

**NWC**  **NAFEMS**  
**NAFEMSWORLDCONGRESS 2019**

17-20 JUNE | QUEBEC CITY | CANADA  
**A WORLD OF ENGINEERING SIMULATION**

incorporating **spdm** **INTERNATIONAL CONFERENCE**  
Simulation Process & Data Management

# Final Agenda & Invitation

[nafems.org/congress](http://nafems.org/congress)





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# NAFEMS World Congress 2019

Engineering analysis, modelling and simulation are dynamic and ever-evolving fields. Gone are the days when everything could be categorised as either FEA or CFD. The rate of progress in software, hardware, techniques and best practice continues at a blistering pace, while the community driving that change also continues to grow and develop to incorporate every part of the product development process.

NAFEMS remains proud to be the only independent, international body dedicated to serving the community, and we want you to play an active role in driving progress and shaping the future of the sector.

As well as hosting the 4th international SPDM conference the Congress will also be hosting Technical Symposia on

- Manufacturing Process Simulation & Additive Manufacturing
- Systems Modelling & Simulation
- Digital trends and what they mean for the engineering simulation community
- VMAP - Interface Standard for Integrated Virtual Material Modelling in Manufacturing Industry

As part of the focus on digital trends, we will be looking at new 'digital' areas from the cutting edge of technology. AI, Digital Twins, VR & AR and Industry 5.0 are just some of the pertinent topics that the Congress will cover.

**This is the only major international event dedicated to your community and your technology. Every aspect of analysis, modelling and simulation will be addressed, covering numerous industries globally. There's nothing quite like it.**

## Registration Fees

### PRESENTING AUTHORS

NAFEMS Members	\$1160 USD
Non-Members	\$1390 USD

### STANDARD DELEGATES

NAFEMS Members	\$1290 USD
Non-Members	\$1520 USD

# Keynote Speakers

Tuesday 18th 09:30

**Charles Poon**

Ford Motor Company  
[USA]



## The Role of Simulation in the Transformation of the Automotive Industry

Charles Poon is Ford's Chief Engineer for Global Powertrain Installation organisation leading a team of over 600 engineers worldwide. He is responsible for all of Ford's global mounts, cooling, exhaust, air induction and fuel system development with the goal of delivering world-class powertrain systems at best in class product development cycle times.

Tuesday 18th 10:00

**Heinz Stoewer**

INCOSE Past President  
and Professor TU Delft  
[GER]



## Systems and Complementary Engineering Disciplines Interactions

Heinz Stoewer is a Past President of INCOSE and Professor at TU Delft. Over his career, he has received multiple national & international honours, produced over 90 publications, and worked at Boeing, ESA, the German & Dutch National Space Agencies, and is Founder/President Space Associates GmbH.

Wednesday 19th 08:15

**Olivier Colmard**

Renault Technocenter  
[FRA]



## Numerical Simulation to Develop and Validate Autonomous Car

Olivier Colmard is Vice President of Integrated CAE & PLM at Renault Group Engineering Division. His focus is on contributing to vehicle & powertrain projects development through CAE, DMU, BOM & Configuration Management, as well piloting the alliance of CAE & PLM Strategy with Nissan & Mitsubishi, Maximize Alliance Synergies, Develop new Methods, Tools & Processes for Numerical Simulation and Digital Continuity.

Wednesday 19th 08:45

**Rodrigo Britto Maria**

Embraer [BRA]



## Applications of SPDM in Aircraft Structural Analysis

Rodrigo Britto Maria is a Senior Engineer in the department of Digital Engineering Systems and Technology Development at EMBRAER S.A. He has worked with the implementation and administration of new CAE, PLM and SPDM solutions at EMBRAER since 2005, and was responsible for the first SPDM implementation at the company.

Wednesday 19th 09:15

**Lyle Levine**

National Institute for  
Standards and Technology  
(NIST), [USA]



## Supporting the Simulation Community with Benchmark Measurements for Additive Manufacturing of Metals

Lyle Levine is a physicist in the Materials Measurement Laboratory of the National Institute of Standards and Technology (NIST), where he leads most of NIST's materials research in additive manufacturing (AM) of metals. Dr. Levine also founded and leads AM-Bench, an international organisation that provides AM benchmark measurements for the AM community.

Wednesday 19th 09:45

Mark Meili

Procter & Gamble [USA]



### "Diffusion of Innovation" Applied to Modeling & Simulation – What can we Learn from Social Science Research and Marketing?

Mark A. Meili is Director of Modeling and Simulation for The Procter & Gamble Company. His role spans both organisations and technical work processes from research to commercialization to supply chain operation. Mark has been a champion of first principles understanding to reduce risk and enable robust technical decision-making throughout his career.

Thursday 20th 08:30

Vicky Pope

Met Office [GBR]



### Achievements and Challenges in Weather and Climate Modelling

Vicky Pope had a long and successful career in the UK Met Office in a variety of roles. She led teams in stratospheric research (working on the ozone hole) and climate model development. In 2002 she became a senior manager of the climate research programme for various government departments, providing climate change science to underpin policy development.

Thursday 20th 09:00

Christian Brix Jacobsen

Grundfos [DEN]



### Implementation of Simulation Driven Development

Christian Brix Jacobsen is Senior Director at Grundfos, heading Mechanical Development and is responsible for design of pumps and electrical motors within the company. He has more than 25 years of experience with simulation methods and the use of these in designing industrial machinery. He also has 20 years of experience in managing R&D in various positions at the company.

Thursday 20th 09:30

Francisco Chinesta

ENSAM ParisTech [FRA]



### The Era of "Twins"! A New Paradigm for Simulation-and-Data-Based Engineering as Applied to Materials, Processes, Structures and Systems

Francisco Chinesta is Professor of Computational Physics at ENSAM ParisTech (Paris, France). He is an honorary fellow of the "Institut Universitaire de France", and fellow of the Spanish Royal Academy of Engineering. He is president of the French association of computational mechanics (CSMA) and director of the CNRS research group on model order reduction techniques in engineering sciences.

Thursday 20th 10:00

Martin Eriksson

Validus Engineering  
[SWE]



### Activities and Factors Essential to the Endorsement of Confidence in Numerical Simulation and Predictions

Martin Eriksson acts as Head of Computational Structural Mechanics at Validus Engineering AB, Sweden. He leads a team of design analysts that performs CAE analyses as well as develops in-house as well as customer company methodologies, procedures, tools and standards for advanced CAE analysis. He has 20 years of experience from CAE analysis activities in various industry sectors.

# Why Attend?

## Increase confidence in your simulation capability.

The simulation and analysis team will only be central in an organisation when it has shown how reliable, repeatable and valuable its results are. Additionally, communicating the real value and ROI of simulation to key stakeholders is vital. To do that, you need to know how other companies are positioning simulation as a strategic capability. And you need to learn how to do it yourself.

## See beyond the “digital” hype.

Virtual and Augmented Reality, the Internet of Things, Artificial Intelligence, Cloud Technology, and Industry 4.0 are becoming embedded in everything we do. Instead of pulling them together under a “digital” name-tag, we need to look beyond the headlines and start discussing, defining and explaining them in the context of the engineering simulation community.

We'll be looking beyond The Hype and exploring (and perhaps bracing ourselves for) the considerable impact that these technologies are expected to have on the engineering industry of tomorrow.

## Gain access to an exclusive programme of short training courses.

One of the great things about the NAFEMS World Congress is the extensive programme of training courses, on FEA, CFD, and related technologies. As an attendee, you can choose from a number of exclusive short courses which will be given by our internationally recognised team of tutors, all as an inclusive part of your Congress experience.

## Discover how systems modeling and simulation fits into your organisation and processes.

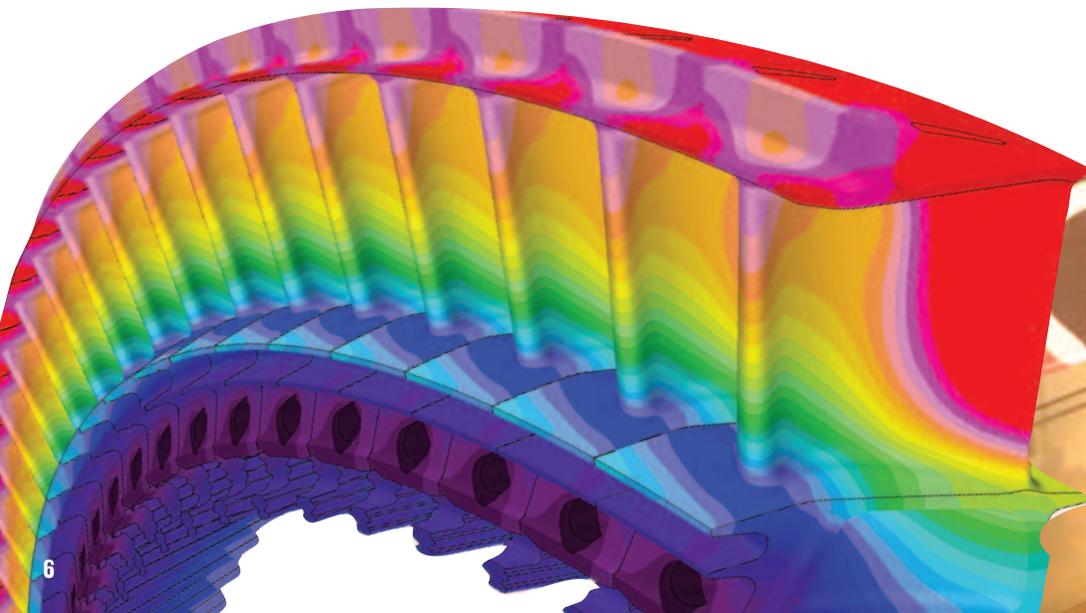
We're seeing systems modeling and simulation at the forefront of many organisation's strategic interests. Increasing product complexity means that multiple disciplines are being integrated to form a complete concept-to-production development process. What impact will this have for you and your team?

## Delve as deep into the technology as you want to.

Of course, we have tracks on the latest trends and hot topics, but the beauty of the Congress is in seeing new trends, technology areas and cutting-edge methods sit alongside traditional papers on the theory, the physics, and the very basis of the technology you work with every day. You'll never be short of discoveries, but there are also myriad opportunities to dig-in to the background and theory you know and love.

## Learn how additive manufacturing and manufacturing process simulation will influence the products of the future.

We're holding a dedicated symposium on additive manufacturing and manufacturing process simulation to discuss and discover the impact of virtual manufacturing tools within the product design and manufacturing cycle. Given each carries the potential to change the way we design and build new products fundamentally, it's critically important for the simulation community to keep pace.



## Understand the transformative potential of SPDM.

Simulation process and data management has grown up. From a once niche area, it is now near-ubiquitous in the simulation and analysis departments of most major corporations. It's still difficult to implement for companies who don't have experience in designing information systems, and many 'off the shelf' solutions don't quite cut it.

The 4th international SPDM Conference, being held as part of the Congress, is the one place to learn what it means, how to implement it, and what mistakes to avoid.

## Connect with colleagues, peers and domain experts.

NWC is entirely independent, and our agenda is driven by what the community has to say about the technology. Attendees face similar challenges, pose comparable questions, and see the same issues and obstacles every day. This is your chance to immerse yourself in the technology and enjoy a conference where you can discuss your work with both peers, and the real industry experts on the same level.

Learn what the move toward hybrid power and electrification means for simulation. Analysis and simulation have a massive role to play as we move away from the traditional combustion engine towards hybrid and electric vehicles. Even for those not directly involved in the automotive industry, the changes are so pervasive that every sector will be affected. The supporting role for simulation must not be underestimated, and it's vital that we understand how we fit-in.

## Visit all of the major software vendors under one roof.

All of the major software vendors are part of the NWC exhibition. This is the one place where they are all treated as equal, in an independent setting dedicated to analysis and simulation. Use that to your advantage by seeing how the latest offerings from each company compare.



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# Quebec City

## La Vieille Capitale



Situated on the northern bank of the Saint Lawrence River, Quebec City is Canada's 'La Vieille Capitale' known for its historic charm and architecture. The city is home to the only remaining fortified city wall north of Mexico, and within these walls (which you can walk on!) lies a treasure trove of historic and visual delights.

Stroll around the cobbled streets of the old city's Lower Town and take in the city's charming architecture and uniquely North American-European feel. Here you will find many boutiques and galleries and of course plenty of bistros where you can get a nice cold craft beer after a day at the Congress. Be sure not to miss the stunning murals dotted around the city, and look out in particular for the impressive Fresque des Québécois on the side of Maison Soumande. History has never looked so alive!

The character of this city is wonderfully reflected in its built environment. From the copper-roofed stone buildings of the Upper Town to the narrow winding streets and many, many stairways (bring your walking shoes!) you really do get a sense of being in a place steeped in a unique history. Of course, if the thought of walking up the 398 stairs of Escalier du Cap-Blanc makes your feet ache there's always the funicular which takes you from the lower to the Upper Town via spectacular views over the city.

Whether on foot or gliding along on the funicular you can't miss the imposing splendour of one of Quebec City's finest buildings, Château Frontenac. With its Chateausque architecture, it dominates the Upper Town's skyline and will be sure to delight.

There's so much crammed into this compact city you might need to take a step back to take it all in. If the strain of craning your neck gets too much, hop on a ferry across the Saint Lawrence river and you will be rewarded with the best views of this magnificent city. If you fancy staying on terra firma, head up to the 31st floor of the Marie-Guyart building and get an unobstructed view of the city from above.

But do not let the romance of the cobbled streets and olde worlde charm fool you, this is only one face of this fascinating city. Québec City is a stunning city where worlds meet and come together in perfect harmony. A forward-facing city deeply rooted in its history and environment, Quebec City has some of the most easily accessible outdoor activities of any world-class city.

15 minutes away from the bustle of Old Quebec you will find the incredible Parc de la Chute-Montmorency where you can either simply marvel at this stunning work of nature from the boardwalk or take a cable car across the gorge for unrivalled views of the falls. Of course, if you're after that adrenalin rush there's always the option to take a zip wire over the magnificent falls and truly get close and personal with this wonder of nature. How many other cities can boast a waterfall on their doorstep?

And the best part? The 2019 NAFEMS World Congress venue, Quebec City Convention Centre, sits on Parliament Hill, right in the heart of the city. The convention centre counts the trendy Saint-Jean Baptiste area as one of its neighbours. This is an area where you will be spoilt for choice when it comes to restaurants and bars. Mere minutes from the Congress venue, wander down Rue-Saint Jean and you will be rewarded with an excellent selection of restaurants serving everything from classic steak frites to the chicest of Nordic cuisine.

A short stroll along Boulevard Honoré-Mercier, a few minutes from the convention centre, brings you to the delightful Fontaine De Tourny and the Parliament Gardens which surround the impressive Parliament building, and is well worth a visit. You will be pleased to know that you will have the opportunity to dine inside the Parliament Building as part of the NWC optional dinner on Tuesday, June 18th. From the Parliament complex Old Quebec and its delights are a further 10 to 15 minutes' walk away.

Thanks to the Convention Centre's excellent location, you will be able to take part in the Congress and enjoy the city with little effort, needing to do little more than step outside.

Quebec City is innovative, forward facing and at home in its history and environment. A place where you can go from strolling along the charming streets of Quartier Petit Champlain to walking over stunning gorges at Canyon Ste-Anne and zipping over the stunning waterfalls at Montmorency Falls Park all in one afternoon. This is a city that truly has something for everyone.



**Quebec City, not just La Vieille Capitale but also La belle Ville, La Ville Exceptionnelle and a city experience like no other.**

**Come join us for NWC19 and experience it for yourself.**

# Short Training Courses

As part of the NAFEMS World Congress 2019, attendees will have access to many short training courses being held over the course of the Congress. These courses will be taken by NAFEMS tutors, and cover topics as diverse as Non-Linear Analysis, Practical CFD, Simulation Credibility and Introduction to SPDM. Registered Congress attendees will be asked to pre-register before the event.

## Numerical Simulation of Multiphase Flows – Basics of Theory and Practical Applications

This short course gives an introduction in modelling and simulation of multiphase flows. The challenges and problems of modelling multiphase flows are discussed and the ideas of different modelling approaches will be described in general. Some examples of multiphase flow simulations show the application of the models as well as advantages and disadvantages of them.

## Simulation Driven Engineering with Computational Acoustics

This short course gives an introduction in modeling and simulation of acoustical phenomena. The challenges of acoustics as a multiphysical approach are discussed and the state of the art of modelling will be outlined. Typical industrial examples show the application of the models and its pros and cons.

## Introduction to Probabilistic Analysis and Uncertainty Quantification

Experienced practitioners who construct complex simulation models of critical systems know that replicating real-world performance is challenging due to uncertainties found in simulation and physical tests. This course will discuss the types of uncertainties and how to quantify these uncertainties through the use of state-of-art statistics and machine learning methods. This course will discuss the broad applications these probabilistic techniques have in analyzing numerous forms of engineering systems including Digital Thread/Digital Twins.

## Composites

Due to the nature of composite materials, stress analysis and failure prediction is far more complex than isotropic materials. The objective of this overview is to break down the composite FE analysis process into clearly defined steps, give an overview of the physics involved and show how to implement practical solutions using Finite Element Analysis.

## Nonlinear Analysis

Many problems facing engineers are nonlinear in nature, where the response of a structure cannot be simply assessed using linear assumptions. One of the most difficult tasks facing an engineer is to decide whether a nonlinear analysis is really needed and if so what degree of nonlinearity should be applied. This overview will examine these issues, and look at the best ways of creating an analysis plan that matches key objectives.

## Dynamic Finite Element Analysis

This a short overview of the basics of dynamics analysis, building quickly from normal modes analysis to transient and frequency response. The session is packed with hints and tips on the most effective ways to set up these analyses - and some reminders about the implications of a dynamic environment for designers and analysts. Attendees qualify for a 15% discount on Tony's new NAFEMS book, How to do Dynamic FEA.



## Structural Optimization - Topology Optimization and Generative Design

This short overview looks at the range of optimization techniques available in FEA today. A brief history shows the development of these methods and the various strengths and weaknesses. The future role of optimization is discussed – particularly when aligned with new manufacturing methods and vastly improving computing resources. The final topic is the continuing role of the engineer in providing the required innovation and definition of the optimization task.

## Fatigue Analysis

This short course gives some insight into the methods behind high and low cycle fatigue and fracture mechanics methods. How are they different? When do we use them? What are the implications for FEA?

## Joints and Connections

Most structures involve some form of jointing or connection. This overview looks at popular FEA methods for simulating mechanical joints, welding and bonding. Different idealization approaches and element types will be reviewed. Hints and tips will be developed based on identifying key analysis objectives.

## Effective Postprocessing of Structural Analyses

The range of post-processing options can be bewildering. However, understanding how to interrogate stress results is key to effective FEA. A road map is developed that shows how to use Von Mises, Cartesian and Principal stresses in a logical and authoritative manner. Examples of contour and XY plotting are shown. Load vectors and free body diagrams are also discussed.

## CFD for Structural Designers and Analysts

This course aims to introduce the essential principles of fluid dynamics, important flow phenomena, and basics of CFD process to structural engineers for their multidisciplinary problems. This course provides a brief overview of the essential concepts and principles of fluid dynamics, CFD, turbulence, and heat transfer relevant to structural analyses through simple examples and case studies.

## Introduction to Practical CFD

Through a simple and moderately technical approach, this course covers topics such as the role of CFD, basic formulation, governing equations and use of model equations, steps in CFD process, need for turbulence modeling, and CFD best practices.



### Elements of Turbulence Modelling

This course is focused on understanding turbulence, need for turbulence modeling, and various modeling approaches. Discussions on the advantages and limitations of various models should help CFD users in selecting appropriate turbulence models for their simulations.

### Sheet Metal Formability – Material Properties, Failure & Simulation

This course is intended to assist all those involved in the design of sheet metal components to identify the key material properties and potential failure modes during manufacture. The course will demonstrate how CAE methods can be used to simulate the manufacturing method in order to identify any potential problems with the process and establish if part design changes are required.

### Introduction to Instability and Buckling of Structures

This short course is based upon material taken from a new online course which will be launched by NAFEMS in the near future. Attendees will be shown the course content, including an associated on-line self-test quiz. The course is designed to provide a broad introduction to instability and buckling of structures and while the focus is on both Euler and nonlinear post-buckling, the course will illustrate a range of other instability phenomena relevant to structures. The topics are well exemplified via industrial examples and videos, with sufficient theory to allow FE practitioners to understand the challenges and procedures inherent in modelling and assessment. In the course literature, the NAFEMS PSE competency statements addressed to some degree are highlighted.

### Introduction to Finite Element Analysis of Pressure Systems and Components

This presentation is designed to provide an overview of a major updating and re-launch of a substantial work-based learning module, originally developed as part of the EU-funded CCOPPS project. The course is accompanied by a sector-specific competency framework and is complemented by 23 worked examples, 14 tutorials and 9 self-test online quizzes with 167 questions. The course is designed for self-paced informal learning and participation entitles the delegate to 5 months access to tutors. The course also includes a new extensive FAQ database, designed to support and enhance the learning experience.

### Introduction to Design by Analysis of Pressure Systems and Components

This presentation is designed to provide an overview of a major updating and re-launch of a substantial work-based learning module, originally developed as part of the EU-funded CCOPPS project. The course is accompanied by a sector-specific competency framework and is complemented by 38 worked examples, 2 tutorials and 5 self-test online quizzes with 111 questions. The course is designed for self-paced informal learning and participation entitles the delegate to 5 months access to tutors. The course also includes a new extensive FAQ database, designed to support and enhance the learning experience.

The course is now consistent with the DBA content in the current versions of ASME VIII Div2 and EN13445. It also now includes Creep-related design checks and content.

# Sponsorship & Exhibition: An Outstanding Opportunity

The NAFEMS World Congress presents a unique opportunity, as delegates are primarily high-level decision makers working in industry across the globe. The exhibition area will be a central point at the Congress, ensuring that there is a consistent level of "traffic" at all times – refreshments, announcements, events, and competitions will focus on this area, giving you the chance to meet as many of our delegates as possible.

## Align yourself with the NAFEMS Brand

As the only international association dedicated to the engineering analysis, modelling, simulation, and systems engineering community, NAFEMS is widely held to be the leading independent source of information and training for engineering analysts and designers of all levels. Sponsors and exhibitors will have the chance to promote their attendance prior to the event, through the various packages outlined at [nafems.org/congress](http://nafems.org/congress). Being seen to be participating in the NAFEMS World Congress gives the analysis world a positive impression of your company's commitment to best practice, standards and continued professional development.

## Benefits

So what are the benefits of sponsoring and exhibiting at the Congress?

- Promote your company to a large but highly focused group of individuals who have a pre-qualified interest in your product
- Establish important contacts within the industry
- Keep an eye on the activities of your direct competition
- Increase your company's visibility and standing in the analysis community
- Showcase your latest product releases and service offerings
- Discover exactly what your target market needs, and what trends are emerging across the industry

[nafems.org/congress/sponsorship-and-exhibition/](http://nafems.org/congress/sponsorship-and-exhibition/)

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# Exhibitors

Altair Engineering  
Ansys  
Aras  
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Beta CAE Systems  
Cadence Design Systems  
Ceetron  
Cybernet Systems  
Dassault Systèmes  
Datadvance  
Desktop Engineering  
Detroit Engineered Products  
Dynardo  
Endurica  
ESI Group  
Esteco  
Famic Technologies  
Front End Analytics  
Granta Design  
HBM Prenscia  
Intes  
ITEA3 VMAP  
kinetic vision  
MachineWorks/Polygonica  
MSC Software  
Murata Software  
NAFEMS  
Nextflow Software  
nTopology  
Open iT  
Penguin Computing  
RecurDyn (FunctionBay)  
Siemens PLM  
SmartUQ  
Synopsys  
Vanderplats R&D  
Volume Graphics  
... and more

## Pre-Congress: Short Training Courses and Workshops

<p>13:15 <b>A1 Multiphase Flows</b></p> <p>Short Course in the Numerical Simulation of Multiphase Flows – Basics of Theory and Practical Applications U. Janoske (University of Wuppertal, GER)</p> <p>This short course gives an introduction in modelling and simulation of multiphase flows. The challenges and problems of modelling multiphase flows are discussed and the ideas of different modelling approaches will be described in general. Some examples of multiphase flow simulations show the application of the models as well as advantages and disadvantages of them.</p>	<p><b>A2 Stochastics Discussion Session</b></p> <p>Stochastics Discussion Session Moderated by the NAFEMS Stochastics Working Group</p> <p>Come along to this discussion session and meeting members of the NAFEMS Stochastics Working Group. Find out about the current activities of the group who are helping organisation extract more business value from their investment in engineering analysis and simulation through the implementation of stochastics applications.</p>	<p><b>B1 Design of Pressure Systems</b></p> <p>Introduction to Design by Analysis of Pressure Systems and Components – Overview of New e-Learning Course with Tutor Support J. Wood (JW Analysis)</p> <p>This presentation is designed to provide an overview of a major updating and re-launch of a substantial work-based learning module, originally developed as part of the EU-funded CCOPPS project. The course is accompanied by a sector-specific competency framework and is complemented by 38 worked examples, 2 tutorials and 5 self-test online quizzes with 111 questions.</p> <p>The course is designed for self-paced informal learning and participation entitles the delegate to 5 months access to tutors. The course also includes a new extensive FAQ database, designed to support and enhance the learning experience.</p> <p>The course is now consistent with the DBA content in the current versions of ASME VIII Div2 and EN13445.</p>	<p><b>B2 Practical CFD</b></p> <p>Introduction to Practical CFD K. Fouladi (Infomec Consulting)</p> <p>This course provides a view into the practical utilization of CFD in real life applications and the challenges faced due to the presence of turbulence, heat transfer, phase changes, and movement of boundaries. Through a simple and moderately technical approach, this course covers topics such as the role of CFD, basic formulation, governing equations and use of model equations, steps in CFD process, need for turbulence modeling, and CFD best practices.</p>	<p><b>C1 Optimization</b></p> <p>Structural Optimization - updated to focus on Topology Optimization and Generative Design T. Abbey (FE Training)</p> <p>This short over-view looks at the range of optimization techniques available in FEA today. A brief history shows the development of these methods and the various strengths and weaknesses. The future role of optimization is discussed – particularly when aligned with new manufacturing methods and vastly improving computing resources. The final topic is the continuing role of the engineer in providing the required innovation and definition of the optimization task.</p>	<p><b>C2 PSE Workshop</b></p> <p>PSE Certificate Moderated by G. Duffett (NAFEMS)</p> <p>PSE (Professional Simulation Engineer) Certification allows simulation engineers to demonstrate competencies acquired throughout their professional career.</p> <p>Get your questions about PSE answered by members of the PSE Board and the PSE administrator.</p> <p>Feature Presentation: Incorporating PSE Competencies into Technical Mentoring for Effective FEA Skill Development * J. Castro (The Boeing Company, USA)</p> <p>Please Note: Candidates applying for PSE at the NWC will be able to access a reduced application fee.</p>
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14:45 Break

15:00 Congress registration opens

<p>15:30 <b>A1 Acoustics</b></p> <p>Simulation Driven Engineering with Computational Acoustics A. Svobodnik (Mvoid Group, GER)</p> <p>This short course gives an introduction in modeling and simulation of acoustical phenomena. The challenges of acoustics as a multiphysical approach are discussed and the state of the art of modelling will be outlined. Typical industrial examples show the application of the models and its pro's and con's.</p>	<p><b>A2 Intro to UQ</b></p> <p>Introduction to Probabilistic Analysis and Uncertainty Quantification G. Jones (SmartUQ, USA)</p> <p>Experienced practitioners who construct complex simulation models of critical systems know that replicating real-world performance is challenging due to uncertainties found in simulation and physical tests. This course will discuss the types of uncertainties and how to quantify these uncertainties through the use of state-of-art statistics and machine learning methods. This course will discuss the broad applications these probabilistic techniques have in analyzing numerous forms of engineering systems including Digital Thread/Digital Twins.</p>	<p><b>B1 Co-simulation</b></p> <p>Why, How and When to Use Co-Simulation? T. Roudier (T-AirTech, CAN)</p> <p>This course provides a view into a pragmatic approach of co-simulation for real use cases, and the challenges brought by the coupling of multi-disciplinary domains of engineering in a global simulation environment. Through a simplified technical approach, this course covers the topics such as the interest of co-simulation in modern modeling and simulation techniques, the fundamental principles of co-simulation, an overview of standards (Functional Mock-up Interface FMI, High Level Architecture HLA IEEE 1516-2010), challenges of hybrid co-simulations, best practices, and the realization of a simple use case.</p>	<p><b>B2 Buckling Introduction</b></p> <p>Introduction to Instability and Buckling of Structures – Overview of New On-Demand J. Wood (JW Analysis)</p> <p>This short course is based upon material taken from a new online course which will be launched by NAFEMS in the near future. Attendees will be shown the course content, including an associated on-line self-test quiz. The course is designed to provide a broad introduction to instability and buckling of structures and while the focus is on both Euler and nonlinear post-buckling, the course will illustrate a range of other instability phenomena relevant to structures. The topics are well exemplified via industrial examples and videos, with sufficient theory to allow FE practitioners to understand the challenges and procedures inherent in modelling and assessment. In the course, the relevant NAFEMS PSE competency statements addressed are highlighted.</p>	<p><b>C1 CFD for Designers</b></p> <p>CFD for Structural Designers and Analysts K. Fouladi (Infomec Consulting)</p> <p>This course aims to introduce the essential principles of fluid dynamics, important flow phenomena, and basics of CFD process to structural engineers for their multidisciplinary problems. This course provides a brief overview of the essential concepts and principles of fluid dynamics, CFD, turbulence, and heat transfer relevant to structural analyses through simple examples and case studies.</p>	<p><b>C2 Composites</b></p> <p>Composites T. Abbey (FE Training)</p> <p>Due to the nature of composite materials, stress analysis and failure prediction is far more complex than isotropic materials. The objective of this overview is to break down the composite FE analysis process into clearly defined steps, give an overview of the physics involved and show how to implement practical solutions using Finite Element Analysis.</p>
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17:00 End of Pre-Congress: Short Trainings and Workshops

18:00 Technical Working Group / Regional Steering Committee Reception (M3, Level 3)

19:00 Congress and Exhibition Opening Reception (Exhibition Hall)



**D CFD Discussion Session**

CFD Discussion Session - led by CFD WG  
Moderated by A. De Souza (Qesada Solutions) and U. Janoske (University of Wuppertal)

Come along to find out the activities being undertaken by NAFEMS for the CFD community. Regional events, publications, CFD benchmarks, the NAFEMS International Journal of CFD Case Studies, and the competency statements for the PSE scheme will all be covered and attendees will be invited to ask questions, suggest topics they would like to see addressed and find out how they can get involved.

**H MPS Challenges**

Man. Proc. Sim. Challenges  
Manufacturing Process Simulation Working Group

Session lead by members of the Manufacturing Process Simulation Working Group discussing manufacturing process where there is significant simulation challenges.

**J Sheet Metal Forming Part1**

Sheet Metal Formability – Material Properties, Failure and Simulation  
T. Dutton (Dutton Simulation)

This course is intended to assist all those involved in the design of sheet metal components to identify the key material properties and potential failure modes during manufacture. The course will demonstrate how CAE methods can be used to simulate the manufacturing method in order to identify any potential problems with the process and establish if part design changes are required.



08:30 P Plenary Presentations

08:30 Welcome and Introduction

C. Stavrinidis (Chairman NAFEMS Council); NAFEMS Team

09:00 Dassault Systèmes Simulia Platinum Sponsor Presentation: Driving Decisions and Discovery with Modeling and Simulation

S. Sett, VP of Marketing & Strategic Initiatives (Dassault Systèmes Simulia, USA)

09:15 The Role of Simulation in the Transformation of the Automotive Industry

C. Poon (Ford Motor Company, USA)

09:45 Systems and Complementary Engineering Disciplines Interactions

H. Stoewer (INCOSE Past President and Professor TU Delft, GER)

10:15 Coffee Break

11:00 1A The Role of Digital Twins



11:05 Usage of Digital Twins for Predictive Maintenance  
C. Schulz, B. Kiess (Anhalt University of Applied Sciences, GER)

11:25 The Role of Analytics in the Digital Twin  
G. Jones, M. Andrews, Z. Graves, P. Chien (SmartUQ, USA)

11:45 Hybrid Twin at the Crossroads of Reduced Order Modeling and Data Science  
F. Daim, S. Guévelou, J. Duval (ESI Group, FRA) F. Chinesta (ENSAM & ESI Group, FRA)

12:05 Building and Using Digital Twins for Product Simulation and Design  
P. Morelle, S. Donders, H. Van der Auweraer (Siemens Industry Software, BEL) G. Sethuraman (Siemens PLM Software, CAN) D. Hartmann (Siemens Corporate Technology, GER) W. Desmet (University of Leuven, BEL)

11:00 1B MPS - Stamping/Forming



11:05 Optimization and Manufacturing Feasibility of Stamped Components to Reduce the Vehicle Mass and Improve Performance  
R. Hoglund, P. Hiremuth (Altair Engineering, USA)

11:25 Use of Numerical Simulations to Model Non-Conventional Metal Forming  
X. Quan (Ansys, USA)

11:45 Design of Automotive Structural Metal - GFPR Hybrid Parts Using the Novel Manufacturing Technique "Hybrid forming"  
D. Heidrich, X. Fang (University of Siegen, GER)

12:05 Hot-Forming of Ultra-High Strength Aluminum Sheets for Lightweight Transportation Systems  
R. Said, P. Saillard, M. Ziame, F. Adzima (ESI Group, FRA) D. Szegda, M. Mohamed (Impression Technologies, GBR)

11:00 1C Systems 1



11:05 Improving Stability and Performance of Flight Controls  
A. Laurella (Maya HTT, CAN)

11:25 Active Torque Distribution for Multi-Track Vehicles to Stabilize the Lateral Dynamics  
R. Degen, H. Ott, F. Klein, M. Ruschitzka (University of Applied Science - TH Köln, GER)

11:45 Enabling Collaborative Simulation Towards a Common Approach for Global Analysis on Smart Power Grids Combined with Cyberphysical Systems  
T. Roudier (T-AirTech, CAN) C. F. Mugombozi, K. Marthe, I. Kamwa (Hydro-Québec Research Institute, CAN) A. Kemmeugne (University of Toronto, CAN)

12:05 PLM- and Microservice-Based Integration Approach of MBSE and System Simulation for Federated Continuous Engineering Platforms  
B. Binder, M. Gottschall, T. Blochwitz (ESI ITI, GER) L. Kirsch (Contact Software, GER)

11:00 1D CFD - Multi-phase/-species

11:05 Centrifugal Oil Pump Modelling Applied to Reciprocating Compressors  
M. Tada, E. R. Hulse (Embraco, BRA)

11:25 Numerical Simulation of Degassing Processes in Filling and Packing Processes of Solid Goods  
U. Janoske (University Wuppertal, GER) T. Freiburger (Optima Consumer, GER)

11:45 Modelling Different Aspects of Once Though Steam Generators  
M. Forcinito, A. Singha (AP Dynamics, Canada)

12:05 Quantitative Evaluation of Separation Performance of the Gas-Liquid Separator: Experiment, Validation of Prediction Method and Numerical Simulation  
M. Irikura, T. Ishigami, M. Maekawa (Chiyoda, JPN) C. Heijckers (MySep, SGP) H. Witteveen (Kranji Solutions, SGP)

11:00 1E Stochastics

11:05 Uncertainty Quantification and Probabilistic Analysis Applied to the Design of Advanced Aero Engines  
A. Karl (Rolls-Royce, USA) R. Bates (Rolls-Royce, GBR)

11:25 Assessment of Low Probabilities of Failure by Extrapolation  
J. Reijmers (Nesvesbu, NED)

11:45 Improving Collapsibility Robustness of an EPS-CD by Means of Simulation and Six Sigma Techniques  
D. Costas Muñoz, M. Majzel (ZF Group, POL) D. Vieker (ZF Group, GER)

12:05 Probabilistic Fatigue and Reliability Simulation  
J. Mentley, K. Munson (HBM Prensia, USA) A. Halfpenny, A. Chabod, P. Czapsk, J. Aldred (HBM Prensia, GBR) M. Bonato (Valeo, FRA)

11:00 1F CAE in the Design Process 1

11:05 Using FEA to Create Derivative Designs With Successful Base Designs  
A. Zhong (Halliburton, USA)

11:25 Augmented Engineering Methodology to Efficiently Improve the Design Process of Sports Equipment at Decathlon  
A. Callens (Decathlon, FRA)

11:45 Let Simulation do the Design - Faster  
M. Shimozone (Intes Japan, JPN) R. Helfrich, R. Fischer (Intes, GER)

12:05 A Study of the Reduced Model of a Battery Cell for Structural Analysis  
T. Reimer, Y. Hahn, F. Letailleur, J.I. Cofer (Dassault Systèmes Simulia, USA)

12:25 Lunch Break

13:35 2A AR & VR for Simulation



13:40 Extended Reality (XR) - The Future of AI System Training?  
J. Jarrett (Kinetic Vision, USA)

14:00 Bringing Simulation to Life with Immersive Virtuality  
G. Donval (Dassault Systèmes Simulia, CAN) L. Bonyngce, C. Finkle (Dassault Systèmes Simulia, USA)

14:20 Overcoming the Team Collaboration Obstacles of Distance and Specialization Through Democratization Technologies \*  
S. Kleidarias (BETA CAE Systems Greece, GRE)

14:40 Going From Collaboration + CAE to True Collaborative CAE: Cloud / Web and VR as Enabling Technologies  
A. Rodriguez-Villa, F. Viken (Ceetron, NOR)

13:35 2B MPS - Injection Moulding



13:40 Experimental and Numerical Investigations into the Effects of Process Parameters on the Quality of Injection Overmoulded Thermoplastic Hybrid Composite Structures  
T. Wu, M. Herath, N. Chapman, S. Cooper, P. Giddings (National Composites Centre, GBR)

14:00 Design Optimization of Extendable Spout for Flexible Packaging  
L. Ma, D. Ramirez (The Dow Chemical Company, USA) J. Gomes (The Dow Chemical Company, BRA)

14:20 Modelling Flow of Optical Fibre through Extrusion Heads  
J. Rodriguez, J. Reboul, J. Marti (Principia, ESP) E. Torres (Aitex, ESP)

14:40 Integrative NVH Simulation of Anisotropic Injection-Moulded Parts  
M. Giess (South Westphalia University of Applied Sciences, GER)

13:35 2C Systems 2



13:40 A Standard Model Description Language for Consistent Content Management in a Collaborative Simulation Platform  
J. Cazeaux (ESI Group, FRA) S. Herssand (Renault, FRA)

14:00 Model-Based System Design and Simulation for Elevator Systems Engineering  
S. Kleiner (em engineering methods, GER) F. Rigazio, W. Moretti (Schindler Elevator, SUI)

14:20 Extracting the Combined Benefits of 3D Finite Element Methods and System Simulation Using Dynamic Co-Simulation  
M. Cameron, P. Longrais, C. Marca (ESI Group, FRA) H. Choi (Hongik University, KOR) T. Neidhold, T. Blochwitz (ESI ITI, GER)

14:40 Systems Modelling and Simulation of Hydraulic Test Rigs for Aircraf Highlift Devices  
M. Raju S, N. Narayan, C. Gangareddy (HCL Technologies, IND)

13:35 2D CFD - Meshing & Methods

13:40 Migrating from 2D FEA to 3D CFD for the Modeling of Ultra-Precision Flat Pads Aerostatic Bearings  
P. Vincent, H. Bastien (Ametek-Creaform, CAN) A. Kamal, J. Roblee (Ametek-Precitech, USA)

14:00 Hybrid Meshing Strategies for Horizontal Axis Wind Turbines and Wind Farm Applications  
C. Pita, T. Carrigan (Pointwise, USA)

14:20 Exploring Design Space by Using Digital Geometry and Level-Set Morphing Methods  
R. Evans, P. Tiller, W. Dawes, M. Hunt, N. Meah (Cambridge Flow Solutions, GBR)

14:40 Validating a Fast Hybrid Method for Modelling Explosions  
M. Abdel-Jawad (Advanced Analysis Australia, AUS) P. Brady (School of Mechanical and Manufacturing Engineering, AUS) M. Ermaliuc (Advanced Analysis Australia, AUS) D. McGuckin (Pacific ESI, AUS)

13:35 2E Uncertainty Quantification

13:40 Using Uncertainty Quantification Together with Terramechanics for Generation of Stochastic Mobility Maps  
N. Gaul, K. Choi (Ramdo Solutions, USA)

14:00 The Assessment of Simulation Credibility in Virtual Engineering Workflows: The Challenge of Uncertainty Quantification  
F. Santandrea (RISE, SWE)

14:20 UQ Challenge Problems  
Moderated by A. Karl (Rolls-Royce, USA)

13:35 2F Integration of Test & Analysis

13:40 Processing of Numerical Simulations and Experimental X-Ray Car Crash Data for Deviation Analyses and Model Quality Assessment  
M. Dlugosch, T. Soot, J. Fritsch (Fraunhofer EMI, GER)

14:00 Operational Loads Measurement and Design Optimization of a Gold Mine Rail Hauling System Showing Fatigue Cracks  
M. Lussier (Optimec Consultants, CAN) D. Paquette (Agnico Eagle, CAN) T. Hunter (Wolfstar Technologies, USA)

14:20 Root Cause Failure Analysis Driven by Numerical Simulation  
V. Lamontagne, P. Duval, H. Bastien (Creaform - Ametek, CAN) J. Théroux (Nova Bus - Volvo, CAN)

14:40 Simulation and Test Process and Data Management: Enabling the Digital Twin  
P. Morelle, S. Donders, E. Allegaert, S. Dutré, H. Van der Auweraer (Siemens Industry Software, BEL) G. Sethuraman (Siemens PLM Software, CAN) D. Hartmann (Siemens Corporate Technology, GER) W. Desmet (University of Leuven, BEL)

The capital letter and number at the beginning of the session title indicate the conference rooms.  
 \* Invited presentation  
 \*\* ITEA3 VMAP contribution  
 WS Workshop

### 1G Shock / Impact / Crash 1

11:05 Streamlining the Design Process and Fine Tuning the Collapse Behavior of a Snowmobile Structure for Frontal Crash Tests: An Effective Use of Advanced Numerical Simulation  
 H. Bastien (Ametek-Creaform, CAN) S. Vézina (BRP, CAN)

11:25 Substituting Physical Testing of Packaging Concepts with Virtual Modelling for Improved Transportation Robustness  
 T. Hansen, J.S. Nielsen (Novo Nordisk, DEN)

11:45 Efficiency-Driven Model Simplifications in Crash Simulations of FRP-Metal Hybrid Material Systems in Automotive Body Structures  
 M. Dlugosch, J. Fritsch, S. Hiermaier (Fraunhofer EMI, GER) D. Lukaszewicz (BMW Group, GER)

12:05 e-Commerce – The Complete Virtual ISTA-6 Model is Here  
 S. Gilmore, K.Wynne (Crux Product Design, GBR)

### 1H Particle Methods 1

11:05 Effective Shape Optimization of Filtration Device to Improve Filtration Efficiency Using MPS Particle Method Based CFD Software  
 S. Tokura (Prometech Software, JPN)

11:25 Simulating Airbag Deployment Using Lumped Kinetic Molecular Method  
 R. Roy, B. Grimes, J. Hurtado, V. Oancea, J. Konert (Dassault Systèmes Simulia, USA)

11:45 Evaluating Moving Particle Simulation Method Against Mesh Based Methods  
 J. Crist (EnginSoft, USA)

12:05 Simulation of Washing Facilities in Automotive Manufacturing  
 Y. Ando (Cradle North America Inc., USA) M. Menon, C. Peng (ESS - Engineering Software Steyr, AUT)

### 1J Dynamics & Vibration 1

11:05 Frequency Domain Spot Weld & Seam Weld Analysis  
 T. Meehan (Ford Motor Company, USA) N. Bishop, P. Murthy (CAEfatigue, GBR) P. Roemelt (Ford Motor Company, GER)

11:25 Efficient Super Element based Data Recovery for Chained FEM-Flexible MBD Engine Simulation  
 S. Sandhu, H. Patel (MSC Software, USA), B. Loibnegger (AVL List, AUT)

11:45 Modelling and Simulation of a Reference Engine  
 G. Breslau, B. Schlecht (Technical University Dresden, GER)

12:05 Loads Enveloping  
 N. Bishop, S. Kerr (CAEfatigue, GBR) E. Costa (Ford Motor Company, BRA) T. Meehan (Ford Motor Company, USA)

### 1K Co-Simulation

11:05 Co Simulation of A 6 DoF Manipulator for HIL Applications: Design, Development and Results  
 F. La Mura, H. Giberti (Politecnico di Milano, ITA) G. Todeschini, L. Palama (Todeschini Mario, ITA)

11:25 Pushing the Boundaries of CAE and System Dynamics with Co-Simulation Toolchains  
 Y. Fan, K. Hanna, E. Pesheck, C. Kopp (MSC Software, USA) N. Grün (BMW, USA)

11:45 A Coupling Solver Architecture for Multiphysics Simulations  
 O. Chernukhin, S. Reuss, J. Thunes (Ansys, CAN) C. Wolfe (Ansys, USA)

12:05 Multidomain Co-simulation between Virtual Machines and Numerical Computing Software  
 J. Montero, V. Remillard (Famic Technologies, CAN)

### 1L SPDM 1 spdm

11:05 Virtual Testing in the Industry - Process Development, SPDM and Automation  
 B. Dóczy, Sz. Jónás, A. Varga, D. Felhős (Knorr-Bremse Rail Systems Budapest, HUN)

11:25 Virtual Testing for High Lift Systems - Script-Based Processes for Efficient and Traceable Model Creation  
 T. Ulmer, R. López Parras (Airbus Operations, GER)

11:45 Automated Model Build Process Through an SPDM System  
 M. Laming (Siemens PLM, USA) B. Peddi, N. Kondrugunta (Siemens PLM Software, USA)

12:05 Big Data Management for Additive Manufacturing Design Process of Compliant Composites Parts  
 P.Y. Lavertu (e-Xstream Engineering, CAN) M. Giuliano Auricchio (e-Xstream Engineering, ITA) R. Ressegui (e-Xstream Engineering, USA) O. Lietaer (e-Xstream Engineering, BEL) K. Dunlop (MSC Software, GBR)

### T1 FEA for Pressure Systems

Introduction to Finite Element Analysis of Pressure Systems and Components – Overview of New e-Learning Course with Tutor Support  
 J. Wood (JW Analysis)

This presentation is designed to provide an overview of a major updating and re-launch of a substantial work-based learning module, originally developed as part of the EU-funded CCOPPS project. The course is accompanied by a sector-specific competency framework and is complemented by 23 worked examples, 14 tutorials and 9 self-test online quizzes with 167 questions. The course is designed for self-paced informal learning and participation entitles the delegate to 5 months access to tutors. The course also includes a new extensive FAQ database, designed to support and enhance the learning experience. The course is designed to compliment the Introduction to Design by Analysis of Pressure Systems and Components course.

### 2G Shock / Impact / Crash 2

13:40 Payload Sudden Stop Analysis for Beluga XL M. Tasic (Airbus, FRA)

14:00 Frontal Crash Simulation of a Bus in Concordance to ECE R 29 Regulation  
 S. López, E. Viteri, L. Orozco (Espoch, ECU)

14:20 How Ecommerce has Disrupted Product and Shipment Packaging Systems  
 J. Topich (Kinetic Vision, USA)

14:40 Development and Validation of Pedestrian Headform Finite Element (FE) Models for AIS 100 / GTR 9  
 S. Deshpande, N. Kulkarni, R. Mahajan (Automotive Research Association of India, IND)

### 2H Particle Methods 2

13:40 Lubrication Simulation in Automotive Gearbox with SPH Method  
 J. Candelier, L. Chiron (Nextflow Software, FRA) F. Ravet, N. Dabert, B. Pelourdeau, L. Dufloy (Renault, FRA)

14:00 An Adaptive Tree Structure for the Discrete Integration of the Weak Forms Arising in the Meshless Simulation of Elliptic Equations.  
 G. Fougeron, A. Kamoulakos (ESI-Group, FRA)

14:20 Meshless Simulation Approach for Complex Liquid Dominated Flows using SPH  
 D. Greif (AVL-AST, SVN), M. Ihmsen (Fifty2 Technology, GER), G. Maier (AVI List, AUT)

14:40 Modelling Primary Atomization of a Simplex Nozzle  
 M. Sami, J. Ibrahim (Ansys, USA)

### 2J Multibody Systems

13:40 An Approach for More Efficient Simulation of Stick Slip Effects  
 P. Schoenhuber, A. Walawalkar, C. Schindler, J. Lekue (RWTH Aachen University, GER)

14:00 MBS-Based Design of Dampers for Furniture Hinges  
 S. Müller, D. Rupp, P. Nachbaur (Julius Blum, AUT)

14:20 Optimization of Kinematics in Furniture Lift Systems  
 P. Nachbaur, D. Rupp, S. Müller (Julius Blum, AUT)

14:40 Multi-Body Dynamic Model Validation of a Recreational Vehicle in the Perspective of Frame Load Evaluation  
 C. Blanchette, M. Boisvert, N. Joubert (Centre de Technologies Avancées, CAN) D. Rancourt, A. Desrochers (Université de Sherbrooke, CAN) Y. St-Amant (Université Laval, CAN)

### 2K Multiscale

13:40 Lattice Optimization Analysis by Means of Multiscale Approach Based on Homogenization Technique  
 K. Yamamoto (Cybernet Systems, JAP) K. Terada (International Research Institute of Disaster Science, JAP) N. Hirayama (College of Industrial Technology of Nihon University, JAP)

14:00 Multiscale- and Multiphysics-Based Approach for Predicting Manufacturability, CAD Conformity, and Residual Stresses in Powder Bed Fusion Parts  
 R. Said, H. Mindt, M. Megahed (ESI Group, FRA) J. Rosser, S. G. R. Brown, N. P. Lavery (College of Engineering, Swansea University, GBR)

14:20 Multiscale Modelling of Sand Erosion: A Step Towards Digitalization  
 C. Wolfe, A. Jatale (Ansys, USA) M. Parsi (DNV GL, USA)

14:40 Application of FEM for an Estimation of Effective Elastoplastic Properties of Shales with Kerogen Inclusions  
 S. Ishbulatov, A.V. Myasnikov, D.I. Sabitov (Skolkovo Institute of Science and Technology, RUS) A.V. Vershinin (Lomonosov Moscow State University, RUS)

### 2L SPDM 2 spdm

13:40 Get the Data Right for Effective Multidisciplinary SPDM – Making the Case for a Tool-Independent Unified Data Model  
 M. Panthaki (Aras, USA) M. Lind (Aras, USA)

14:00 SPDM Solutions for Automotive CFD Applications  
 F. Ross, N. Kondrugunta (Siemens PLM Software, USA)

14:20 Open Data Formats in Commercial FEA Software  
 K. Walker (MSC Software, USA)

14:40 Recent Developments on an In-house Database Driven SDM Tool and its Deployment  
 S. Howell, S. Feven, P. Middha (Abercuss, GBR)

### T1 Nonlinear FEA

Nonlinear Analysis  
 T. Abbey (FE Training)

Many problems facing engineers are nonlinear in nature, where the response of a structure cannot be simply assessed using linear assumptions. One of the most difficult tasks facing an engineer is to decide whether a nonlinear analysis is really needed and if so what degree of nonlinearity should be applied. This overview will examine these issues, and look at the best ways of creating an analysis plan that matches key objectives.

15:00 Coffee Break

**3A Autonomous Vehicles** 

15:40 Full Virtual ADAS Testing. Application to the Typical Emergency Braking EuroNCAP Scenario  
M. Hadj-Bachir, E. Abenius, J.C. Kedzia, P. De Souza (ESI Group, FRA)

16:00 LIDAR Sensor Simulation in Adverse Weather Condition for Driving Assistance Development  
M. Hadj-Bachir, P. De Souza (ESI Group, FRA)

16:20 Impact of Vehicle Dynamics Model Fidelity in the Development of ADAS  
D. Kinne (Siemens PLM Software, USA) M. Grottoli, A. Van Der Heide, Y. Lemmens (Siemens PLM Software, BEL)

16:40 Safety Assessment and Uncertainty Quantification of Automated Driver Assistance Systems Using Stochastic Analysis Methods  
T. Most, V. Bayer, R. Niemeier (Dynardo, GER) P. Ubben, M. Rasch (Daimler, GER)

**3B MPS - Metals** 

15:40 Increase Product Qualification Rate of Aircraft Engine Castings by Applying Machine Learning Methods  
J. Zhang (AECC-ESI, CHN) J. Lan (BIAM, CHN) X. Li (Baimtech, CHN) A. Gittens (ESI Software, GER)

16:00 Mechanical Effects of Casting & 3D Printing Defects – Simulation and Validation  
K. Nigge, J. Fieres, C. Reinhart (Volume Graphics, GER)

16:20 A Comparative Study on Numerical Simulation of Residual Stresses of a Single Pass Bead-on-plate Weld  
Y. Ma, Z. Fan, S. Wen, S. Yan Zhang, P. Zhang (Centre of Excellence for Advanced Materials, CHN) D. McPhil (ISIS Facility, Science and Technology Facilities Council (STFC), GBR)

**3C Systems 3** 

15:40 System Modelling for Engine and Nacelle Compartment Ventilation and Thermal Integration  
Y. Sommerer (Airbus, FRA) B. Michel (Altran, FRA)

16:00 System Simulation with FEA and Optimization for Electric Vehicle Development  
P. Musunuru (ESI Group, USA) Y. Debray (ESI Group, FRA)

16:20 Machine Knowledge Software: Key Factors and Best Practices for Market Adoption and Integration of Systems Simulation  
V. Rémillard, J. Montero, D. Lenoble (Famic Technologies, CAN)

16:40 Efficient Cross Domain Knowledge Sharing to Deliver System Value  
P. Grimberg, A. Munck (Digital Product Simulation, FRA)

**3D CFD - HVAC**

15:40 The Aero-Acoustic Design and Optimization of a Ground Transportation HVAC System using Lattice Boltzmann Methods  
J. Biermann (BMW, GER) C. Luzzato (Dassault Systèmes Simulia, GER) R. Fouque (Université de Toulouse, FRA)

16:00 Aerodynamic Analysis of Ventilation in Janggyeongpan-Jeon Using Finite Volume Approach on Adaptive Cartesian Mesh Structure  
I. Sohn (Korea Institute of Science and Technology Information, KOR) M. Jung, K. Lee (Solution Lab, KOR)

16:20 CFD to Analyse Clean Environments  
P. Vincent (Ametek-Creaform, CAN)

16:40 Analysis of Turbulent Flow Data Based on a Spectral Basis Representation  
C. Gscheidle, R. Iza-Teran, J. Garcke (Fraunhofer SCAI, GER) L. Berger (CFD Schuck Ingenieurgesellschaft, GER)

**3E Simulation Governance**

15:40 The Importance of Sound Simulation Governance for Design of Pipeline Repair Products: Overview and Two Case Studies  
M. Langerholic, Q. Li, (T.D. Williamson, USA)

16:00 It's in the Interpretation – Three CFD Based Case Studies from the Oil and Gas Sector That Demonstrate How Alternative Interpretations of Simulation Predictions Can Lead to Significantly Different Engineering Decisions  
S. Howell, S. Feven, P. Middha (Abercus, GBR)

16:20 Managing Simulation Quality and Data at the UK Atomic Weapon Establishment  
H. Edwards, M. Savory (UK Atomic Weapons Establishment, GBR)

16:40 Analysis Management and Simulation Data Management, Complementary Techniques to Assure Confidence in Simulation Results \*  
A. De Souza (Quesada Solutions, GBR) M. Norris (theSDMConsultancy, GBR) S. Howell (Abercus, GBR)

17:00 Quality Assurance of Engineering Simulations: An Overview of Project SPRUCE (Investigation of Standardization Practices for a Responsible Use of Computational models in Engineering) \*  
F. Santandrea (RISE, SWE)

**3F Composites 1**

15:40 Multi-Objective Thermal and Structural Optimization of Potted Inserts in Composite Sandwich Panels for Mass Transit Vehicles  
C. Cameron (RISE Sicomp, SWE)

16:00 Framework to Facilitate Textile Composite Modelling  
F. Stig (RISE Sicomp, SWE)

16:20 Analytical Method to Obtain Ply Specific Engineering Constants from Simple Material Tests of NCF Composite Parts  
L. Kovacs (eCon Engineering, HUN) B. Fodor (BMW Group, GER)

16:40 Multiscale Simulation of Unidirectional Carbon Fiber Reinforced Polymer Strength  
H. Cornwell, F. Souza, L. Lima (MultiMechanics, USA)

17:00 Coffee Break

**4A Extreme Scale Simulation** 

Birds of a Feather Session on Extreme Scale Engineering Simulation  
L. Margetts (University of Manchester, GBR)

This session, organised by the NAFEMS HPC Working Group (in collaboration with the European Extreme Data and Computing Initiative - EXDCI), will explore the opportunities promised by the fusion of high performance computing, big data and artificial intelligence and discuss the barriers faced by the engineering community in their uptake. Common issues and challenges that may be covered include access to large-scale facilities, performance of commercial software, scalable meshing tools and solvers, disruptive numerical methods, domain specific languages and coupling engineering simulation with AI.

**4B Design Using MPS** 

17:35 Model-based Manufacturing of Novel Single-piece Aircraft Centre Wing Box  
S. Van Der Veen (Airbus Operations, FRA) A. Doux (Digital Product Simulation, FRA)

17:55 Full End to End Virtual Prototyping of Fiber Reinforced Polymers Taking Into Account Manufacturing Effects  
A. Trameçon (ESI Group, FRA) S. Muller (ESI SW, GER) C. Florimond (ESI Group, CAN)

18:15 Coupled Thermal-Mechanical Simulation of the Ski Manufacturing Process  
G. Hauenstein, D. Schiffmann, R. Baumann (Lucerne University of Applied Sciences and Arts, SUI) M. Fauve (Stöckli Swiss Sports, SUI)

**4C CFD 1D-3D**

17:35 Coupling 1D and 3D CFD: Myth or Reality  
V. Soumoy (Fluids & Co, CAN)

17:55 Numerical Simulation of Thermal Management of an Electric Three-wheel Roadster Battery Pack  
M. Ariana, M. Roux (Centre de technologies avancées BRP – Université de Sherbrooke, CAN) F. LeBel, J.P. Trovão (e-TEC Lab., Université de Sherbrooke and CTA.BRP-UdeS, CAN)

18:15 A Novel Approach to Combining 1D and 3D Simulations to Accurately Model the Immersion Cooling of CPUs and GPUs of a Blade Server  
M. Croegaert (Siemens PLM Software, USA) J. Halestrap, A. Young (Icoptope, GBR) J. Parry (Mentor Graphics - A Siemens Company, GBR)

**4D CFD - Process**

17:35 Predicting Baked Food Texture Blisters Through Modeling Approach  
K. Kreter, L. Zhao, T. Johnson, A. Warning (PepsiCo, USA)

17:55 Using CFD to Simulate Mixing Tank Clean-In-Place Process  
M. Sami, J. Ibrahim, H. Metwally (Ansys, USA) K. Brown (Spraying Systems, USA)

18:15 Analysis of Downdraft Gasifier Parameters in an Equipment Implemented in the Central Zone of Ecuador  
L. Orozco Cantos, D. Montenegro, S. López, E. Viteri (Escuela Superior Politécnica de Chimborazo, ECU)

**4E Education & Training**

17:35 When the Old Meets the New: Examples of What Established Analytical Methods Look Like in a Modern Computer Environment  
J. Aas (CT Innovations, GBR)

17:55 An Introduction to the Anatomy of Implicit and Explicit Finite Element Codes and their Application  
G. Kalsi (AWE, GBR)

18:15 Impact of Simplifications on Simulation Accuracy  
G. Westwater, D. Lira (Emerson Automation Solutions, USA)

**4F Composites 2**

17:35 Assess Impact of Fiber Waviness on Composite Structure Performance by Finite Element Modelling  
C. Lequesne, H. Xiong, J. Delsemme (Samtech, a Siemens Company, BEL) M. Bruyneel, F. Streppe (GDTEch, BEL) V. Destoop, T. Pardoën (UCLouvain, BEL) T. de Lumley Woodyear (Sonaca, BEL) V. Nepper (Saba, BEL)

17:55 Internally Smeared Method for The Modelling of Composite Laminate Components  
A. Clugston, T. Robinson, D. Nolan (Queen's University Belfast, GBR)

18:15 Virtual Design of 3D Woven Composites – Joint Research Between Industry and Academia  
S. Müller (ESI Group, GER) A. Collado, R. Said (ESI Group, GBR) B. El Said, A. Thompson, S. Hallett (University of Bristol, GBR) L. Brown, A. Endruweit, A. Long (University of Nottingham, GBR) V. Koncherry, P. Potluri, M. Gautam (University of Manchester, GBR)

18:35 End of Presentations

19:00 **Optional Dinner in The Québec Parliament Building**  
(Not included in the Congress fee. To be ordered separately on a first come, first served basis. Availability is limited.)

### 3G Contact 1

15:40 Application of Variable Order Spectral Element Method on Nonconformal Unstructured Meshes for an Engineering Analysis of Assemblies with Geometric Inaccuracies  
A. Vershinin, V. Levin (Lomonosov Moscow State University, RUS) A. Kukushkin, D. Konovolov (Fidesys, RUS)

16:00 Contact Analysis - An Alternative Approach  
R. Helfrich, M. Ast (Intes, GER)

16:20 Multi-Megawatts Wind Turbine Gearbox Contact Stress and Strength Analysis  
Y. Song, Y. Li (Chongqing Wangjiang Industrial, CHN)

### 3H Discrete Element Method 1

15:40 Off-Road Industry Needs for Leading Innovation in Soil & Crop Systems \*  
C. Plouffe (Deere & Company, USA)

16:00 CFD-DEM and DEM Modelling for Particle Flows and Multiphase Flows  
A. Mayrhofer, C. Goniva, A. Hager, C. Kloss (DCS Computing, AUT), S. Chewning (ESCO, USA) T. Keskitalo (Neste Engineering Solutions, FIN)

16:20 Numerical Modeling of Bulk Solids Flow Using the DEM Approach  
M. Esaki, D. Craig, (Jenike & Johanson, CAN)

16:40 Methodology for the Simulation of Conveyor Belts Using the Discrete Element Method  
E. Fimbinger (University of Leoben, AUT)

### 3J Acoustics / NVH 1

15:40 Correlation Between Structural-Acoustic Analysis and Measurements on the Permanent Magnet Synchronous Motor of Electric Vehicle  
H. Lee, S. Yoo, E. Kong, C. Hong (LG Electronics, KOR)

16:00 Acoustic Simulation of Dynamic Structural Events in Complex Mechanical Devices  
S. Gilmore, L. Green, R. Collings (Crux Product Design, GBR)

16:20 Virtual Systems Engineering for Professional Audio Applications  
A. Svobodnik (Mvoid Group, AUT) S. Hutt (Mvoid Group, GER) T. Nizzoli (Mvoid Group, ITA) M.-O. Chauveau (Mvoid Group, FRA)

16:40 A Computational Solution to Evaluate and Improve Wind Noise Generated by Sensors of Autonomous Vehicles Early in the Design Process  
S. Senthooan, M. Desouky, R. Powell, Z. Sugiyama (Dassault Systèmes Simulia, USA)

### 3K Electromagnetics 1

15:40 Computational Electromagnetics for Nuclear Fusion Engineering and Design  
R. Otin, S. Aria, V. Thompson, R. Lobel, J. Williams, Z. Vizvary, D. Iglesias, M. Porton (UK Atomic Energy Authority, GBR)

16:00 Enabling Rapid Electric Motor Design and Analysis  
J. Wanjiku (Siemens PLM Software, CAN)

16:20 Energy Budget of Electrical Arcs in a Gas-Blast Circuit Breaker  
R. Fuchs, H. Nordborg (HSR University of Applied Sciences Rapperswil, SUI)

16:40 mm-Wave Antenna Array Modeling for ADAS Applications  
L. Salman, S. Carpenter (Ansys Canada, CAN)

### 3L SPDM 3

 15:40 Cerber, a SPDM Proof of Concept Based on OpenSPDM to Manage Bearing Design for Aircraft Engines at Safran Aircraft Engines  
J. Leroux, C. Le Lann (Safran Aircraft Engines, FRA) M. Norris (TheSDMConsultancy, GBR) G. Delabrousse, S. Grau (Inensia, FRA)

16:00 Challenges in Simulation-based Decisions Towards the Transformation of the Product Life-Cycle  
M. Atak, I. Raghupatruni, M. Einsiedler, A. Graetz A. Hatz, M. Dod, H. M. Heinkel, D. Seiler-Thull (Robert Bosch, GER)

16:20 Should CAE Simulation Results be Stored in 2D or 3D?  
A. Perifanis (BETA CAE Systems, GRE) V. Pavlidis (BETA CAE Systems International, SUI)

16:40 Quality Management of CAE Data Within an SPDM Environment  
S. Tzamtzis, I. Makropoulou, M. Pappas (BETA CAE Systems, GRE)

### T1 Sheet Metal Forming Part2

Sheet Metal Formability – Material Properties, Failure and Simulation  
T. Dutton (Dutton Simulation)

This course is intended to assist all those involved in the design of sheet metal components to identify the key material properties and potential failure modes during manufacture. The course will demonstrate how CAE methods can be used to simulate the manufacturing method in order to identify any potential problems with the process and establish if part design changes are required.

### 4G Contact 2

17:35 Circuit Breakers for Future Power Grids: Development and Evaluation on High Dynamic Actuated Mechanisms  
M. Schneider, O. František (ABB Corporate Research, GER)

17:55 Digital Twin of Electric Cables and Wire Harness  
P. Andry, A. Schyns (Samtech, BEL)

18:15 Numerical and Semi-Analytical Analysis of the Stick-Slip Effect Observed in Hydraulic Sealing Systems Made of Polyurethanes  
C. Wehmann, S. Dey, C. Schüle, M. Wilke (Trelleborg Sealing Solutions, GER)

### 4H Discrete Element Method 2

17:35 Simulation of Granular Flow Rate Through Grates in Semi-Autogenous Grinding Mills by Using DEM  
Y. Yang, A. Saxena (ME Global/Elecmetal, USA)

17:55 DEM Investigation of Voidage Gradients in Grain Bulks  
H. Landry (PAMI / Westest, CAN)

18:15 Simulation of Surface Damage and Body Breakage by Using DEM  
M. Sousani, C. Bosch Padros (DEM Solutions, GBR) A. Chagas (IPAT Institut für Partikeltechnik, GER), A. Saxena, Y. Yang (MEGlobal, USA)

### 4J Acoustics / NVH 2

17:35 Finite Element Integrated Methodologies Applied to External Gear Pump Vibroacoustic Analysis  
G. Miccoli (C.N.R. - IMAMOTER Institute, ITA) K. Hamiche (Siemens Industry Software, BEL)

17:55 Efficient and Accurate Broadband FEM-Based Vibro-Acoustics  
K. Hamiche, K. Vansant, S. Donders, O. Atak, H. Bériot (Siemens PLM Software, BEL)

18:15 Simulating Clutch Nonlinearity Effectively to Improve Transmission NVH Prediction  
M. Felice, W. Z. Nie, Y. Cheng, F. Pan, B. Juang, Y. Dai, Z. Fu (Ford Motor Company, USA)

### 4K Electromagnetics 2

17:35 Numerical Simulation of Ablation-Radiation-Magnetic Field Coupling in High-Voltage Circuit Breaker Chambers  
S. Arabi, J. Trepanier, R. Camarero (Polytechnique Montreal, CAN) P. Robin-Jouan (General Electric, FRA)

17:55 Multiphysics Analysis of a Three-phase Power Transformer Under Short-circuit Fault Conditions: Study of Electromagnetic Forces and Deformations in the Windings and the Structural Elements  
A. Rodríguez González, P. Lombard, T. Guffroy, V. Leconte (Altair Engineering, FRA)

18:15 Design of 5G mm-Wave Compatible Covers for High End Mobile Phones  
R. Enju, M. Rüttschlin (Dassault Systèmes, GER)

### 4L Leading Edge SPDM 1

 Leading Edge SPDM Architecture and Methodology Workshop Part 1  
R. Clay (chair, SNL), J. J. Billings (ORNL), J. Capul (CEA), D. Laney (LNL), D. Montoya (LANL)

The US Dept of Energy laboratories are at the leading edge of simulation technology and methodology, driving by mission requirements. In many cases physical testing is impossible and the consequences of failure are unthinkable, leading the labs to develop means to understand the uncertainties and margins associated with critical computational analyses. Developing better means to run automated, parametric studies is essential, and a key goal of the lab SPDM projects. Further, managing the [SPDM] information for credibility purposes is essential, as the labs develop capabilities for design-space exploration, multi-disciplinary design optimization, multi-physics and robust (stochastic) design. See sessions on Thursday for further details.

### T1 Postprocessing

Effective Postprocessing of Structural Analyses  
T. Abbey (FE Training)

The range of post processing options can be bewildering. However, understanding how to interrogate stress results is key to effective FEA. A road map is developed that shows how to use Von Mises, Cartesian and Principal stresses in a logical and authoritative manner. Examples of contour and XY plotting are shown. Load vectors and free body diagrams are also discussed.

08:15 P Plenary Presentations

- 08:15 **Numerical Simulation to Develop and Validate Autonomous Car**  
O. Colmard (Renault Technocentre, FRA)
- 08:45 **Applications of SPDM in Aircraft Structural Analysis at Embraer**  
R. Britto Maria, M. de Freitas Leal, E. Sousa Junior, V. Leite Lemos, P. Magalhães Cardoso, L Cosme de Oliveira (Embraer, BRA) D. Joshi (MSC Software, USA)
- 09:15 **Supporting the Simulation Community with Benchmark Measurements for Additive Manufacturing of Metals**  
L. Levine (National Institute for Standards and Technology (NIST), USA)
- 09:45 **„Diffusion of Innovation” Applied to Modeling & Simulation – What can we Learn from Social Science Research and Marketing?**  
M. Meili (Procter & Gamble, USA)

10:15 Coffee Break

10:55 5A Machine Learning



- 11:00 Theory-Guided Machine Learning Composites Processing Modelling for Manufacturability Assessment in Preliminary Design  
A. Floyd, D. Van Ee, A. Poursartip (Convergent Manufacturing Technologies, CAN) N. Zobeiry (University of British Columbia, CAN)
- 11:20 Powertrain Mount Bracket NVH Design Development Through Genetic Algorithm and Machine Learning  
K. Flores, C. Diaz (Ford Motor Company, MEX) C. Li, K. Zouani (Ford Motor Company, USA)
- 11:40 Study of Machine Learning Algorithms for the Prediction of Idle Combustion Uniformity  
A. Zouani, X. Li (Ford Motor Company, USA)
- 12:00 Forecasting Software License Usage Using Machine Learning in a Predictive Analytics Platform  
T. Rosenwinkel, L. Cole (Open IT, USA)

5B Assembly Simulation



- 11:00 Online Simulation Considering Production Uncertainties to Improve Assembly Quality  
F. Claus, F.A. Rupprecht, H. Hagen (Technical University of Kaiserslautern, GER)
- 11:20 3D Scanning and Geometric Tolerance Investigation in Support of a Tooling Failure Analysis using Numerical Simulation  
P. Duval, M. Lépine, W. Sirois (Creaform - Ametek, CAN)
- 11:40 Physics-based Simulation of Assembly Processes: The Need for More Automated Software Tools  
S. Van Der Veen (Airbus, FRA)

5C INCOSE - NAFEMS Leadership



- Systems Engineering meets Engineering Simulation
- A special session, inspired by the Systems Modelling and Simulation Working Group, as part of the INCOSE-NAFEMS programme of collaboration.
- Introduction by C. Stavriniadis (NAFEMS Chairman) and G. Roedler (INCOSE President)
- Presentations by
  - W. Miller (USA)
  - R. Hartmann (Airbus Defense and Space, GER)
  - E. Landel (Renault, FRA): Model Architecture & Model Identity Cards to Ensure the Simulation of Complex Systems
  - P. Coleman (Airbus, GBR)



5D Meshing

- 11:00 Analysis-Driven Geometry and Meshing for Large Scale Simulations  
S. Tendulkar, M. Beall, R. Nastasia, O. Klass (Simmetrix, USA) M. Shephard, O. Sahni (Rensselaer Polytechnic Institute, USA)
- 11:20 Dislocation Meshing – A Credible Solution to Automatic Hexahedral Meshing  
J. Aas (CT Innovations, GBR)
- 11:40 The Marching Tetra Method for Full Vehicle Meshing  
M. Lautsch (Lautsch Finite Elemente, GER)
- 12:00 FEM Mesh Generation Using CAD Surface Shape Recognition Technique  
K. Otani (Integral Technology, JPN)

5E CAE in the Design Process 2

- 11:00 Performance Assessment of Novel Building Technology Using Numerical Methods  
I. Paulson, H. Landry (Prairie Agricultural Machinery Institute (PAMI), CAN) M. Douglas (Natural Resources Canada, CAN)
- 11:20 Design Automation and Optimization of Outer Body Panels by CAx-Processes  
M. Mueller, I. Sokrut, S. Kolodzie (Ostfalia, University of Applied Sciences, GER)
- 11:40 Advancing Vehicle Development Using Digital Human Modeling During Early Stage Design: Case Example in the Design of a Novel Electric Cargo Scooter  
S. Fischer (University of Waterloo, CAN), M. Hetzler (Thumbprint Solutions, CAN)
- 12:00 Design Guide of the Vehicle Structural Components in the Concept Design Phase for Crashworthiness  
Y. Choi (Dassault Systèmes Simulia, USA) R. Nagose, A. Pathak (3dplm Software Solutions, IND)

5F Composites 3

- 11:00 A Benchmark Example for Delamination Growth Predictions Based on the Single Leg Bending Specimen Under Fatigue Loading  
R. Krueger (National Institute of Aerospace, USA) L. Deobald, H. Gu (The Boeing Company, USA)
- 11:20 Structural Performance of Recycled Carbon Fibre Composite Materials  
M. Rouhi, M. Juntikka (RISE Sicomp, SWE) J. Landberg (RISE IVF, SWE) M. Wysocki (RISE, SWE)
- 11:40 Weight Reduction Through Composites and Optimization  
N. Wagner (Intes, GER)
- 12:00 Advances in Material Modeling for High Velocity Impacts on Composites  
M. Bruyneel, A. Rajaneesh, F. Strepenne, (GDTech, BEL) P. Flores (University of Conception, CHL) J.P. Ponthot (Université of Liège, BEL)

12:20 Lunch Break

## 5G Optimisation 1

11:00 Shape Optimization Based on an Adjoint Method for Improving Aerothermal Performance of Heat Exchangers  
N. Francois (Valeo, FRA) T. Plusa (Valeo, POL)

11:20 Shape Optimization of a Shell Structure Restricted to a Complex Design Space  
S. Paquin, Y. St-Amant (Université Laval, CAN) D. Rancourt, A. Desrochers (Université de Sherbrooke, CAN) M. Turcotte, F. Lambert (Centre de Technologies Avancées, CAN)

11:40 The Optimal High-Volume Production Line  
L. Green, S. Gilmore, M. Phillippo (Crux Product Design, GBR)

12:00 Optimizing the Dynamic System Behavior of Machine Tools  
R. Helfrich, B. Kirchgäßner, G. Nötzel-Steidle (Intes, GER)

## 5H Fatigue & Fracture 1

11:00 Hot-Spot Identification for Accelerated Multiaxial Fatigue Analysis  
C. Strzalka, M. Zehn (Technical University of Berlin, GER)

11:20 Ductile Tearing Instability Analysis of Piping Bend with Surface Cracks Using J-R Resistance Curve and 3D Crack Meshes in Elastic-Plastic FEA  
G. Thorwald, E. Jensen (Quest Integrity Group, USA)

11:40 Derivation of Transfer Function to Relate Strain Data to Control Point Stresses for Fatigue Monitoring  
K. Pasinlioglu (Turkish Aerospace Industries (TAI), TUR)

12:00 Fatigue Modeling of Threaded Connectors  
S. Acharya, A. Chaurasia, H. Radhakrishnan (Ansys, USA) G. Mannella (GB Connections, USA)

## 5J AM Process Simulation



11:00 Automated Distortion Compensation Functionality for Metal Additive Manufacturing  
M. Tateishi (MSC Software, JPN) H. Schafstall, P. Mehmert (Simufact engineering, GER)

11:20 Additive Manufacturing Process Chain Modelling and Simulation  
A. Yaghi, S. Afazov, M. Villa (MTC, GBR)

11:40 Predicting Additive Manufacturing Build Cracks Using XFEM  
A. Narasimhan, J. Bi, Z. Du, V. Oancea (Dassault Systèmes Simulia, USA) V. Savane (Dassault Systèmes Simulia, IND) J. Laureto (Renishaw, USA)

12:00 Route Toward the "Additive Manufacturing Using Metal Pilot Line": MANUELA's Ambition and Status  
O. Tabaste (MSC Software, FRA) E. Onillon (CSEM, SUI)

## 5K Simulation for Electric Vehicles 1

11:00 Motor and Gear NVH CAE Analysis for a Hybrid Transmission Development  
M. Felice, M. Saadat, Z. Fu, B. Juang (Ford Motor, USA)

11:20 Electric Drive Noise and Vibration Analysis  
T. Reimer, M. Pöschl, G. Mohan (Dassault Systèmes Simulia, GER)

11:40 Optimized Motor Design Integrating Electromagnetic and Stress Simulation  
H. Jun-Wen, P. Verma, Y. Shi, D. Farina (Dassault Systèmes Simulia, USA)

12:00 Design and Simulation of an Inverter Power Module for an Electric Vehicle  
A. Van der Velden, K. Gundu, S. Prasad, P. Kanade, J. Zhou (Dassault Systèmes Simulia, USA)

## 5L VMAP Interoperability 1



11:00 A Reference Language and Ontology for Materials Modelling and Interoperability  
G. Goldbeck (Goldbeck Consulting, GBR) E. Ghedini (University of Bologna, ITA) A. Hashibon (Fraunhofer IWM, GER) G. Schmitz (Access, GER) J. Friis (Sintef, NOR)

11:20 FE Solver Integration Framework  
J. Szarazi (koneksys, GBR) C. Bock (NIST, USA)

11:40 Coupling Process Analysis Results to Structural Simulation: Ongoing Research on Mapping and Homogenization Algorithms  
C. Liebold, T. Usta, A. Haufe (DYNAmore, GER)

12:00 Recommended Best Practices for Model Based Engineering's Digital Twin: Analysis and Simulation  
J. G. Draper, R. L. Dreisbach (Boeing, USA) J. C. Johnson (Lockheed-Martin Aeronautics, USA) J. Boy (prostep ivip, GER) J. M. Crepel (AFNeT, FRA) P. Rosche (Advanced Collaboration Consulting Resources, USA) A. Lévy (Cimpa – subcontractor for Airbus EZMBB, FRA)

12:20 Towards an ICME Methodology in Europe – Nomenclature, Taxonomies, Ontologies, and Marketplaces  
G. Schmitz (Access, GER) G. Goldbeck (Goldbeck Consulting, GBR) E. Ghedini (University of Bologna, ITA) A. Hashibon (Fraunhofer IWM, GER) J. Friis (Sintef Industry, NOR)

## T1 Dynamics FEA

Dynamic Finite Element Analysis  
T. Abbey (FE Training)

This is a short overview of the basics of dynamics analysis, building quickly from normal modes analysis to transient and frequency response. The session is packed with hints and tips on the most effective ways to set up these analyses - and some reminders about the implications of a dynamic environment for designers and analysts. Attendees qualify for a 15% discount on Tony's new NAFEMS book; How to do Dynamic FEA.



NAFEMS and INCOSE (International Council on Systems Engineering) are collaborating to accelerate innovation for engineering simulation and model based systems engineering. This collaboration includes the implementation of a joint cross organizational working group on Systems Modeling & Simulation.

More information can be found at  
[www.nafems.org/about/technical-working-groups/systems\\_modeling](http://www.nafems.org/about/technical-working-groups/systems_modeling)

**13:20 Sponsor A Dassault Systèmes Simulia**

Towards Industry Renaissance with Simulation Driven Experiences

As Industries move into the Age of Experience, being practical or aesthetically appealing is not sufficient anymore for engineered products. Products need to be designed to drive consumers' engagement and loyalty, through the maximization of user experience, often defined as comfort, connectivity or interactivity. However, competing requirements make it challenging to achieve simultaneously performance and experience, and only through simulations can optimal products be designed from early conceptual phase to manufacturing. Industry solutions from Dassault Systèmes SIMULIA enable design through simulations, and will be presented in this session in the context of digital product engineering for experience and performance.

**Sponsor B ANSYS**

ANSYS is making simulation more pervasive. Learn about the new capabilities that have dramatically broadened the scope and performance of simulation solutions for additive manufacturing and multiphysics. See the new user-experience advancements that are speeding time to solution while making ANSYS Fluent and ANSYS Mechanical accessible to more engineers with less training. Learn how you can rapidly explore new ideas, iterate and innovate with ANSYS Discovery 3D design software and enable better, greener, safer products with Granta, the leader in materials information technology.

**Sponsor C Siemens PLM**

Simulation is critical to the creation of digital twins and any company's journey towards digitalization. Siemens Simcenter is a complete solution for the creation of effective, efficient and accurate digital twins in support of product development. Discover how Simcenter enables our customers to discover better designs faster, continuously improve product performances and adapt to the real world. We will use real industrial examples presented by customers to illustrate how Simcenter solutions for multidisciplinary, multiphysics simulation and generative design are being used to advance performance engineering.

**Sponsor D ARAS**

Managing Simulation in the Digital Thread: Join the Aras team for this interactive software demonstration and Q&A session featuring our NAFEMS presenter, product management, and industry partners. Learn how the Aras solution combines simulation data management, automated multi-physics and multi-fidelity processes, and your existing tools and expertise to scale the use of simulation across the enterprise and throughout the product lifecycle. Engineers can quickly run simulations in easy-to-use apps that enforce repeatable best practices while ensuring results are connected to the product's configuration, maintaining a traceable digital thread of product information that includes simulation inputs and results.

**Sponsor E ESI / HBM Prencia**

13:20 - 14:00 ESI Group  
Using off-the-shelf CAE technology to support the design and manufacturing of new products has been a daily-routine in some industries for years. Engineers in Automotive have even reached the stage where Virtual Prototyping, with truly "zero physical prototyping", is already a reality! This talk will cover not only Virtual Prototyping solutions supported by ESI for more than a decade, but also elaborate on its strategy to follow the product into the "In-Service" stage, so that the entire Product Performance Lifecycle™ can be covered. Benefiting from the recent revolution in the IoT and AI, the talk will also show how a new paradigm for using simulation and modelling to support "real-time" decision making is emerging. Coupling data and physics-based modelling, while supported by advanced Model Order Reductions techniques, the unique approach adopted by ESI for building Hybrid Twin will be demonstrated.  
Dr Fouad el Khaldi (ESI Group)

14:05 - 14:45 HBM Prencia  
The democratization of engineering software has gained momentum by companies looking to enable more engineers to perform sophisticated simulations. The vision for this next step in the use of CAE tools has many aspects and projected benefits; requiring easy-to-use apps that help capture and transfer corporate knowledge, reduce the reliance on key individuals, increase the productivity of more engineers, improve quality and reduce errors. It increases the ability for the non-expert to perform analysis tasks that traditionally only experts have done. This presentation describes the capabilities required to turn democratization into a reality and outlines a new product for this purpose called Aqira from HBM Prencia.  
J. Aldred (HBM Prencia)

**Sponsor F Altair / Front End Analytics**

13:20 - 14:00 Altair Engineering  
How Simulation-Driven CAE will be Profoundly Changed by Data Intelligence and Machine Learning  
Machine learning is not a new concept, however, all the elements required for machine learning in engineering applications have come together only recently. Access to more bandwidth to transfer data, affordable data storage, and increasingly powerful computational resources create new opportunities to leverage data intelligence and machine learning to inform more accurate engineering decision making. We will discuss a few exciting applications including predictive modeling and prescriptive analytics of CAE or test data, merging physics-based simulations with data-driven predictive models, and the merging historical and real-time data.  
Dr. Fatma Kocer, VP Business Development Design Exploration

14:05 - 14:45 Front End Analytics  
A Real-Time Physics Informed Predictive Analytics Digital Twin for Thermal Mechanical Fatigue  
This session will demonstrate a real-world Predictive Maintenance Digital Twin for an industrial application. The Digital Twin continuously takes data from the field and instantaneously (real-time) predicts thermomechanical fatigue failure. The predictive engine associated with this Digital Twin is a proprietary Causality Based Physics Informed Multistage Surrogate, which was validated, and blind tested with computational models. The computational models used CFD, FEA and fatigue analysis software from DS SIMULIA software suite and the Digital Twin App was built using the EASA software platform.

**14:45 Coffee Break**

**15:25 6A Digital Twins** 

Digital Twins in an Uncertain World  
Moderated by A. Karl (Rolls Royce, USA)

The digital twin concept unites the strengths of modelling and measurements to enable reliable decisions to be made based on all available knowledge. But no knowledge is perfect, and this fact needs to be reflected in the methods used to implement the concept. All measurements have an associated uncertainty (due to experimental repeatability, sensor drift & nonlinearity, sample instability, etc.), which means that all model inputs have an associated uncertainty. Then, all model outputs must also have an associated uncertainty. To make intelligent and effective use of data, models, and digital twins, these uncertainties need to be taken into account. This need will place demands on the contents of the data streams and the models used, and on the methods used to update the models based on the data. This panel discussion will explore the concepts underpinning digital twins and stochastic simulation and will highlight the future research, developments and considerations that will be needed to enable the technology to reach its full potential. Please contact the swg@nafems.org if you have any questions you want the panel to address.

**15:30 6B MPS - Composites** 

15:30 Probabilistic Process Simulation and In-situ Process Prediction During Composite Manufacturing as Contribution to Industry 4.0  
R. Hein, T. Wille, M. Liebisch (German Aerospace Center, GER)

15:50 Manufacturing-Oriented Bead Patterns for Long Fiber-Reinforced Polymer Structures  
S. Revfi, A. Albers, M. Spadinger (Karlsruhe Institute of Technology (KIT), GER)

16:10 Braiding Process Simulation: Comparison of Kinematic and Finite Element Models for Large Scale Components  
A. Treviso (National Composites Centre, GBR) L. Thadhani (O, GBR) D. Ivanov, L. Kawashita, R. Sun (University of Bristol, GBR)

16:30 Simulation of Deposition Manufacturing Processes of Polymer Matrix Composites  
P. Silva, M. Lane, J. McRoberts, A. Forghani, A. Poursartip (Convergent Manufacturing Technologies, CAN) S. Hind, D. Djokic, M. Rahmat, A. Yousefpour (National Research Council, CAN)

**15:30 6C INCOSE - NAFEMS Discussion** 

Progress in Modelling and Simulation for Systems Engineering

Integrating Modelling and Simulation at all Levels of Engineering: Element, System and System-of-System

Overview of the joint NAFEMS/INCOSE System Modelling and Simulation Working Group  
R. Dreisbach (formerly Boeing, USA)

Panel discussion:  
K. Lunney (INCOSE President-Elect of INCOSE, AUS) - moderator  
P. Coleman (Airbus, GBR)  
R. Dreisbach (formerly Boeing, USA)  
R. Hartmann (Airbus Defense and Space, GER)  
E. Landel (Renault, FRA)



**15:30 6D Elastomers & Polymers**

15:30 Incremental Critical Plane Method for Fatigue Analysis of Elastomers  
W. Mars, J. Suter (Endurica, USA)

15:50 Simulation of Polyurethane Foaming Process for Seat Cushions and Automotive Components  
A. Trameçon, M. Blondel, M. Schaefer (ESI Group, FRA)

16:10 Scalable Linear Solvers for Computational Material Design of Filled Rubbers  
G. Hülsmann, A. Krechel, H.J. Plum, M.A. Schweitzer (Fraunhofer SCAI, GER) W. Hu, C.T. Wu (Livermore Software Technology Corporation, USA) M. Koishi (Yokohama Rubber Company, JAP)

16:30 High Strain Rate Testing and Modeling of Thermoplastics  
S. Teller, J. Bergstrom (Veryst Engineering, USA)

**Sponsor E Dassault Systèmes Simulia**

Experience Transformation in All-Physics and All-Scale Design

Numerical simulation of physics based phenomena has become essential for design as products have become more complex and lifecycles shorter. Building multiple physical prototypes is simply not cost- or time-effective in many industries and no longer necessary as the capability and reliability of simulation tools have matured. The new challenge is multi-physics and multi-scale system design where interdependent physics at varying scales must be considered at the earliest design stage to ensure correct function and regulatory compliance of the final product. Platform based simulation with access to cloud high performance computing can meet these demanding requirements and transform the user experience. This session will present some of the current challenges in multi-physics and multi-scale design and look at how a platform and cloud first approach can drive innovation.

**15:30 6F Methods**

15:30 A Novel End-to-End Solution for Solving Super Large Structural Simulation Problems  
V. Belsky, M. Kim, C. Ianculescu, J. Jang, W.J. He, Y. Shi (Dassault Systèmes Simulia, USA)

15:50 Active Structures in an Interactive Simulation Environment  
D. Marinkovic, M. Zehn (Technical University of Berlin, GER)

16:10 Model Creation and Pre-Processing in the Age of Iso Geometric Analysis for Crash Simulation  
L. Rorris (BETA CAE Systems International, SUJ) A. Vafeidis, I. Chalkidis (BETA CAE Systems, GRE)

16:30 Isogeometric Analysis for More Accurate Simulation  
M. Sederberg (Coreform, USA) M. Scott (Brigham Young University / Coreform, USA)

**16:50 End of Presentations**

**NWC Sunset Dinner Cruise: 17:30 Option for a bus/coach to Quebec harbor - 18:00 Boarding of ship - 19:00 Ship departs - 23:00 Ship returns**

**Sponsor G MSC / Murata**

13:20 - 14:00 MSC Software  
 Creating a 20-Node Hexahedral Element Model: An Innovative Solution to an Old Problem: One of the many critical analysis tasks in aircraft design is the evaluation of structural stability, and since the invention of finite element analysis (FEA), engineers around the world have been attempting to do this with as few elements (and thus lowest amount of computational hardware) as possible. One of those "sweet spots" between mathematically accurate results & lowest elements possible is the 20-node Hexahedral element. Unfortunately, from a historical perspective, the process required to develop geometry suitable for a hexahedral mesh has been complicated and time-intensive – almost to the point of negating the time saved by faster solves due to the hexahedral mesh. With the advent of MSC Apex's hex meshing technological advancements, engineers now have a quick and innovative solution to their structural analysis workflows. J. Pura (MSC Software)

14:05 - 14:45 Murata Software  
 A great wave of CAE software has arrived from Japan!  
 Based on the finite element method, Femtet solves a wide range of engineering challenges with its extensive functionalities of pre/post processing and simulation. The scope of simulation ranges from electromagnetism to mechanical stress, heat conductivity, piezoelectricity, and acoustics. Interactions between the multiple physics can be solved as well. What makes Femtet unique is its easy and intuitive operation for its capabilities. The leading engineers must concentrate on the problem solving, not on the time-consuming simulation setups. At Murata Software's session, you will experience firsthand how Femtet makes it possible with reliable results.

**Sponsor H Esteco / Polygonica**

13:20 - 14:00 Esteco  
 Democratization and Knowledge Management of a Virtual Product Development Process using Core Tenets of SPDM  
 A plethora of factors like expanding product portfolio, complexity of the products, reduction in time to market lead to companies adopting simulation as a cornerstone of their product development process. As simulation and modeling capability matures the impact of simulation is felt across the product development lifecycle from component level detailed design to subsystem and system level design.  
 In this presentation we explore the use of a web-based collaboration and simulation data management platform to democratize virtual product development workflows. Further we explore the ability of such a system to enable decision making by using mathematical optimization and analytical decision-making techniques. The also enables traceability and knowledge management of design decisions, supporting models and workflows in an intuitive web-based interface.

14:05 - 14:45 Polygonica  
 The advanced Polygon modelling capabilities of Polygonica are becoming widely adopted by vendors in Additive Manufacturing and CAE. Embedded within ANSYS Discovery, ANSYS Spacedaim, CONVERGE Studio, 3DXpert, GrabCAD Print and Synopsys Simpleware, Polygonica offers a range of boundary mesh pre-processing, modelling and post-processing functionality. Offered as software libraries Polygonica can be deployed on public or on-premise clouds as well as Windows, Linux and Mac desktops. This session focuses on some of the key features of Polygonica including automatic mesh healing, mesh gluing, feature-based defeaturing, mesh quality refinement, coarsening and decimation, Booleans, isotropic and anisotropic offsetting, fairing and smoothing.

**K Probabilistic Analysis**

Introduction to Probabilistic Analysis and Design  
 D. Riha (Southwest Research Institute, USA)

This course is intended for engineers, scientists, and technical managers who are concerned with managing uncertainty and risk of structural, mechanical and other engineering systems, and desire to become familiar with the background and the use of state-of-the-art probabilistic methods. The course will include the motivation, methods, and tools for probabilistic analysis and design. These methods are general and used to design for reliability and systematically account for variations and uncertainties in engineering systems. Probabilistic analysis and design approaches allow the analyst to quantify the reliability and identify the important variables in their design. These results provide decision makers additional information for decisions related to issues such as certification, fleet management, and condition based maintenance. Selected design problems will be used to illustrate the technology.

**L Turbulence**

Elements of Turbulence Modelling  
 K. Fouladi (Infomec Consulting)

This course is focused on understanding turbulence, need for turbulence modeling, and various modeling approaches. Discussions on the advantages and limitations of various models should help CFD users in selecting appropriate turbulence models for their simulations.

**T1 Fatigue**

Fatigue Analysis  
 T. Abbey (FE Training)

This short course gives some insight into the methods behind high and low cycle fatigue and fracture mechanics methods. How are they different? When do we use them? What are the implications for FEA?

**6G Optimisation 2**

15:30 Multidisciplinary Design Optimization of a Composite Aircraft Radome  
 K. Hunter, E. Whalen, G. Gampala, S. Mishra, C. Reddy (Altair Engineering, USA)

15:50 Automatic Detuning of Steam Turbine Rotor Blades' Eigenfrequencies Away From Critical Areas  
 A. Saratov (Datadvance, RUS) M. Stepanov, D. Kshesinskii (Ural Turbine Works, RUS)

16:10 Design and Sizing of an Airship Supported by CAE  
 M. Bruyneel, O. Banse, L. Fitsch, S. Gohy, J. Buret (GDTEch, BEL) N. Caeymax (Flywin, BEL) M. Duponcheel (Université Catholique de Louvain, BEL) P. Hendrick (ULB, BEL) E. Callut (Deltatec, BEL)

16:30 Shaping Engine Cylinder Head for a Uniform Contact Pressure Distribution  
 M. Shimozono (Intes Japan, JPN)

**6H Fatigue & Fracture 2**

15:30 Application of Gaussian Process and Three-Dimensional FEA in Component Level Crack Propagation Life Assessment  
 A. Loghin (Simmetrix, USA) S. Ismonov (Jacobs Technologies, USA)

15:50 Evaluation of the Effect of Unconventional Material Cracking over Structural Residual Strength  
 I. Rivero Arevalo, A. Palomar Claudio, M. Lozano Hidalgo, J. Gomez-Escalonilla Martin, J. Ignacio Armijo (Airbus, ESP)

16:10 Fatigue Simulation of Welds Using the Total-Life Method  
 J. Mentley K. Munson (HBM Prensaia, USA) A. Halfpenny, P. Roberts (HBM Prensaia, GBR)

16:30 Study Approach to Crack Initiation at Tungsten Plates using FEM  
 N. Jaksic, I. Zammuto, A. Herrmann, H. Greuner, A. Kallenbach (Max-Planck-Institut, GER)

**6J AM - Validation & Calibration**

15:30 Simulation of Additive Manufacturing Processes for Metals: Amazing Experiences  
 H. Gysin, R. Gantenbein (HSR Hochschule für Technik, SUI)

15:50 A Modified Shrinkage Method for Fast Prediction of Residual Distortion and Stresses in Additive Manufacturing of Metal Parts  
 A. Durán, J. Jorge, M.A. Guerrero (Idonial Technology Center, ESP)

16:10 Simulation of the Laser Powder Bed Fusion Process to Predict Part Distortion  
 C. Simoneau (SimuTech Group, CAN) F. Zongo, A. Timercan, A. Tahan, V. Brailovski (Ecole de technologie supérieure, CAN)

16:30 Additive Manufacturing Simulation of Thin-Walled Structures  
 Z. Francis, R. Mitchell (Ansys, USA)

**6K Simulation for Electric Vehicles 2**

15:30 A Study on the Optimization of EV Inverter Power Module Considering Tolerances  
 Y. Kim, Y. Kim, C. Hong, M. Kang, K. Kim (LG Electronics, KOR)

15:50 Design and Analysis of a Battery Pack for a Light Weight Sports Car  
 K. Illa, W. Seeley, N. Romain (Siemens PLM Software, USA) R. Spotnitz (Battery Design, USA)

16:10 Designing Energy Efficient Traction Machines for Electric and Hybrid Vehicles  
 A. Rodriguez, V. Leconte, P. Lombard, A. Soualmi (Altair Engineering, FRA) P. Wendling (Altair Engineering, USA)

16:30 A Dynamic Optimization Process Applied to the Design of Propulsion System for Electric Cars  
 M. Tout, P. Menegazzi (Valeo, FRA) P. Sebastian (University of Bordeaux, FRA) J. Pailhès (Arts et Métiers ParisTech, FRA)

**6L VMAP Interoperability 2** 

15:30 Lessons Learned from Developing a Digital Prototype Within the ARENA2036 Environment and Improvements with the New VMAP Standard  
 C. Liebold, A. Haufe (DYNAmore, GER) M. Vinot, M. Holzapfel (DLR Stuttgart / German Aerospace Center, GER) J. Dittmann, P. Böhler (IFB – University of Stuttgart, GER) F. Fritz, H. Finckh (DITF – Deutsches Institut für Textil und Faserforschung, GER)

15:50 Mapping Made Easy: How the New VMAP Interface Standard Can Be Utilized Towards Smooth Preprocessing  
 A. Fassas, G. Mokios (BETA CAE Systems, GRE)

16:10 From Manufacturing to Performance Analysis for Composite Structures – Efficient Data Handling and Exchange  
 S. Müller (ESI Group, GER) T. Bergmann (AUDI, GER)

16:30 Material Data Transfer in Virtual Engineering Workflows: Application of the VMAP Standard in a Neutral Mapper Tool \*\*  
 A. Oeckerath, P. Gulati, K. Wolf (Fraunhofer Institute for Algorithms and Scientific Computing – SCAI, GER)

**T1 Joints & Connections**

Joints and Connections  
 T. Abbey (FE Training)

Most structures involve some form of jointing or connection. This overview looks at popular FEA methods for simulating mechanical joints, welding and bonding. Different idealization approaches and element types will be reviewed. Hints and tips will be developed based on identifying key analysis objectives.

Preliminary conference agenda, subject to alteration. Presentations times and days may change.

08:30

**P Plenary Presentations**

- 08:30 Achievements and Challenges in Weather and Climate Modelling**  
V. Pope (Met Office, GBR)
- 09:00 Implementation of Simulation Driven Development**  
C. Brix Jacobsen (Grundfos, DEN)
- 09:30 The Era of "Twins"! A New Paradigm for Simulation-and-data-based Engineering as Applied to Materials, Processes, Structures, and Systems**  
F. Chinesta (ENSAM ParisTech, FRA)
- 10:00 Activities and Factors Essential to the Endorsement of Confidence in Numerical Simulation and Predictions**  
M. Eriksson (Validus Engineering, SWE)

10:30

Coffee Break

11:10

**7A Digital Hype - AI & ML**

**11:15 Toward Disruptive Methods for Optimization Study in Automotive Industry Including Recent and New Reduction Techniques**  
E. Gstalter (Renault/UTC, FRA) S. Assou (Renault/ Ecole Centrale Lyon, FRA) F. De Vuyst (Universite de Technologie de Compiègne (UTC), FRA) Y. Tourbier (Renault, FRA)

**11:35 Deep Learning for Geometry Understanding**  
S. Suwelack, S. Slavetinsky, D. Haensch, M. Stoll (Renumics, GER)

**11:55 How AI will Change the Role of Simulation and the Simulation Processes \***  
M. Schlenkrich (MSC Software, GER)

**12:15 How to Leverage Applied AI & Deep Learning in Manufacturing and Simulation**  
R. Duquette (Maya HTT, CAN)

**7B AM Enabled Optimisation**

**11:15 Democratization of Lattice Structure Generation and Topology Optimization Tools**  
J. Coronado (PTC, CAN) A. Vlahinos (Advanced Engineering Solutions, USA)

**11:35 Leveraging Simulation to Optimize Design for 3D Printing**  
S. Sithambaram (Dassault Systèmes Solidworks, USA)

**11:55 Lattice Optimization and Process Simulation of a Turbine Blade**  
A. Narasimhan, V. Deshpande (Dassault Systèmes Simulia, USA) V. Savane (Dassault Systèmes Simulia, IND) R. Galtier (Dassault Systèmes Catia, FRA)

**12:15 Simulation Driven Development for Additive Manufacturing of Critical Components for High Temperature Applications of Industry Pump – An Industrial Approach**  
M. Kristensen, A. Jensen (Grundfos, DEN)

**7C Heat Transfer 1**

**11:15 CFD Tool in the Development of the New BRP Can-Am Ryker with Aerodynamic, Heat Management and CVT Cooling**  
T. Driant (BRP, CAN)

**11:35 Conjugated Heat Transfer Modelling of Hotfilled or Thermally Treated Beverages for Predicting Food Spoilage**  
A. Warning, R. Bigsby, M. McNichols, L. Zhao, M. Mitchell, Y. Lou, G. Schimmel (PepsiCo, USA)

**11:55 Virtual Development of Cooling Strategies for LED Street Lights Using Conjugate Heat Transfer Methods**  
U. Janoske (University Wuppertal, GER) K. Müller (Gratz Luminance, GER)

**12:15 Prediction of Deuterium-Tritium Ice-Layer Uniformity in Direct-Drive Inertial Confinement Fusion Target Capsules**  
B. Rice (Rochester Institute of Technology, USA) J. Ulreich, M. Shoup (University of Rochester, USA)

**7D Multiphysics 1**

**11:15 Introduction of Fluid Element to Structural-Thermal Analysis in Diamond Light Source**  
H. Huang (Diamond Light Source, GBR)

**11:35 Modeling Thermal-Fluid-Structure Interaction for Leakage Prediction in Diesel Engine Fuel Pumps**  
C. Wolfe (Ansys Software, USA) V. Rao, J. Mutyal (Ansys Software, IND)

**11:55 A Multiphysics-Circuit Coupled Dynamic Modeling of Electroactive Polymer Based Capacitive Force Sensor**  
S. Badgajar, S. Sewalkar, D. Phatak (John Deere India, IND)

**12:15 2-Way Coupled FSI Simulation for Reciprocating Compressor Reed Valve**  
M. Rajus, M. Soppin, V. Kumar Turaga P. Ag (HCL Technologies, IND)

**7E Joints & Connections**

**11:15 FEA and Physical Correlation of Bolted Joints' Response to Transverse Loading**  
S. Huston (Ingersoll Rand, USA) S. Legan (Thermo King, USA)

**11:35 Probabilistic Joint Stiffness Analysis With Hole Clearance and Position Variations**  
D. Can Erdayi, M. Kutlu, B. Ay (Turkish Aerospace, TUR)

**11:55 Multidisciplinary Spotweld Optimization**  
T. Jankowiak, R. Nimbalkar, V. Gandhi, J. Sims (BETA CAE Systems, USA)

**12:15 Iterative Design Method for Plastically Stressed Shaft-Hub Connections with Optimized Contact Pressure**  
D. Ulrich, H. Binz (University of Stuttgart, IKTD, GER) R. Meissner, M. Liewald (University of Stuttgart, IFU, GER)

**7F HPC**

**11:15 Design and Implementation of a Scalable Library of Krylov Subspace Solvers**  
D. Grünwald, F. Pfreundt, D. Stoyanov (Fraunhofer ITWM, GER)

**11:35 The Effect of InfiniBand In-Network Computing on CAE Simulations**  
Y. Qin, O. Maor, G. Cisneros-Stoianowski, G. Shainer (HPC Advisory Council, USA)

**11:55 Using Cloud HPC to Simulate MEMS Resonators**  
S. McInnaran, A. Patel, A. Tweedie, G. Harvey, R. Banks (OnScale, USA)

**12:15 Yield Stress is Not Enough: Recent Innovations in Micromechanics for Nonlinear Analysis**  
L. Margetts, S. Hewitt (University of Manchester, GBR) A. Shterenlikt (University of Bristol, GBR) J. Arregui Mena (Oak Ridge National Laboratory, USA) L. Evans (University of Swansea, GBR) F. Levrero (University of Oxford, GBR) P. Pankaj (University of Edinburgh, GBR)

12:35

Lunch Break

13:35

**8A Digital Twins in Industry**

**13:40 How to Tell the Difference Between a Model and a Digital Twin**  
L. Wright, S. Davidson (National Physical Laboratory, GBR)

**14:00 Spacecraft Digital Twin as Development Accelerator**  
C. Ducamp (Airbus, FRA) S. Estable (Airbus, GER)

**14:20 Beyond the Obvious - The Industry 5.0 by Hybrid Modelling**  
V. Lämsä, S.-P. Leino, J. Kortelainen, B. Hemming, V. Nieminen, O. Saarela, P. Kivikytö-Reponen, V. Kotovirta (VTT Technical Research Centre of Finland, FIN)

**14:40 Product Digitalization: Towards the Design of Digital Twins**  
U. Abusomwan, L. Alteirac (Schlumberger, USA)

**8B Optimising the AM Process**

**13:40 Non-Differentiable Functions in Topology Optimization: Application to Additive Manufacturing**  
D. Weinberg (Autodesk, USA) N. Kim (University of Florida, USA)

**14:00 A Novel Approach to Avoid Internal Support Structures in Fluid Flow Optimization for Additive Manufacturing**  
F. Lange, A.S. Shinde, K. Bartsch, C. Emmelmann (Fraunhofer IAPT, GER)

**14:20 A Novel Approach to Support Structures Optimized for Heat Dissipation in SLM by Combining Process Simulation With Topology Optimization**  
K. Bartsch, D. Herzog, C. Emmelmann (Hamburg University of Technology, GER) F. Lange (Fraunhofer IAPT, GER)

**14:40 Multiphysics Design and Process Optimization of Additively Manufactured Radio Frequency Components**  
S. Acharya (Ansys, USA) I. Waldron (Ansys, USA)

**8C Heat Transfer 2**

**13:40 Tackling Vehicle Thermal Management Challenges With a Novel Fast Transient Analysis Approach**  
H. Ghazialam, Z. Zhang (Ansys, USA) T. Juan (Karma Automotive, USA)

**14:00 Automated End-to-end Modeling Technique for Board-level Thermal Analysis: A Qualitative and Quantitative Comparison between a Full 3D and a 2D Multi-layer Shell Approach**  
Y. Sigmen (Maya HTT, CAN)

**14:20 Transient CFD/CHT Analysis of an All-Ceramic Premolar Dental Bridge in a Dental Ceramic Furnace**  
A. Eser, S.D. Heintze (lvodar Vivadent, LIE) R. Hu (Cadferm (Suisse), CHE)

**8D Multiphysics 2**

**13:40 FEM-BEM Coupling for Non-linear Electromagnetic Field Computations**  
T. Rüberg, L. Kielhorn, J. Zechner (Tailsit, AUT)

**14:00 Multiphysics Modeling: Electro-Thermal-Vibro-Acoustics Analysis of a Permanent Magnet Machine for Electrical Vehicles**  
K. Illa (Siemens PLM, USA) K. Kucukcoskun (Siemens PLM, BEL)

**14:20 Harmonic Analysis in Power Transformers: Oil Influence**  
S. Tavares, M. Pinto, C. Novais, C. Coutinho, C. Linhares, H. Mendes, J. E. Santo, R. Teixeira (Efaced, POR)

**8E Automation**

**13:40 Development of Pre-processing Automation Tools for a Seat FE Analysis**  
S. Sung (Hyundai Dymos, KOR)

**14:00 Optimization Strategy for a High Dimensional and Heavily Constrained Expensive Black-box Problem**  
Z. Xue, A. Barnard (Esteco North America, USA)

**14:20 Innovative Techniques on Beam Section Optimization: A BIW Case Study**  
D. Drougkas, G. Korbetis (BETA CAE Systems, GRE) K. Skolarikis (BETA CAE Systems International, SUI)

**14:40 Reconfigurable Formulation and Implementation of MDAO Systems**  
J. Jenkins (Noesis Solutions, USA) R. Lombardi (Noesis Solutions, ITA) I. Van Gent, G. La Rocca (Technical University of Delft, NED)

**8F Acoustics / NVH 3**

**13:40 Lightweighting with Improved NVH**  
B. Gadhia (MSC Software, USA)

**14:00 Comprehensive Optimization Process to Deliver NVH and Weight Attributes for Automotive Underhood Components**  
K. Zouani, S. Panchxrimath (Ford Motor Company, USA) K. Flores (Ford Motor Company, MEX) J. Gowtham (Global Engineering Services-GES, IND)

**14:20 The Vibration Comfort Optimization of an Off-road Vehicle Using Finite Element**  
M. Bolduc, E. Poulin (BRP, CAN) H. Bastien (Ametek-Creaform, CAN)

## 7G Optimisation - Business Issues

11:15 Achieve High ROI with the Insight of Software Usage  
L.M. Cole (Open IT, USA)

11:35 How Optimization Techniques can be used to Minimize Use of Resources While Increasing a Simulation Project Chance of Success  
M. Robitaille, Y. Sirois, J. Therien (LxSim, CAN) F. Martel, D. Rancourt (Université de Sherbrooke, CAN)

11:55 When is it Worth Using Design Exploration in Practice?  
N. Wagner (Intes, GBR)

12:15 A Platform for Physical Product Performance Trade-offs  
A. Van Der Velden, D. Kokan (Dassault Systèmes Simulia, USA)

## 7H Material Characterisation

11:15 Estimate of Material Parameter Uncertainties in Calibrated Simulation Models  
T. Most, R. Kallmeyer, R. Niemeier (Dynardo, GER)

11:35 Digital Prediction of Porosity and Permeability Variation of Unconsolidated Sands Caused by Overburden Pressure  
B. Crouse, J. Bautista, G. Balasubramanian, D. Freed (Dassault Systèmes Simulia, USA)

11:55 Calibration of a Phenomenological Foam Material Model from Microscale Simulation  
R. McIendon, D. Cojocaru, T. Dalrymple (Dassault Systèmes Simulia, USA) T. Spirka (Synopsys, USA) P. Young (University of Exeter, GBR)

## 7J Civil Engineering

11:15 Simulation of Digitally Printed Concrete Structures Using 3D Extrusion  
J. Cervenka, L. Jendele, M. Vaitova (Cervenka Consulting, CZH)

11:35 Model Uncertainties and Global Safety Formats for Reinforced Concrete Design by Numerical Simulation  
J. Cervenka, V. Cervenka (Cervenka Consulting, CZH)

11:55 Application of Finite and Spectral Element Methods for Rock Modeling at Different Scales  
A.V. Vershinin, M. Yakovlev, V.A. Levin (Lomonosov Moscow State University, RUS) K.M. Zingerman (Tver State University, RUS) D. Konovalov (Fidesys, RUS)

## 7K Fracture & Fatigue 3

11:15 FFT Solver for Local and Non-local Damage in Heterogeneous Quasi-brittle Materials  
D. Vasiukov, Y. Chen, C. Park (IMT Lille Douai, FRA) L. Gélébart (Atomic Energy and Alternative Energies Commission (CEA), FRA)

11:35 Two-Wheeler Fatigue and Random Response  
N. Bishop, K. Harsha (CAEfatigue, USA) M. Sethi, A. Sharma, S. Khare (Hero Moto, IND)

11:55 Fatigue Analysis of Numerical Bolted Connections  
A. Camara, J. Robert, F. Penneç, S. Durif, A. Bouchair (Institut Pascal, FRA)

12:15 Loads Conditioning for Frequency Domain Analysis  
S. Kerr, N. Bishop (CAEfatigue, USA) S. Datta (Chrysler Technical Center, USA)

## 7L Leading Edge SPDM 2

Leading Edge SPDM Architecture and Methodology Workshop Part 2  
R. Clay (chair, SNL), J. J. Billings (ORNL), J. Capul (CEA), D. Laney (LLNL), D. Montoya (LANL)

The session description continues from the session on Wednesday.

In this workshop focused on Simulation Data and Process Management we bring together some of the leaders from the US labs and practitioners from other leading-edge engineering companies with similar challenges and ambitions to compare and contrast approaches. The capabilities being developed are all targeting large-scale parallel computation, as this is now the norm for computing in this sector. The workshop will highlight recent developments, and consider some of the technical challenges as well as opportunities for leveraging the various capabilities. We expect to present a clear picture of where things stand and where they're heading, and have a lively discussion about the various approaches from the teams. See the session below for more details of the contents of this course.

## T1 VMAP - Interoperability 3

11:15 Composites in Automotive Vehicles (Use Case) \*\*  
C. Krauß (Karlsruhe Institute of Technology (KIT), GER)

11:35 Composites in Aerospace \*\*  
A. Floyd (Convergent Manufacturing Technologies Inc., CAN)

11:55 The ITEA VMAP Project: How the Simulation Workflow of Blow Moulded Plastic Parts Benefits from the VMAP Interface Standard \*\*  
P. Michels, O. Bruch (Dr. Reinold Hagen Stiftung, GER)

12:15 Prediction of Warpage by Combining Plastic Flow and Structural Simulations \*\*  
M. Groen (Philips Health Tech, NLD)

## 8G Biomedical / Life Sciences

13:40 An Automated Finite Element Approach for the Optimisation of Manufacturing Tolerances in Complex Drug Delivery Devices  
L. Green, S. Gilmore, J. Gresham (Crux Product Design, GBR)

14:00 Subject-Specific Twin Model of the Human Foot to Improve Foot and Ankle Surgery  
E. Lété, A. Stenti, A-X Fan, S-Y.Yi, (Digital Orthopaedics, BEL) T. Leemrijse, P-A Deleu (Foot & Ankle Institute, BEL) B. Ferré (IM2S, MCO)

14:20 Structural FEA Skeletal Muscle Model as a Mean to Investigate Muscle Actuation and Dysfunction  
H. Bastien (Ametek - Creafom, CAN) M. Léonard, D. Rancourt (Université de Sherbrooke, CAN)

## 8H Materials for Engineering

13:40 Materials for Engineering Moderated by G. Goldbeck (Goldbeck Consulting, GBR)

14:00 Materials in an ICME Framework: From Composition and Processing of Materials to Properties and Applications of Components  
G. Schmitz (Access, GER)

14:20 Maturity of Materials Modelling in Industry  
G. Goldbeck, A. Simperler (Goldbeck Consulting, GBR)

14:40 Materials and Simulation: From CAE to ICME, A 2040 Vision  
B. Conlon (Ansys, USA) S. Baker, S. Warde, J. Goddin (Granta Design, GBR)

## 8J CAE in the Design Process 3

13:40 Structural Design and Optimisation of a Lunar Rover Wheel  
M. Roux (Centre de Technologies Avancées (CTA), CAN) P. Edmundson, P. Visscher (Canadensys Aerospace, CAN)

14:00 Rotorcraft Fuselage Sizing Methods in the Open-Source Framework Pandora  
D. Schwinn, M. Petsch, D. Kohlgrüber, J. Heubischl, C. Leon Munoz, P. Weiland, M. Buchwald (German Aerospace Center (DLR), GER)

14:20 Constitutive Modelling and Analysis of Automotive Side Door Closing Operation  
A. Kimbrell, A. Patil, D. Strunk, B. Sayre (Honda R&D Americas, USA)

14:40 Fully Integrated Design Exploration for In-cylinder Simulation  
F. Ross, W. Seeley (Siemens PLM Software, USA) S. Fischer (Siemens PLM Software, GER)

## 8K Buckling

13:40 A Study on the Analytical Approach to Evaluation of the Seat Wrinkling and Bagginess  
O. Kwon (Hyundai-transys, KOR) T. H. Kim, J. Yun (Hyundai-motors, KOR)

14:00 Composite Plate Design Optimization Using Enhanced Hyper-cube Ant Colony Optimization Algorithm  
A. Ahmid, V. Lê, T. Dao (École de Technologie Supérieure, CAN)

14:20 Identifying Buckling Modes: A New Solution to an Old Problem  
K. Walker (MSC Software, USA)

## 8L Leading Edge SPDM 3

Leading Edge SPDM Architecture and Methodology Workshop Part 3  
R. Clay (chair, SNL), J. J. Billings (ORNL), J. Capul (CEA), D. Laney (LLNL), D. Montoya (LANL)

Session description continued from above.

Panel Themes/Questions:  
- Addressing workflow data management challenges  
- Workflow ecosystem and applications  
- Key challenges for current workflow systems  
- Opportunities for collaboration and standards adoption  
- Future of scientific and engineering workflows

## T1 VMAP Open Discussion

VMAP Workshop Moderated by K. Wolf (Fraunhofer SCAI, GER)

The ITEA VMAP Project - Industrial Demands and Software Standards for a Unified Material Data Interface \*\*  
K. Wolf, P. Gulati, A. Oeckerath (Fraunhofer SCAI, GER)

The VMAP Material Data Interface Standard - A New Approach to Unify Information Transfer in Virtual Manufacturing Workflows \*\*  
P. Gulati (Fraunhofer SCAI, GER)

Open discussion session to be chaired by the VMAP project coordinator Dr. Klaus Wolf (Fraunhofer SCAI, GER) with brief seed presentations to start discussions by users, collaborators and developers on needs, requirements, difficulties, possible solutions, etc.

15:00 Coffee Break

15:30 P Plenary Session

15:30 Conference wrap-up

NAFEMS team, working group members, steering committee members

15:45 Delegate Feedback Questionnaire - Prize Draw

NAFEMS team

15:55 Best Paper Awards / Farewell

M. Zehn (Vice Chairman of NAFEMS Council / Technical University of Berlin)

16:10 End of Congress



Thursday, June 20 - 2

# venue

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With a convenient location at Old Québec's doorstep, unsurpassed customer service, and a staff proud to be anything but conventional, the Québec City Convention Centre now stands as one of North America's top venues for major events.

Convention attendees can look forward to an exceptional experience at the Centre itself, but they will also fall in love with Québec City—an anything but conventional convention destination. A lively, safe walled city teeming with culture and activities, Québec City charms visitors with its European feel, rich history and culture, nearby natural wonders, fine dining, and friendliness.

[nafems.org/congress/venue](http://nafems.org/congress/venue)



# The NAFEMS World Congress Sunset Dinner Cruise

Wednesday, June 19th

## NWC19 SUNSET DINNER CRUISE

Taking place aboard the AML Louis Jolliet on June 19th, the NWC19 sunset dinner cruise, which is included in your registration, will take you on a memorable journey to discover the beautiful views of Quebec between Montmorency Falls and Quebec bridges.

Boarding: 6 pm  
Departure: 7 pm  
Disembarking: 12 am

Full details will be announced soon



## A Private Banquet at The Québec Parliament Building

Optional Dinner - Tuesday, June 18th

(Not included in Congress registration fee)

Places are limited for this fantastic evening at The National Assembly in Quebec. Guests will have the opportunity to tour the parliament building, before enjoying a sumptuous dinner at Le Parlementaire Restaurant. Host to numerous state dinners and formal receptions, and venue par excellence for Québec products where MNAs and the general public can mingle, Le Parlementaire is unique among the city's gourmet restaurants.

This optional activity will be available on a first come, first served basis, and booking will be available to registered attendees in due course.

# REGISTER

Alternatively, you can register online by visiting [nafems.org/congress](http://nafems.org/congress)

Contact Name to whom all correspondence will be sent (BLOCK CAPITALS PLEASE)

Title	Family Name	First Name
Organisation		
Mailing Address		
Post/Zip Code	Country	
Tel. No.		
Email		

## CONGRESS FEES

### PRESENTING AUTHORS

NAFEMS Members

\$1160 USD

Non-Members

\$1390 USD

### STANDARD DELEGATES

NAFEMS Members

\$1290 USD

Non-Members

\$1520 USD

## YOUR REGISTRATION COVERS:

- Attendance at both the World Congress & SPDM Conference
- Invitation to the opening cocktail reception
- Access to a number of NAFEMS Accredited Training Courses during the congress (this does not apply to post-congress courses)
- Access to all workshops and tracks in both the World Congress and SPDM Conference
- Access to the extensive exhibition areas for both events
- Lunches and refreshments over the three days of the event
- Attendance at the exclusive Congress Sunset Dinner Cruise
- One set of proceedings, including conference papers on USB, as well as other delegate materials

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online registration at  
[nafems.org/congress](http://nafems.org/congress)