsky has a Ph.D. degree in Structural Engineering from the University of Civil Engineering in Moscow, Russia. He started his career at SIMULIA in 1996 as a Development Engineer. Currently he is a R&D Technology Director, Equation Solvers. He and his group are responsible for development of highly efficient scalable linear equation solvers, eigensolvers and other capabilities heavily influenced by the solver technology.

Vladmir will present A Novel End-to-End Solution for Solving Super Large Structural Simulation Problems on the 30th October at 10:15am.

Abstract:
The demand for solving super large structural simulation problems has been significantly increased in recent years. Ten years ago, it was a dream for finite-element analysis specialists to solve structural problems with the sizes of 50 million to 100 million degrees of freedom. Today, this is no longer a dream but has become a reality because of the evolutions of the software and its supporting hardware. This presentation includes the description of an end-to-end solution for solving super large structural simulation problems that can be more than 200M degrees of freedom. The ultimate goal is to reduce manual workloads of simplifying and abstracting geometrical details and to achieve an unprecedented high level of simulation fidelity and accuracy. This novel end-to-end solution covers modeling, solving, and result analysis, making "simulate as designed" possible.

Dr. Victor Oancea, SIMULIA R&D Sr. Technology Director, CSO Structures

Victor earned his PhD from Duke University in 1996 in the area of computational mechanics. He joined what was then called Hibbitt, Karlsson and Sorensen, Inc., which today is SIMULIA. Victor has worked in a variety of R&D positions through the years and is today the Mechanics Technology Director as part of the SIMULIA CTO office. In the last few years Victor has led the additive manufacturing simulation efforts at SIMULIA, micro-mechanics based multiscale materials, particle methods for extreme deformation, oil and gas multiphysics formulations, developed co-simulation-based multi-scale modeling.

Victor will present: SIMULIA Update and Beyond on the 31st at 3:20pm.

John William, Senior solution consultant, SIMULIA EURONORTH

John has over 15 years of experience in the simulation and modelling industry. He has a master degree in Simulation techniques from the RWTH in Aachen. Over the years he has been working in different roles within the SIMULIA brand such as technical support, engineering services and technical sales. John has been actively involved from the start with the Dassault Systemes Cloud offering and is currently working with the major accounts in the EURONORTH region promoting the Simulation products on the cloud.

Pieter Degelin - EuroNorth Cloud Advocacy Expert

Pieter has over 20 years of experience in the CAD, PLM industry. He has a master degree in Electro Mechanics from the technical university BME in Ghent. Since last year he is responsible for the advocacy of the 3DEXPERIENCE platform on the cloud.Previously he has been working in different roles in the Value Solutions partner support. His technical expertise lies mainly in CATIA 3D modeling and cloud.

John and Pieter will present Cloud 3DEXPERIENCE on the 31st October at 12:20pm.

Abstract: This presentation will start with an overview of the Dassault Systemes cloud offering. We will discuss the different types of cloud offering and the benefits of using a cloud-based business platform. Later we will take a look at the latest SIMULIA solutions for cloud simulation. We will discuss how the cloud HPC is well suited to manage varying simulation workloads in an age of increasing compute diversification. Finally will also show how to get started with running simulation on the cloud.

User Presentations - The centrepiece of the RUM

The Regional User Meeting has become a time-honoured tradition. For 30 years industry and academia have met across the country to exchange success stories and challenges, and to debate and predict the future of simulation technologies.

The core of the conference is the shared user experiences and this e-Book details the abstracts that will be presented as technical papers during the conference. Some of the other features of the conference are also discussed in order to give as full a picture as possible of the benefits attainable from attending this event.

User presentations provide first-hand knowledge of deploying SIMULIA solutions and developing workflows for real world realistic simulation. These presentations usually contain additional detail such as videos and animations not available in the published papers. More importantly, the live presentations enrich the paper by providing unique user-specific viewpoints.

Attending the conference also provides you with the opportunity to ask questions at the end of each presentation to clarify specific points and to meet the presenters in the networking sessions for more detailed discussion of ideas.

User Paper Session One: Fluids, Structures and Electromagnetics

An Overview of Computational Aeroacoustics Research at TU Delft with PowerFLOW - Francesco Avallone - Delft University of Technology

An overview of the computational aeroacoustics research activities carried out at TU Delft with the software SIMULIA PowerFLOW will be presented. Numerical simulations are used to provide additional information compared to experiments, necessary to enrich the fundamental knowledge of the noise sources and to develop physics-based noise reduction strategies. In this talk, comparisons between experimental and computational results will be shown for several cases (e.g. trailing edge noise, jet installation noise and acoustic liners) with particular focus on the application of porous material models to replicate homogeneous porous material, widely used for noise mitigation.

Dynamic FSI impact simulation and verification for rubber mount with fluid using Abaqus - Robert Luo – Trelleborg

This report presents an integrated procedure for dynamic impact predictions and an experimental verification for rubber–metal bonded components with fluid to be used as potential engineering applications. There are three steps involved in the procedure. First, a quasi-static analysis was performed to verify the elastic properties of the rubber material using hyperelastic models. Second, a dynamic impact evaluation on selected hydro-mounts without fluid was conducted using the Natural Frequency Region (NFR) approach. Finally, a coupled NFR with Fluid-Structural-Interaction approach, different from the usual viscoelastic methods, was initiated to predict the dynamic impact responses of the component with the fluid in time domain. All the analyses have been validated with experimental data. The first two stages have been briefly described and the third stage is detailed. It should be noted that a powerful computer with multi-central processing units is essential to obtain a reasonable result within an acceptable time frame. It has been suggested that the natural frequency region–fluid–structure interaction methodology is reliable and could be used at the design stage. The work may provide a reference for the relevant work and help to more accurately simulate the dynamic response of the rubber antivibration systems with fluid. Support on this simulation from Abaqus team in UK is much appreciated.

Increasing the efficiency of TWT by increasing from 2 to 4 stage collector - Ben Hall - TMD Technologies

Using the CST Studio we have been modelling the efficiency increase of a TWT by increasing the number of collectors from 2 to 4. A combination of Tracking and PIC solvers have been used to compare simulations and optimise the shape of the structure.

Active Millimeter Wave Beam-Steering Array Antennas for 5G - Aakash Bansal - Loughborough University

To meet the increasing demand for faster data-rates and reliable connectivity for everyone everywhere, and to support new technologies such as Internet of Things, millimeter waves have been identified as a suitable spectrum for developing fifth generation technology. mmWave communication systems already exist for point-to-point indoor communications, however, to develop the same for smartphones and base stations in an outdoor setting poses a new challenge because of interference/attenuation from atmospheric particles and rain drops. New types of antennas are needed that can focus radiation in particular directions to minimise losses and interference. Traditionally, complex phase shifters feeding antenna arrays are used to beamform radiation patterns in different directions. These can be cumbersome and are not ideal for small installations.

This work is looking into developing cheaper and more feasible active antenna array systems for electronic beam-steering. It investigates smart Substrate Integrated Waveguide (SIW) slot antenna arrays with a new feeding technique at 28GHz. By including the active control on the feed network itself, the antenna can steer the beam in different directions without any phase shifters, thus saving cost on fabrication and miniaturizing the overall structure.

User Paper Session Two: Simulation Workflows

Democratisation of CAE within Jaguar Land Rover - Mike Brown JLR

The automotive industry is highly competitive. Improving efficiency within product delivery without compromising performance is vital. Development of associative CAD and automated CAE methods have been distinctly separated over time within Jaguar Land Rover's Body Engineering Department. With the implementation of SIMULIA within the 3DEXPERIENCE platform, efficiency gains have been realised through automated and standardised CAD/CAE templates. Enabling our engineers to repeatedly conduct early component testing earlier in the design process assured of the quality of the results.

Engineering solutions fundamentally involve Methods, Processes and Tools, but it is the Engineer that has to bring these together. Since our previous presentation at RUM 2016, we have now grown and expanded use of automated simulation engineering templates. The democratisation of CAE and introduction of these new tools into an existing product development process has presented significant challenges. This paper explores the positive impact this new technology has had on our engineers and how we can increase this in the future.

Topology optimization including parametrization of joint positions and characteristics: Application to a rear wheel suspension assembly - Andreas Mattiasson, Aliki Berndtsson, Robin Larsson - Volvo Car Corporation & Anton Jurinic - Dassault Systemes Sweden

The shift towards electric propulsion of automotive vehicles brings higher demand for lightweight structures since the high prices of battery capacity put further need on energy efficiency. Lightweighting is one among several ways, e.g. reduce drivetrain losses, aerodynamic drag and rolling resistance, to improve energy efficiency and it can bring significant cost advantages in terms of price per range. Topology Optimization (TO) is a design tool often used to refine the geometrical layout relatively late and is applied to single components with predetermined

boundary conditions such as joint loads and joint positions, i.e. constraints that narrow the solution space for the design. Therefore, the main idea is to broaden the solution space by introducing TO on system level together with an outer parametric loop for the joint positions. A Finite Element (FE) model of a rear wheel suspension system is developed and validated with respect to the force signals from an existing fully modeled, dynamic, vehicle system. FE modelling techniques using SIMULIA Abaqus of structural and tuning parts such as cast components, thin sheet components, bushing joints, screw joints, dampers and springs are treated. The linkages are then optimized with respect to stiffness and weight based on current joint positions.

The proposed scheme for parametrization of joint positions is limited to a two-component system model. It is used for demonstration of a combined workflow where parametric and non-parametric optimizations are performed simultaneously. SIMULIA Tosca Structure is used for non-parametric stiffness optimization in an inner optimization loop and SIMULIA Isight is used in the outer optimization loop for parametric DoE (Design of Experiments). The studied parameters are geometric dimensions and bushing locations of the suspension components as well as the bushing characteristics. SIMULIA Abaqus/CAE is applied to automatically build the new suspension assemblies based on the input parameters from the outer loop of SIMULIA Isight. The demonstrator shows fully automated parametric and non-parametric optimization workflows with different type of trade off studies on the assembly.

Overall, the FE-model correlates well with respect to the force signals. However, there is still room for improvement, especially with respect to modeling of the dampers. There is also a need for correlation of the FE-model with respect to displacements in order to introduce proper stiffness constraints during optimization. The future potential for TO on system level is promising. In addition to a broader solution space through parametrization, the relative mass distribution between the components is achieved within one single system optimization.

Predicting the Microstructure of Additively Manufactured Parts using Cellular Automata and Abaqus -Tyler London – TWI

Additive Manufacturing (AM) enables the production of complex, highly optimised, lightweight geometries with applications in the aerospace, automotive and biomedical industries amongst others. Whilst AM has seen increasing attention, one of the main challenges is the link between processing conditions, microstructure and mechanical properties.

At present, the impact of different processing conditions such as scan strategy, substrate pre-heat, and energy density on the resulting grain structure is widely unknown. However, this knowledge is necessary for a reliable relationship to be developed between the microstructure and mechanical properties of the manufactured part. To that end, computational modelling can complement empirical studies to provide insights into observed behaviours and features.

One approach for predicting grain structure resulting from transient thermal gradients is the cellular automata (CA) method. CA models have developed rapidly in the last few years as their predictive power has been increasingly demonstrated and validated. In this work, CA methods are coupled to nonlinear, transient heat transfer models in Abaqus to predict (1) the solidification microstructure for single-track laser scans; (2) the functional grading and tailoring of microstructures in laser powder bed fusion AM parts; and (3) the prediction of columnar-to-equiaxed microstructures in wire-arc additive parts. The work is presented through the framework of the AM modelling capabilities in Abaqus that were validated through the NIST AM Benchmark competition.

Piloting 3DEXPERIENCE for End-to-End Body NVH & Durability Analyses at JLR – Part 2 - Dr T. Zeguer1*, Dr G. Georgiou1 and K. Kueres2

The objective of this work was to continue an investigation into new methods for Design-integrated simulation to improve overall efficiency of Body Development at JLR using the 3DEXPERIENCE platform. To meet this goal, we have investigated 3DEXPERIENCE for end-to-end selected Body Noise Vibration Harshness (NVH) and Crash load-cases in 3DEXPERIENCE, resembling Design Verification Processes (DVPs) that are used during the Product Creation & Delivery System phases (PCDS) at Jaguar Land Rover (JLR). For this purpose, the physical product of the Jaguar XE Trimmed BiW was selected and its FE representation was built in 3DEXPERIENCE according to JLR model build processes. A previous study [1] covered aspects of the development process including FE model assembly and load case definitions. This addendum aims to cover in more detail the topics of automatic reporting and collaborative results sharing in addition to the demonstrating the capabilities to interact with external solvers.

Keywords: Body NVH & Durability Analyses, Design Verification Process, Model Build-Up, FE Representations, Orphan Meshes, Load-cases Set-Up, HPC submission, Light-Weight Visualisation, Reporting.

[1] Piloting 3DEXPERIENCE for End-to-End Body NVH & Durability Analyses at JLR – SIMULIA 2018 Regional User Meeting

User Paper Session Three: Structural Mechanics

Development of a wear algorithm using finite element analysis to investigate design variations on the wear rates in total hip replacements - Shawn Toh - Liverpool John Moores

The number of people receiving Total Hip Replacement (THR) are increasing every year at around 3.5% while the average age of the recipients is decreasing. The current average life of a THR is between 15 to 20 years which is not adequate for young active patients. Wear is known as one of the main reasons affecting the longevity of these implants which leads to infection or loosening of the prosthesis. Computational analysis can improve the design and increase the longevity of the implants by investigating different parameters including design variations and surgical techniques. A previously developed in-house fretting wear algorithm has been shown to model effectively the evolution of wear at the taper junction of THRs which exhibit short relative displacements as validated against retrievals. The overall aim of this study is to develop a general wear algorithm to simulate the wear rate at the taper junction and the bearing surfaces (which are subject to much larger relative displacements). As such, in this study, the in-house fretting wear algorithm which uses a Python program in the Abaqus environment has been generalized to facilitate the analysis for wear and material loss at both the taper junction and bearing articulating surface for different THR designs. It has been shown that the generalized fretting wear algorithm can predict the evaluation of wear rate at the taper junction of any design of THRs which can be used to investigate the design variations on the wear rates.

BV Hydrogen-Diffusion Coupled Cohesive-Zone Modelling of Crack Propagation in Steel Structures - Vincent Bouwman, Dr. Nils Götzen & Gaëtan van den Berg - 4RealSim

Simulation of hydrogen-driven embrittlement of steel structures has become a hot topic over the recent years and various solutions have been proposed (Jemblie et al., 2017). We present a coupled diffusionstress analysis approach in combination with a cohesive zone model to simulate the hydrogen driven material degradation and crack propagation in steel structures, which are exposed to a sour environment.
The interaction between hydrogen diffusion and trapping with mechanical loading, specifically hydrostatic stress and plastic deformation is governed by the mass conservation law proposed by Sofronis (1989) and Krom (1999) and implemented into the simulation using UMATHT and UHARD subroutines on the basis of the well-established analogy between hydrogen diffusion and heat transfer.

The crack propagation along a predefined crack path is introduced into the simulation using general contact pairing with cohesive behavior definitions, while the material degradation (embrittlement) is implemented via dependencies of the cohesive strength and fracture energy on field variables representing the hydrogen concentration/coverage at the surfaces of the cohesive zone.

The developed approach is employed to conduct virtually the NACE Standard Double-Cantilever-Beam Test (NACE TM0177 Method D standard) while its applicability is evaluated. Furthermore, challenges in the implementation of and communication between the multitude of used subroutines is discussed. Last but not least, the numerical issues to obtain a converging solution are addressed

Characterisation of an energy absorbing component in dynamic analysis - Poppy Harrison - Atkins

Atkins has undertaken dynamic finite element analysis of safety-critical containers for use in highly regulated industries. The work presented here uses the capabilities of ABAQUS/Explicit to model a stainless steel container and assess the performance of the structure in a 1m drop event. The system comprises the container wall, a lid which is attached to the body of the container with a clamping arrangement, miscellaneous unsecured contents, and an energy absorbing component designed to attenuate the load applied to the container and lid during an impact.

A modelling method was developed for the energy absorber, including calibration against practical test data with the properties tuned to capture localised behaviour of parts of the global model. The FEA models were used to analyse the performance of the system in a range of impact orientations, and the effect of variance in key parameters such as material stiffness, geometry, and crushing load of the energy absorber was investigated. Sensitivity to modelling methods used to simulate the energy absorber (including connector element definition) was also explored.

Post processing of the models was enabled through python to assess transient model deformation including gapping between the container lid and the body of the container. The residual plastic strain in key components was also investigated and compared to an allowable based on relevant material standards

Replenishment at Sea: Simulating the release of tensioned wire rope systems - Bill Austen – QinetiQ

One of the responsibilities of the Royal Fleet Auxiliary (RFA) - a branch of the British Royal Navy - is to support the UK fleet with supplies, fuel and maintenance services whilst deployed around the world. To fulfil this role it is necessary to transfer materiel and food supplies between vessels in open waters, which may be accomplished by a procedure known as Replenishment at Sea (RAS). RAS involves establishing and maintaining a tensioned Jackstay (wire rope) between the two moving vessels so that goods can be hauled between them via mechanised winch systems. This presentation describes modelling work undertaken by QinetiQ's Farnborough-based Structural Analysis team to assess the dynamic behaviour and potential hazards associated with release/failure of the tensioned RAS system during operation. The approach taken, using Abaqus, is relatively simple in concept but required significant challenges to be overcome in order to reach a successful conclusion. Once developed, the analysis methods were implemented through scripted processes to evaluate multiple scenarios on two different RAS systems. Output from this work will assist UK MOD in understanding the concept of potential failure of steel wire rope being used in such applications as this.

Networking - Connect to your local community

We expect more than 150 attendees at the 2019 RUM. The attendees will come from across Europe and represent a wide variety of organizations. The agenda for the 2019 conference has been planned to maximise the opportunities for networking allowing delegates to learn from the experiences of others.

With delegates representing a wide range of industries and academic institutions you are sure to meet somebody working in a similar field to yourself. However, often the breakthroughs in simulation methods come from looking at work on quite different applications, so be sure to speak to a range of delegates.

In addition to the usual breaks per day, the 2019 RUM will offer the following networking opportunities:

Wednesday 30th October

11:00 Exhibition Break

13:00 Lunch

15:30 Exhibition Break

18:30 Drinks Reception – Exhibition Area

19:00 Conference Banquet – Princes suite

Followed by.... After Dinner Game!

Back by popular demand is the after banquet challenge, a competition of skill unrivalled in its levels of buffoonery and problem solving. So prepare yourselves for the 2019 'experiment':

Sink or Swym!

Thursday 31st October

11:00 Exhibition Break

13:00 Lunch

Conference Exhibition

NEW FOR 2019*

In addition to our partnered sponsors, during breaks and lunches the Dassault Systemes team will be exhibiting our extensive range of solutions to industry challenges and workflows. Our technical team will be providing a combination of interactive stands, allowing attendees to get hands-on, and demonstration models to highlight key capabilities within these solutions.

The Great British clean up *

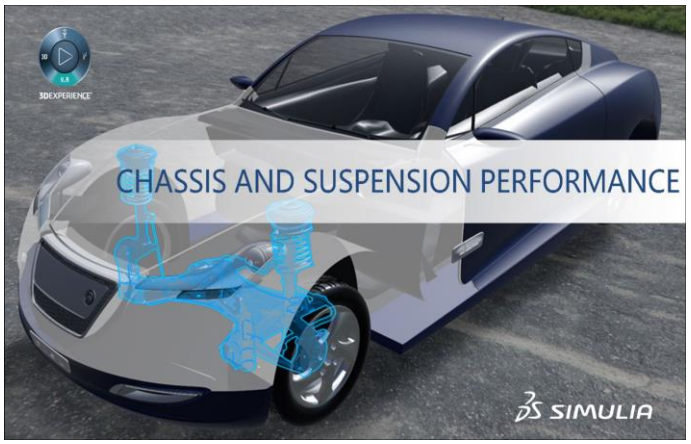
Have you got what it takes to save the world? Can you create the best drone to clear up a potential fatal chemical spill?

During the exhibition breaks we challenge ALL conference attendees to participate in the toughest SIMULIA challenge yet!

Attendees will be tasked to use Dassault Systemes solutions (provided at the SIMULIA stand) to create the optimal drone capable of removing the reactive agent away from the chemical spill.

All submitted designs will be 3D printed during the conference and LIVE tested on stage during closing remarks where we will announce the winner.

3DEXPERIENCE: Driving Innovation*



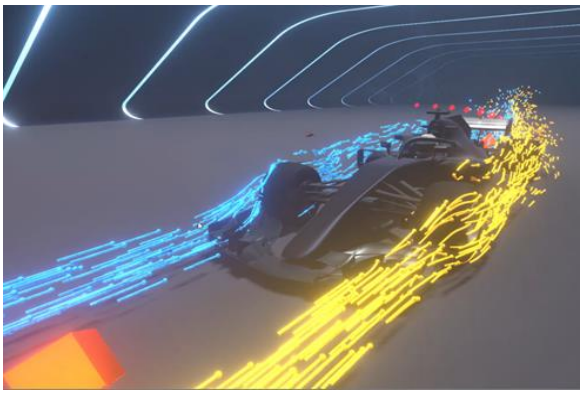
Come visit us at the 3DEXPERIENCE area where our SIMULIA experts will be discussing and demonstrating integrated simulation technology within an industry example; DRIVING INNOVATION within chassis and suspension design.

Learn more about:-

- Material calibration: Interpret experimental data for simulation use, assess and match captured data to the optimal material model
- Large component deformation: Analyse and validate components subjected to intense load conditions
- Component optimization: Tailor your design based on operational needs and manufacturing methods
- Durability: Design for improving fatigue life at component and system level

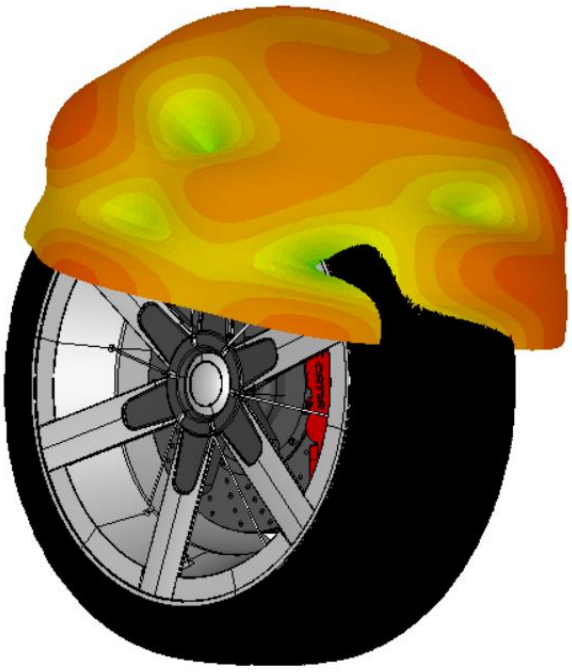
Step into Two of our Virtual Worlds

1. This interactive virtual reality demonstration allows us to explore and experience the airflow around a Formula 1 Car as it goes through the 1st Turn at the Spa-Francorchamps Circuit. This includes for the very first time a simulation of the way the flow changes in real time due to the steer, pitch, roll, and yaw of the car."



2. The Virtual Human Experience for the Vive is an example of how well-managed data coupled with fully immersive, virtual reality environments can enable experts to better understand the human body through 3D visualization in order to more confidently treat patients.

SIMULIA Electromagnetics Automotive Sensor Simulations



Regulations in the automotive industry directly affects the way cars look, how their components are designed, the overall performance of the vehicle and most importantly the safety features built into a modern day car. Electronic sensors play a crucial role in the passenger experience and safety. It is critical to obtain optimized product designs within the tight constraints of costs and time to market.

A modern car can host a wide variety of sensors with the aim of aiding the driver and increasing the safety for passengers and other vehicles. One of such devices is the tire pressure monitoring system (TPMS). A tire pressure monitoring system can actively measure the pressure of the tires in the vehicle and warn the driver whether one or more tires are significantly under-inflated, creating a potential unsafe driving condition. Located within the tire or placed on it, a TPMS will operate in adverse weather conditions, is subject to corrosion, dirt from the road (for example, rain, mud or snow) and different car conditions. Essentially, TPMS systems must be extremely robust and reliable.

During the exhibition, attendees will have the opportunity to verify and test a working model of a TPMS system. They will reproduce a failure condition and optimize the system design to make it reliable in order to guarantee the needed performance in adverse working conditions. Moreover, the attendees will have the chance to see how the SIMULIA electromagnetic solution (CST STUDIO SUITE) allows engineers to easily design and verify the performance of such devices.

Partner Sponsors

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Integral to the success of the SIMULIA RUM, our sponsors bring knowledge, experience and expertise offering innovative solutions that will help streamline and support your engineering process. SIMULIA is pleased to recognise those partners participating in the 2019 SIMULIA Regional User Meeting.

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