

# NAFEMS Technical Working Groups Overview 2019

# Business Impact

- The NAFEMS Business Impact Working Group (BIWG) is the newest group, having met for the first time in March 2019.
- The BIWG is concerned with communicating the overall value of Engineering Simulation to a business and how it is increasingly a requirement for continued innovation and the ongoing competitiveness of companies.
- Large companies in industries (e.g. automotive and aerospace) may not appreciate the value of Engineering Simulation consistently across the organization. In industries where the use of simulation is not as mature, the value that simulation can bring is less well understood. Small and medium sized businesses (SMBs) need advice on how to quantify the benefits of Engineering Simulation for them.
- Monthly online meetings.
- **Chair:** Roger Keene, Consultant
- Information about the Business Impact Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/business-impact/](http://www.nafems.org/community/working-groups/business-impact/)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/business-impact/get\\_involved/](http://www.nafems.org/community/working-groups/business-impact/get_involved/)

# Business Impact

- **Topics of interest include:**

- to demonstrate, document, and communicate the business value of Engineering Simulation;
- to provide a framework for discussions with executive management and the commercial and financial branches of companies to:
  - enable savings
  - change work processes
  - deliver higher quality, higher productivity and better employee engagement
  - provide insights that will lead to discontinuous innovations and competitive advantage;
- to identify successful implementations of Engineering Simulation which can be used as case studies demonstrating a return on investment, and promoting the lessons learned from these implementations;
- to disseminate techniques that will allow organisations to maximise their investment in Engineering Simulation, including change management, skills development and simulation management;
- to develop guidance on how to democratize Engineering Simulation to maximize positive business impact in order to extend the reach of simulation within an organisation.

# Business Impact

## Future plans:

- A biennial white paper quantifying and commenting on the impact and value of Engineering Simulation to the engineering industry, including industry case studies.
- Methods and/or approaches that help tell the “financial story” - the arguments that need to be communicated to executives and Finance in order to achieve a step level change in use of Engineering Simulation tools.
- A biennial survey report on the current impact of Engineering Simulation within the engineering industry.
- A cost/benefit report on different methods of deploying an Engineering Simulation capability.
- A series of webinars on assessing the business value and ROI that Engineering Simulation can bring to an organisation.
- A series of webinars highlighting organisations who have successfully democratised Engineering Simulation with a positive business impact.

# Chair Bio

A former Strategic Leader client, Roger was a member of the executive leadership team of Dassault Systemes Simulia Corp (Abaqus prior to acquisition by Dassault Systemes) for 21 years. As VP of Worldwide Sales & Operations, he focused on global sales, customer service and operations, growing revenue more than ten times to several hundred million dollars. He transitioned the company from a technical sales model based on features and benefits to an enterprise approach based on value, as well as setting up an indirect sales channel worldwide. He led a global team of over 400 technical and sales professionals, including over 80 direct sales staff, in 19 countries across the Americas, Europe and Asia, as well as managing around 200 value-added resellers worldwide. A strong believer in the importance of loyal and happy customers, he emphasized the importance of providing outstanding customer support and service.

## Key areas of expertise:

Global operations, enterprise sales, direct and indirect sales channels, outstanding customer service and support, M&A and successful integration of acquired companies.



# Composites (CWG)

- The NAFEMS Composites Working Group was formed in 2010, following strong demand from within the NAFEMS membership for a high level of activities related to the application of numerical methods to the analysis and assessment of composite materials.
- The goal of the working group is to act as the focal point for all of NAFEMS activities relating to composite materials and to spearhead the development of guidelines which will be of high value to industrial practitioners working in the field.
- The group meets on the 2<sup>nd</sup> Wednesday of each month online via WebEx.
- **CWG Chair** – Ronald Krueger, National Institute of Aerospace
- **CWG Vice-Chair** – Roger Assaker, e-Xstream engineering SA/ MSC.Software
- **CWG Vice-Chair** - Kim Parnell, PEC - Parnell Engineering and Consulting
- The group includes representatives of Airbus, Autodesk, Altair, Convergent, Delft University of Technology, DYNAmore, Embraer, ESI Group, e-Xstream engineering, Fachhochschule Nordwestschweiz Switzerland (FHNW), FETraining, German Aerospace, Institute of Composite Structures and Adaptive Systems, University of Liege, MDAO Technology, MSC.Software, MultiMechanics, National Composites Centre, National Institute of Aerospace, Parnell Engineering and Consulting, Penso, Purdue University, Siemens, IRT Saint Exupéry, Teton Composites, University of Bristol, University of British Columbia, Western New England University.
- Information about the Composites Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/composites/](http://www.nafems.org/community/working-groups/composites/)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/composites/get\\_involved/](http://www.nafems.org/community/working-groups/composites/get_involved/)

# Composites (CWG)

- **Current topics of interest**

- Draft “How to Obtain Material Properties for Structural Analysis of Composites” - under review
- Publication "FEA of Composite Materials: A review of engineering requirements and current facilities" - concept

- **Recent Activities**

- NAFEMS benchmark magazine with 10 articles focussed on composites, June 2015
- Review of Composites Simulation Tools – online review on NAFEMS Website
- Composite Finite Element Analysis, NAFEMS e-Learning course
- Structure Genome: A Revolutionary Multiscale Approach to Bridging Materials Genome and Structural Analysis, NAFEMS Webinar 2017

- **Recently Supported Events**

- JEC Paris, June 2016, Paris, France
- Experience Composites 2016, JEC, September 2016, Augsburg, Germany
- NAFEMS - Practicalities of Analysing Composites, September 2016, Coventry, UK
- American Society for Composites, September 2016, Williamsburg, USA
- Simulation von Composites – Bereit für Industrie 4.0, October 2016, Hamburg, Germany
- SAMPE, May 2017, Seattle, USA

# Composites (CWG)

- **Technical area**

- The NAFEMS Composites Working working group is the focal point for NAFEMS activities related to composite materials. The expertise of the group is on the analysis of fiber reinforced materials. This includes continuous fiber reinforcements made of carbon, glass and aramid fibers as well as woven fabrics, long and short fibers. The matrix material is typically a thermoplastic or thermoset polymer.

- **Key achievements:**

- SAMPE, May 2017, Seattle, USA
- American Society for Composites 32<sup>nd</sup> Technical Conference, October 2017, West Lafayette, IN, USA
- *NAFEMS Composites Simulation Review: Volume 1, 2018* – available for download to NAFEMS members

- **Current activities:**

- Publication "How to Obtain Material Properties for Structural Analysis of Composites" – under review
- Publication "FEA of Composite Materials: A review of engineering requirements and current facilities" - concept
- *NAFEMS Composites Simulation Review: Volume 2* – papers under review
- Revision and update of PSE statements

- **Future plans**

- Call2Tender "How to Obtain Material Properties for Structural Analysis of Composites"
- New Composites survey in collaboration with Manufacturing Working Group



# Chair Bio

Dr. Krueger currently holds the position of an Associate Research Fellow at the National Institute of Aerospace (NIA), which he joined in January 2003. He is involved in the development of durability and damage tolerance analyses for composite structures using finite element analysis and fracture mechanics. Dr. Krueger is an accomplished presenter and awarded author of over 60 technical papers published in refereed journals and international conference proceedings.

Dr. Krueger received both his Diploma and his Doctorate degree in Aerospace Engineering from the University of Stuttgart, Germany, in 1989 and 1996, respectively, where he worked as a research and teaching assistant at the Institute for Statics and Dynamics of Aerospace Structures. From August 2000 until December 2002 he worked as a Staff Scientist at ICASE located at NASA Langley Research Center. Prior to joining ICASE Dr. Krueger held a NRC Post-Doctoral research position at NASA Langley Research Center.

Dr. Krueger is an Associate Fellow of the American Institute for Aeronautics and Astronautics (AIAA). He currently serves as chairman of ASTM International Committee D-30 on Composite Materials. Further, he serves as co-chair of the Disbonding and Delamination Task Group within Composites Materials Handbook-17 (CMH-17).



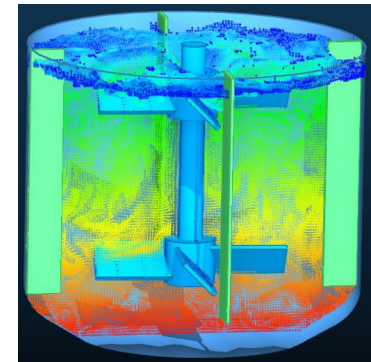
# Computational Fluid Dynamics (CFDWG)

- The Computational Fluid Dynamics Working Group (CFDWG) is concerned with all aspects of Computational Fluid Dynamics (CFD), including the flow of fluids (gases and liquids), heat and particulate flows. All computational approaches are included (FVM, FEM, LBM, System-level or 1D-CFD etc.) and the related technologies required whether for pre-processing (including meshing for CFD), solving or post-processing. The group was formed in 1995 to address the needs of the Engineering and scientists using CFD tools. The group comprises nearly 40 members from industry, consultancies, vendors and academia, many of whom have been actively involved for more than a decade.
- In 2016 the working group identified that the Oil and Gas industry often lacked standardised modelling approaches and the Oil and Gas focus group was formed and operates under the remit of the parent CFDWG. The Oil and Gas Focus group is currently developing guidance in the areas of atmospheric dispersion, helideck environment, natural ventilation assessment and fire modelling.
- The CFDWG meets approximately every 6 weeks online via WebEx, plus at least 1 face-to-face meeting each year, often coinciding with an event.
- **CFDWG Chair** - Althea de Souza, Quesada Solutions
- **Oil and Gas Focus Group Chair** – Steve Howell, Abercus
- **CFD Journal Editor** – Don McGlinchey, Glasgow Caledonian University
- The group includes representatives of Abercus, ac&e, Airbus, ANSYS Inc., Bergische Universität Wuppertal, Boeing, BP, Cambridge Consultants, Cambridge Flow Solutions, Caspus, CD-adapco, Doosan-Babcock, ESI, FLUIDS & C<sup>o</sup>, Ford Motor Company, Frazer-Nash, GE Power, Glasgow Caledonian University, Health and Safety Executive, Infomec, Widener University, Jaguar Land Rover, Lea CFD Associates, Marine Engineering Consulting, Mentor Graphics, MMI Engineering, Norton Straw, Quesada Solutions, Rolls-Royce, University of Oxford, 8020 Engineering
- Information about the Computational Fluid Dynamics Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/computational-fluid-dynamics](http://www.nafems.org/community/working-groups/computational-fluid-dynamics)
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# Computational Fluid Dynamics (CFDWG)

## Current CFDWG Activities:

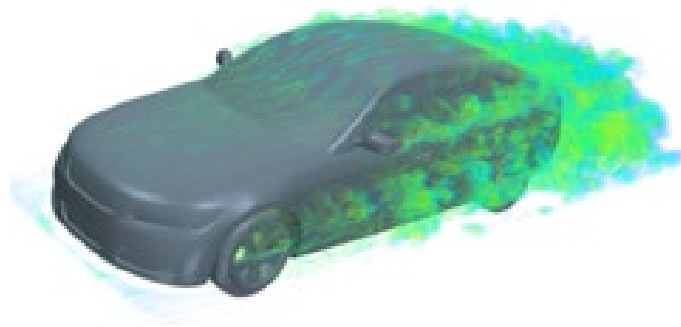
- The CFDWG like to have a lot of activities on the go. They have a considerable number of publication in progress with “The Designers’ Guide to CFD” and an introductory guide “What is Systems CFD?” out imminently.
- Other publications that are in development include “How to Model Radiation”, “Why to Heat Transfer with CFD”), “Industrial Validation for CFD” and “How to Model Rotor Aerodynamics”.
- “Finite Element Analysis for Engineers – A Primer” has long been a flagship publication for NAFEMS and the CFDWG is currently developing a complementary publication aimed at providing Engineers getting to grips with analysis in the fluid domain with a practical textbook.
- The CFDWG is helping to introducing engineers to advanced techniques by providing a series of introductory flyers. The group are currently developing “What is Multispecies CFD?”, “What is Turbulence Modelling?” and “What is Multiphase FlowCFD?” pamphlets.
- The first volume of the NAFEMS International Journal of CFD Case Studies was published in 1998 and is still going strong with Volume 12 currently in production.



# Computational Fluid Dynamics (CFDWG)

## Recent CFDWG Outputs:

- The CFDWG have recently released a publication discussing the advantages and disadvantages of 3D CFD when compared to 1D Systems Simulation.
- NAFEMS has a long history of producing benchmarks that can be used by developers and end users to demonstrate the quality of software codes. There is a substantial library of benchmarks in the structural domain and it was fantastic to recently have the first in series of benchmarks aimed at simulation in the fluid domain.
- The CFDWG regularly supports the activities of our Regional Steering Committees by organising technical seminars. Recent CFDWG seminars include “A Guide to High-Fidelity CFD for Industry” and “A Guide to Hybrid RANS-LES Methods: Industrial Examples and Theory”.



# Chair Bio

Dr Althea de Souza is a Chartered Engineer (CEng), Fellow of the Institute of Mechanical Engineers (FIMechE), FEANI registered Eurlng and a founding member of the NAFEMS Professional Simulation Engineer scheme (PSE) and Member of the Royal Aeronautical Society (resigned). She has been a member of the NAFEMS CFD working group since 1998 and chair since 2002.

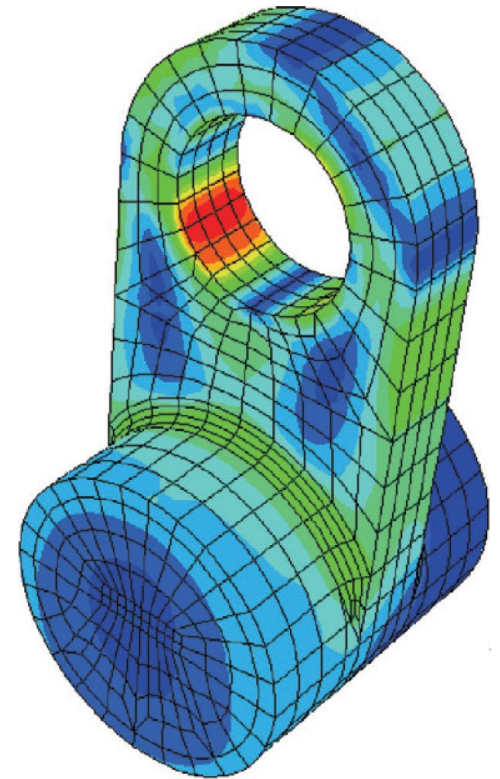
Director of Quesada Solutions, Althea has 20 years experience in flow simulation and engineering analysis for the solution of fluid flow problems. She previously developed and led a team of specialist engineering analysis and test engineers at Pall Europe and immediately prior to starting Quesada Solutions Ltd was the Senior Design Engineer at dezineforce, providing pre and post sales technical support and web-based training for on-demand engineering optimisation.

Since forming Quesada Solutions in 2010, she has worked in partnership with several other consultancies, including a number of years with Tridiagonal Solutions. She has used several different CFD tools through her career, starting with Fluent in the mid-90s and including the Lattice-Boltzmann code, XFlow and cloud-based SimScale.



# Computational Structural Mechanics

- The NAFEMS Computational Structural Mechanics Working Group (CSMWG) is concerned with the branch of engineering that uses numerical methods to calculate deformations, deflections, internal forces and stresses within structures.
- Meet face-to-face once every three months with dial-in facilities available. Meet online in the interim for more focussed discussions on specific topics.
- Collaborate with other groups where there are overlapping interests.
- **Chair:** Louise Wright, NPL  
**Vice Chair:** Adam Towse, Assystem
- The group includes representatives of Altair Engineering Ltd, ANSYS UK Ltd, Assystem UK Ltd, Atkins, AWE, Boeing, Cyient Ltd, Cummins Inc., Dassault Systemes UK Ltd, DIANA FEA, Dutton Simulation, ESI France, FETraining, GHD, Ingersoll Rand Club Car, MDAO Technologies, National Physical Laboratory, PDL Solutions (Europe) Ltd, Polytechnic Institute of Porto, Ramboll, Rolls-Royce, Rolls-Royce Submarines, Siemens PLM Software, Zentech International Ltd.
- Information about the Computational Structural Mechanics Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/computational-structural-mechanics](http://www.nafems.org/community/working-groups/computational-structural-mechanics)
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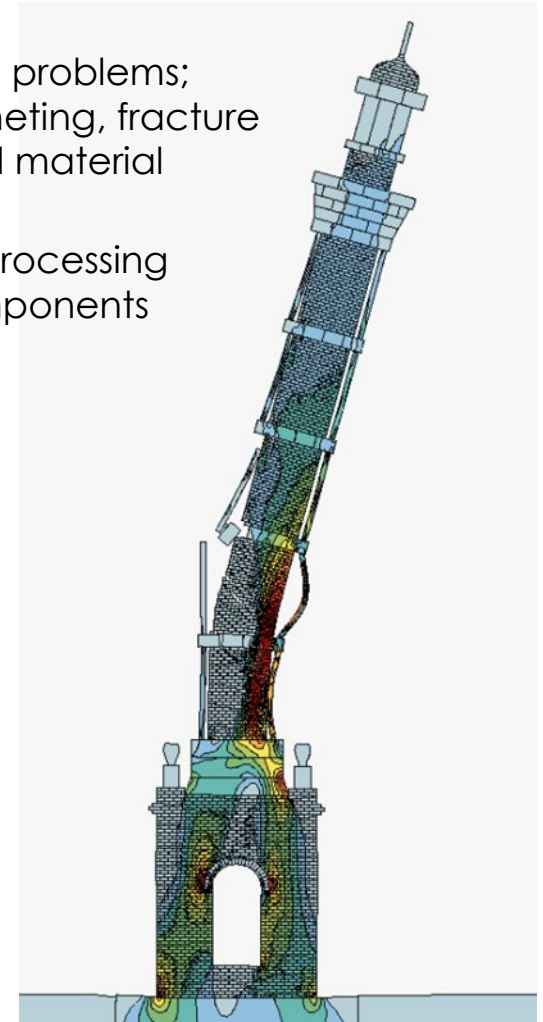
# Computational Structural Mechanics

- **Topics of interest include:**

- implicit and explicit dynamics; impact and large deformation problems; elastic-plastic, creep, fatigue, limit analysis, shakedown, ratcheting, fracture and damage; contact, joints and connections; and structural material models.
- emerging modelling methods and new manufacturing and processing methods that affect structural response of materials and components

- **Current activities:**

- Benchmark Special Edition on Structural Integrity, including:
  - Limit load and bolted joints
  - Bolt loosening
  - Crack propagation
  - Screwed joints
  - Evolution of codes
- Publications at the review stage:
  - How to model bolted & riveted joints
  - How-to assess welded structures
  - How-to model the welding process



# Computational Structural Mechanics

## A Selection of Recent Outputs:

[What are Particle and Meshless Methods?](#) – Introductory Information

[Why Do Manufacturing Simulation](#) – Publication

[Multiscale Modelling - Bridging Different Scales](#) – Webinar

## Future plans:

- **Two ITTs currently out:**
  - Considerations when modelling extreme deformation
  - Assessment of structures subject to blast loading
- **Assembling a set of explicit “Challenge problems” to highlight important aspects of modelling dynamic problems well**
  - Disseminate via Benchmark magazine
  - Publish problem definition one issue & solution & discussion the next.
- **Seeking to put together a multiscale modelling event**
  - Would like industry input rather than just academic research
  - May focus on composites as some techniques are more widely used than for metals & alloys



# Chair Bio

Louise Wright is the Science Area Leader for Modelling at the National Physical Laboratory, the UK's national measurement institute.

Following an MA in Mathematics and an MSc in Mathematical Modelling and Numerical Analysis, she spent four years working with FE and CFD in industry before joining NPL in 1999.

Louise's work uses FE and similar methods to support experimental design, interpretation of measurement results, and solution of industrial problems. She is interested in improving confidence in use of FE results in decision-making processes and works on uncertainty evaluation applied to finite element models.



# Education & Training

- The NAFEMS Education and Training Working Group (ETWG) is formed to examine the **education and training needs** for all numerical analysts and to provide information and documents to satisfy these needs.
- The ETWG are responsible for **accrediting courses** run by NAFEMS and other external agencies. In addition, the working group support the NAFEMS **Professional Simulation Engineer** Scheme and are responsible for a significant number of education publications that have been developed. The working group reviews the existing gaps in NAFEMS archive of best practice information and addresses these gaps by collaborating with other NAFEMS Technical Working Groups or by commissioning the documents themselves.
- Meetings are held both face-to-face, at the Institute of Mechanical Engineering in London, and online using WebEx online meeting platform.
- **Chair** - Professor Adib Becker, University of Nottingham, UK
- The group includes representatives from Altair, D. J. Goode & Associates, Cyient, Dassault Systemes, FETraining, GKN Aerospace, Glasgow Caledonian University, MSC Software, Ohio State University, Open University, Ramsay Maunder Associates, SELEX-ES, STRAND7 software, University of Manchester, University of Nottingham, Widener University, Wood Plc.
- Information about the Education and Training Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/education](http://www.nafems.org/community/working-groups/education)
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# Education & Training

- **Areas of Activity**
  - Accreditation of classroom and eLearning short courses on engineering simulations
  - Monitoring the Professional Simulation Engineer (PSE) scheme
  - Commissioning publications to meet the education and training needs of engineering analysts
- **Publications in Progress**
  - How To Model Crack Propagation Using FEA
  - Case Studies Demonstrating Industrial Usage of Engineering Analysis & Simulation
  - Online Assessments for the PSE Core FEA Technical Area
- **Recent Publications**
  - Why do Discrete Element Analysis
  - How to perform linear dynamic Finite Element Analysis
  - How to perform electromagnetic Finite Element Analysis
  - The NAFEMS Benchmark Challenge - Volume 1
- **Proposed Publications**
  - Lay Person's Guide to FEA
  - FEA and Engineering Design Codes and Standards
- **Other Activities**
  - The working group are encouraging academic institutions to gain NAFEMS Approval for modules/courses with engineering analysis and simulation content.
  - The group has initiated a Compendium of NAFEMS Benchmarks to contain a collection of the best representative benchmarks published by NAFEMS.



# Chair Bio

Professor Adib Becker obtained his BSc(Eng) in Mechanical Engineering from Imperial College London and continued his studies at Imperial College to obtain a PhD in 1983. He then took up a Senior Lecturer post at Staffordshire University and returned to Imperial College as Lecturer in 1986. He joined the academic staff at the University of Nottingham in 1990 and was appointed to a Chair in Mechanical Engineering in January 2001. He was awarded a DSc in 2010.

In addition to being Chair of the NAFEMS Education and Training Committee, Adib is a member of the IMechE Professional Review Committee and was Chairman of the IMechE Structural Technology and Materials Committee (2010-2012). Adib serves on Editorial Boards of two international journals, and has organised and chaired several international conferences. He has served as an External Examiner for many PhD theses in the UK and abroad, and an External Examiner for undergraduate courses. He has also served on international expert research panels abroad and is a member of the [Gas Turbine and Transmissions Research Centre](#) (G2TRC).



Professor Becker has published over 275 publications in the open literature, including 137 journal papers, and is the author of four textbooks on computational mechanics. He has Research Expertise in computational mechanics and stress analysis, including Finite Element advanced simulations, Boundary Element techniques, high temperature and creep applications, analysis of welds, contact mechanics, fracture, structural integrity and manufacturing simulations. Innovative applications include inverse mechanics, simulation of surgery and modelling plant root growth.

# Manufacturing Process Simulation (MANWG)

- The NAFEMS Manufacturing Process Simulation Working Group (MANWG) was launched in February 2016 with the following mission statement:  
  
'to promote the development and use of virtual manufacturing tools within the product design and manufacturing cycle to improve outcomes in industrial manufacturing processes'.
- The Manufacturing Process Simulation Working Group has three Focus Groups, concentrating on **Composites**, **Metallic Additive Manufacturing** and **Metals**.
- Monthly online meetings via WebEx
- **Chair** – Peter Giddings, National Composites Centre
- **Vice Chair** – Anas Yaghi, Manufacturing Technology Centre
- **MANWG Composites Focus Group Chair** – Amit Visrolia, National Composites Centre
- **MANWG Metallic Additive Manufacturing Focus Group Chair** – Sjoerd Van der Veen, Airbus
- **MANWG Metals Focus Group Chair** – Trevor Dutton, Dutton Simulation
- The group includes representatives of The Aerospace Corporation, Airbus, ANSYS, Birmingham University, Brunel University, Centre for Process Innovation, Convergent, Dutton Simulation, Endress+Hauser, Enginsoft, ESI, Herbertus, HOERBIGER Corporation of America, Intrinsic, University of Leuven, Manufacturing Technology Centre, National Composites Centre, Purdue University, Queen's University Belfast, Rolls Royce, Ryobi Die Casting, Saudi Aramco Oil Company, Sheffield University, Southwest Research Institute, Swerea KIMAB, Technical University of Denmark, Tecnalía, Transvalor S.A., TWI Ltd, Universitat Politècnica de Catalunya - CIMNE, University of Strathclyde/AFRC, Warwick University / WMG, Wilde Analysis
- Information about the Manufacturing Process Simulation Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/manufacturing-process-simulation](http://www.nafems.org/community/working-groups/manufacturing-process-simulation)
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# Manufacturing Process Simulation (MANWG)

The MANWG aims to be a focal point for independent and reliable information on simulation capabilities and requirements, specifically by pursuing its goals of:

- making virtual manufacturing tools more **reliable, accurate and efficient**
- making virtual manufacturing tools **wide-spread and effective** in design and execution of manufacturing processes
- **increasing awareness** of virtual manufacturing and its value in real-world manufacturing
- **becoming a hub** for modellers to be well informed and interconnected concerning simulation matters
- sharing best practice
- **facilitating innovation** through the promotion and support of virtual manufacturing tools within academia, policy makers and throughout the manufacturing community
- creating guides, bench marks and 'how to' guides
- collaborating with others
- attending and promoting events

# Manufacturing Process Simulation (MANWG)

## **MANWG Composites Focus Group:**

- The MANWG Composites Focus Group was set up in 2018 and aims to:
  - To promote best practice simulation methods for all manner of composites manufacturing processes by clarifying the potential benefits, addressing the technical challenges and providing a source of information.
  - To identify the areas that require more investigation to allow greater application of these methods to industrial composites users.
- Further details of the group's aims and activities can be found at [https://www.nafems.org/community/working-groups/manufacturing-process-simulation/composites\\_manwg\\_focus\\_group/](https://www.nafems.org/community/working-groups/manufacturing-process-simulation/composites_manwg_focus_group/).

## **MANWG Metallic Additive Manufacturing Focus Group:**

- The MANWG Metallic Additive Manufacturing Focus Group was set up in early 2017 and aims to:
  - compile a list of defects in order to prioritise the work of the group, including identification of which defects are most critical.
- Further details of the group's aims and activities can be found at [https://www.nafems.org/community/working-groups/manufacturing-process-simulation/metallic\\_additive\\_manufacturing\\_focus\\_group/](https://www.nafems.org/community/working-groups/manufacturing-process-simulation/metallic_additive_manufacturing_focus_group/).

## **MANWG Metals Focus Group:**

- The MANWG Metals Focus Group was set up in early 2018 and aims to:
  - promote best practice simulation methods for all manner of metal manufacturing processes, by clarifying the potential benefits, addressing the technical challenges and providing a source of information.
  - identify the areas that require more investigation to allow greater application of these methods in industry.
- Further details of the group's aims and activities can be found at [https://www.nafems.org/community/working-groups/manufacturing-process-simulation/metals\\_manwg\\_focus\\_group/](https://www.nafems.org/community/working-groups/manufacturing-process-simulation/metals_manwg_focus_group/).



# Chair Bio

## **Dr Peter Giddings CEng MiMechE:**

Dr Giddings leads the development and implementation of novel manufacturing capabilities and their associated value streams in his role as Chief Engineer for the iCAP programme at the National Composites Centre (NCC) in Bristol. He brings academic research background from the University of Bath and industrial composite R&D experience at United Technologies Aerospace Systems to guide the creation and industrialisation of innovative composite manufacturing processes.

His primary research focus is in combined use of predictive simulation and data-driven decision making to accelerate product and process development within concurrent engineering environments.





# Multiphysics

- The NAFEMS multiphysics working group (MPWG) has been set up to promote and support the use of Multiphysics simulation in industry
- Industrial use of multiphysics simulations is a diverse and challenging topic. The main driving force is the need for more realistic numerical simulations of coupled problems, combined with the continuing improvements in hardware and software.
- Monthly online meetings.
- Yearly physical meetings during the NAFEMS World Congress and Multiphysics conference.
- **Chair** - Alfred J. Svobodnik, Mvoid Group, Vienna, Austria  
**Vice Chair** - Henrik Nordborg, HSR - University of Applied Sciences, Rapperswil, Switzerland
- The MPWG includes representatives of AdCo EngineeringGW, Airbus, Altair, ANSYS, ATOA Scientific Technologies, Dassault Systemes, DYNAmore, ESI, Festo, Fraunhofer SCAL, Free Field Technologies, Fujifilm, HSR University of Applied Sciences, IMAMOTER-CNR, John Deere, MVOID Group, National Physical Laboratory, TETRA PAK, TimeTooth Technologies, University of Luxembourg, University of Manchester, Veryst Engineering
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# Multiphysics

- **Areas of Current Interest**

- Webinar on Multiphysics
- NAFEMS Journal on Multiphysics
- Publication: How to do MP
- An online repository for Multiphysics case studies

- **Recent Outputs**

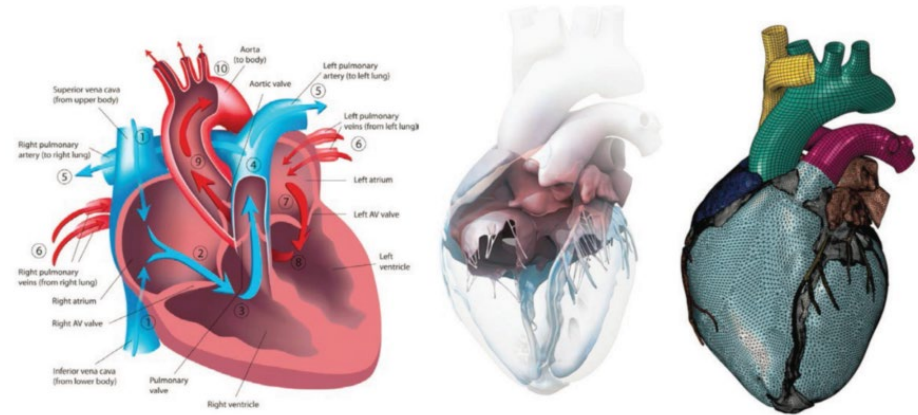
- MPWG recently produced the first issue of the NAFEMS International Journal of Multiphysics Case Studies.
- A guide to Multiphysics analysis titled “Why Do Multiphysics Analysis?” was commissioned by the working group.
- The proceedings from the NAFEMS European Multiphysics Conference are available for NAFEMS members to view.

- **Past Events**

- European Multiphysics Conference, Budapest, October 2018
- European Multiphysics Conference, Copenhagen, November 2016
- European Multiphysics Conference, Manchester, October 2014
- European Multiphysics Conference, Frankfurt, October 2012

- **Future Plans**

- European Multiphysics Conference, tbd, October/November 2020



# Chair Bio

Dr. Alfred J. Svobodnik, President & CEO of the Mvoid Group, is an entrepreneur, thought leader, engineer and scientist. He has been researching for more than 25 years in the areas of Multiphysics and virtual as well as computational acoustics. His passion is Jazz music.

Previously, Alfred spent five years with Harman International Inc. where he held several senior managerial and executive advisor positions in the areas of simulation and virtual acoustics for audio systems. Alfred started his career as founding member, Executive Partner and CTO in 1990 with Numerical Analysis and Design, a company specialized in engineering analysis with finite and boundary elements for stress analysis, structural dynamics and computational acoustics.

He is honorary member of NAFEMS, member of the NAFEMS German Steering Committee and Chair of the NAFEMS Multiphysics Working Group as well as founding member of the NAFEMS Professional Simulation Engineering Scheme. Furthermore, he is a full member of the Audio Engineering Society (AES) and Chairman of the AES Technical Committee for Automotive Audio.

Alfred: 'One of my favorite quotes is: "Nothing is more powerful than an idea whose time has come" (Victor Hugo). For me, this guiding principle includes: always act with foresight, take a look at new, undiscovered ideas, sometimes move away from conventional ways, think outside the box in order to give ideas room to evolve. Ideas, whose time have come.



# Optimisation

- The NAFEMS Optimisation Working Group is responsible for promoting the adoption, further development and best practice of optimisation theory and methods to engineering simulation for the benefit of the analysis community
- Optimisation is the process of selecting the best option from a range of possible choices
- Regular online meetings
- **Chair** – Nadir Ince, GE Power
- The group includes representatives of 4RealSim, Altair Engineering Ltd, ANSYS, Applied Computing & Engineering Ltd, Atieva Inc, Boeing Company, Comercia, Cranfield University, Dynardo GmbH, EADS Innovation Works, EnginSoft UK Ltd, ESI Group, ESTECO SpA, FE-Design GmbH, Federal-Mogul Nürnberg GmbH, GE Power, General Motors, GRM Consulting, iChrome Ltd, Icon Technology & Process Consulting Limited, Land Rover Chassis, Leeds University, MDAO Technologies, Newcastle University, Noesis Solutions NV, Rolls-Royce Group PLC, Siemens, Strathclyde University, Taylor's University, Tecnalia, Wilde Analysis Ltd
- Information about the Optimisation Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/optimisation](http://www.nafems.org/community/working-groups/optimisation)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/optimisation/get\\_involved](http://www.nafems.org/community/working-groups/optimisation/get_involved)

# Optimisation

- **Areas of Interest**
  - Optimisation benchmarks & worked examples
  - The group have recently formed a special interest group for NAFEMS members who have an interest in optimisation technology but are not necessarily experts. This special interest group is meeting on a bi-monthly basis.
- **Recent Publication**
  - How to Perform Optimisation Under Uncertainty
  - Robust design optimisation in virtual product development
- **Optimisation Special Interest Group**
  - The Optimisation Working Group has formed a Special Interest Group (SIG) in order to help disseminate best practice and encourage the adoption of optimisation methods and technology.
  - To participate in the Optimisation SIG you do not have to be an expert in this technical area.
  - The Optimisation SIG is for NAFEMS members who are interested in expanding their capabilities in the optimisation technical area.

# Chair Bio

## **Dr Nadir Ince**

Director, Analytics & Digital Engineering Power Digital Solution  
GE Power

- MSc & PhD - University of Manchester – Thermo Fluids Dept.
- Several years experience as a Post Doctoral research fellow and Lecturer at several universities
- Area of research interests:
  - CFD tool development
  - Turbulence modelling
  - Multi-disciplinary optimization
- Active member of NAFEMS and Ercoftac



# Simulation Data Management

- The mission of the NAFEMS Simulation Data Management Working Group (SDMWG) is to provide a vendor-neutral, end-user driven consortium that promotes the advancement of the technology and practices associated with the management of engineering simulation data management and processes. This includes education, communication, promotion of standards, and development of requirements that will have general benefits to the simulation and analysis community with the identification of benchmarks and major strategic issues (grand challenges).
- Monthly online meeting via WebEx on the second Thursday of each month.
- **Chair:** Laura Michalske, The Procter & Gamble Co.
- **Vice Chair:** Robert Clay, Sandia National Laboratories
- Information about the Simulation Data Management Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/simulation-data-management](http://www.nafems.org/community/working-groups/simulation-data-management)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/simulation-data-management/getinvolved](http://www.nafems.org/community/working-groups/simulation-data-management/getinvolved)



# Simulation Data Management

- **Topics of interest include:**

- SDM and SPDM systems vary depending on the end users need for work flow. Guest speakers have been sharing various approaches to capture models and work flow including PIDO tools.
- Deployment of SDM & SPDM.
- Ongoing focus on the breath of models including spreadsheets to be included in SDM & SPDM solutions.
- Standards or lack of standards utilization and their implication to SDM & SPDM systems

- **Current activities:**

- A “**Spreadsheet Management**” survey has been completed to understand the ramifications of unmanaged/managed spreadsheets. A paper is in progress based on the survey results & CAASE 2018 presentation.
- “**How to Implement a Simulation Process and Data Management Capability**” paper is in the process of being written.
- **NAFEMS SPDM Congress** – held in conjunction with the NAFEMS World Congress.



# Simulation Data Management

## Recent Outputs:

- The Simulation Data Management Working Group have produced an introductory flyer explaining the basic principles of SDM.
- With SDM implementation proving difficult and time-consuming to implement the working group produced a publication to show case the Business Value that can be produced by effectively implementing an SDM capability.
- In order to provide a baseline set of user requirements against which the roadmap of the SDMWG could be set, the working group conducted a user survey. The results of the survey were published in the "Simulation Data Management Survey Report".

## Future plans:

- **SDM PSE** – SDM competencies have been identified and the team is about to embark on populating the PSE with the relevant books, training courses, and documents.
- Working with the Systems Modeling & Simulation Working Group and the Systems Modeling & Simulation Working Group to help understand and drive standards adoption.

- Maintain the SDM publications List (link below):

<https://www.nafems.org/about/technical-working-groups/simulation-data-management/publications/>

# Chair Bio

Laura Michalske is a Procter & Gamble Section Head for Health Care Modeling & Simulation. She has a Bachelor of Science in Chemical Engineering from the University of Cincinnati. Laura has 29 years of experience in the consumer goods industry working in engineering and manufacturing. Laura is a recipient of Procter & Gamble's PRISM award given to engineering masters who have made a real difference in Procter & Gamble through their sustained and exceptional technical contributions.

Laura is the chair for the NAFEMS Simulation Data Management Working Group and is a member of the NAFEMS Americas Steering Committee. She also represents Procter & Gamble on the ASSESS Initiative Advisory Committee. Laura is involved in inspiring students to pursue STEM degrees through her involvement as an engineering mentor with Batavia Middle School's Future City team for the past 12 years.



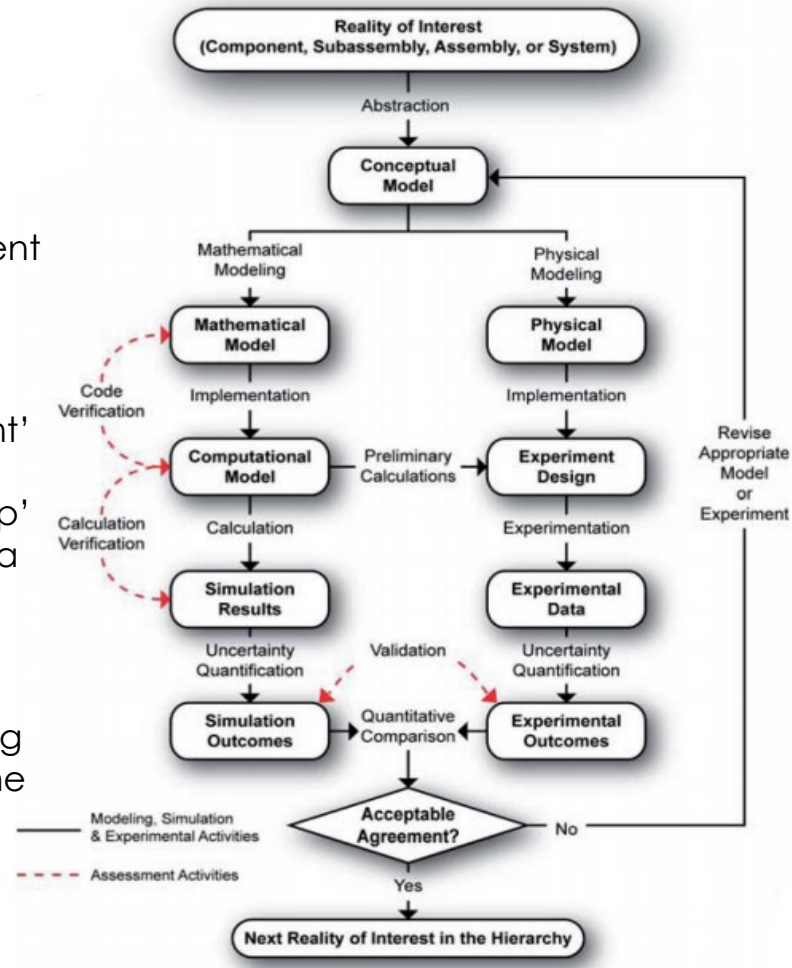
# Simulation Governance & Management

- The focus of the Simulation Governance and Management Working Group (SGMWG) is to champion and improve best practices that relate to engineering analysis and simulation. It will promote and enrich simulation management practices aligned with the rapidly-developing technologies in advancing the productivity and quality of virtual product development processes. This includes the development and promotion of requirements and standards that will have general benefits to the international engineering analysis and simulation community.
- The group meets on a fortnightly basis online via WebEx.
- **SGMWG Chair** – Chris Rogers, CREA Consultants.
- The group includes representatives of Abercus Limited, ASME, CIMdata, Inc., CREA Consultants Ltd, Dynamic Design Solutions, IEAC, International Nuclear Services, J W Analysis, Knorr-Bremse SfS GmbH, Office for Nuclear Regulation, RISE Research Institutes of Sweden, Rolls-Royce Corporation, SIMconcept Consulting, The SDM Consultancy, Tor Engineering Ltd., US Nuclear Regulatory Commission, WLO Consulting.
- Information about the Simulation Governance and Management Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/simulation-governance-management](http://www.nafems.org/community/working-groups/simulation-governance-management)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/simulation-governance-management/get\\_involved](http://www.nafems.org/community/working-groups/simulation-governance-management/get_involved)

# Simulation Governance & Management

## Current Areas of Activity:

- The Simulation Governance and Management Working Group are currently developing two documents which provide guidance on how the ISO 9001 standard, which specifies the requirements for a quality management system, can be implemented for Engineering Analysis and Simulation activities. These documents are anticipated to have the titles “Engineering Simulation Quality Management Standard” and “Engineering Simulation Quality Management Guidelines”.
- While the SGMWG is a long-standing NAFEMS Working Group, the name ‘Simulation Governance & Management’ is a recent adoption. In 2018 the working group decided revise its name from ‘Analysis Management Working Group’ to ‘Simulation Governance & Management’ to represent a change in focus for the group.
- The foundational components of Simulation Governance are the executive management policies and procedures assuring that the business benefits of engineering modelling and simulation across the product lines are aligned with the strategic vision and goals of the company.
- A document describing how to implement simulation governance is in production.
- The group is also working of a publication describing different validation methods.



# Simulation Governance & Management

## A Selection of Recent Outputs

- The SGMWG recently published a short introductory flyer on 'What is Simulation Governance and Management?' which describes the principals of simulation governance. This document is freely available on the NAFEMS website.
- The SGMWG were also responsible for the introductory document 'What is Verification & Validation?'. This document is also freely available and was co-published with ASME (The America Society of Mechanical Engineers).
- The working group recently published a document aimed at managers helping them understand the concepts of verification, validation and uncertainty quantification. The intent behind this publication was to help managers and decision-makers who are using simulation results to understand the confidence level of their results as well as the potential risks.
- Generating confidence in the results produced by simulation has been a priority topic for NAFEMS for over thirty years. With this in mind, the Simulation Governance and Management Working Group agreed to helm an issue of our quarterly 'Benchmark' magazine on this topic.
- SGMWG members were responsible for leading a recent webinar presenting introductory information on verification, validation and predictive capability. 'Verification, Validation and Predictive Capability: What's What?' sketches a framework for incorporating a wide range of error and uncertainty sources that are identified during mathematical modelling, verification and validation processes with the aim being to estimate the total predictive uncertainty of the simulation.

# Chair Bio

Chris Rogers is a Chartered Structural Engineer and Information Technology Professional with a strong leaning towards engineering analysis/simulation and the analysis interface with design.

Since 1982 Chris' experience has been in the safety-related and defence industries, mainly related to nuclear power generation, nuclear reprocessing and petrochemical industries. His principal activities have revolved around the analysis of structures, plant and equipment to survive extreme and hazard loads, such as wind, seismic/earthquake, fire, explosion and impact. Chris also has a strong background in structural dynamics and non-linear static and dynamic response, plus experience in many other fields including general industry and the leisure industry.

Specialties: Structural and mechanical engineering analysis, Finite Element Analysis (FEA), dynamic/seismic Soil Structure Interaction (SSI), non-linear response, advanced design, hazard and extreme loading, fire, explosion, blast, seismic, earthquake, vibration, impact, thermal, forensic analysis, expert witness support, design and analysis troubleshooting, peer review, independent technical assessment, programming for analysis.



# Stochastics Working Group

The focus of the SWG is to champion and improve best practices that relate to stochastic engineering analysis and simulation methods and tools. It will promote the extension of current engineering analysis and simulation practices to include stochastic methods and tools to enable the virtual product development processes to be closer to the real world behavior of the modelled systems and components

This will allow you to extract significantly more business value from your investment in engineering analysis and simulation via:

- the generation of repeatable, realistic and rapid results
- the reduction of design cycle times through faster iterative analysis
- the reduction of the number of physical prototypes required for design validation
- improved accuracy to drive down product, development, manufacturing, and warranty costs
  
- Monthly online meeting.
  
- Chair – Alexander Karl, Rolls-Royce
  
- Information about the Stochastics Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/stochastics](http://www.nafems.org/community/working-groups/stochastics)
  
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/stochastics/get\\_involved](http://www.nafems.org/community/working-groups/stochastics/get_involved)



# Stochastics Working Group

## Current topics of interest for the working group

- the NAFEMS focal for stochastic engineering analysis and simulation methods and tools
- the NAFEMS focal for Uncertainty Quantification (UQ) methods related to performing engineering simulation,
- the primary link between NAFEMS and the other areas active in the UQ and Stochastics space, and to capture and share knowledge & guidelines related to:
- Stochastic engineering simulation processes, methods and tools,
- Uncertainty Quantification associated with engineering simulation processes, and
- Competency requirements related to Stochastics and UQ.

## Outputs recently created by the working group

- 1<sup>st</sup> publication: Stochastics and its Role in Robust Design
- "Challenges in Uncertainty Quantification" (Benchmark, October 2014)
- Working on 2<sup>nd</sup> publication: topic area will be Uncertainty Quantification

## Events recently supported by the working group

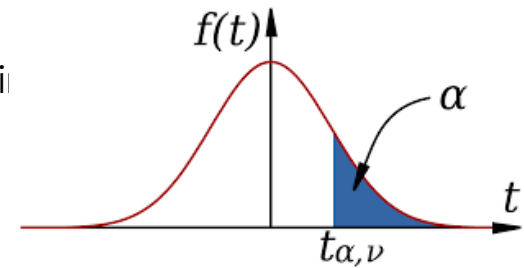
- Seminar: Uncertainty analysis in engineering computations held at "Politecnico di Milano" on the 10th of April 2017
  - *"The seminar had 82 participants and gave an overview on the most recent advancements in the fields of reliability analysis, robust and accurate modelling of uncertainties, sensitivity analysis, advanced simulation techniques as well as imprecise probabilities."*
- 2 Stochastic Sessions at NWC17
- 1 Stochastic Session at NAFEMS Americas Conference, June 7-9 2016, in Seattle.
- 1 Training Session "Introduction To Probabilistic Analysis And Design", at NAFEMS Americas Conference, June 7-9 2016, in Seattle.



# Stochastics Working Group

## Current / future areas of interest

- Define terminology, acronyms etc. in this area
- Develop Benchmarks and Challenges in this area
- Define the profession simulation engineer competencies in this area
- Develop appropriate training materials in this area



## Key Individuals in the working group.

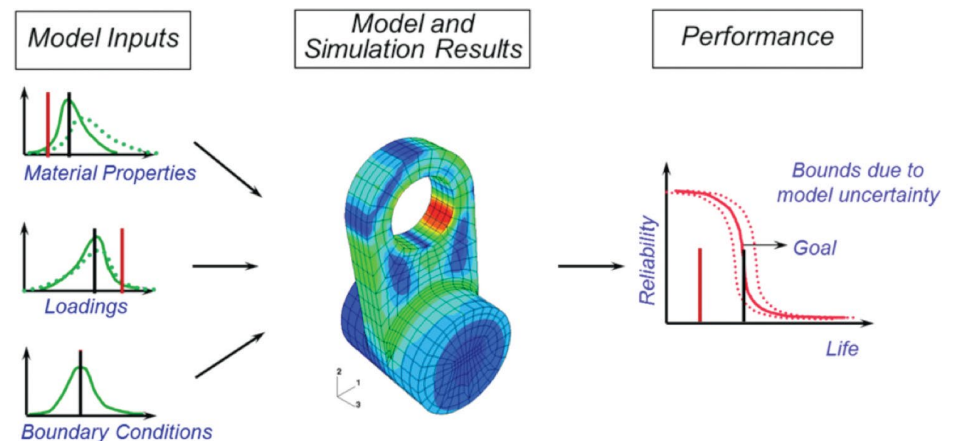
- Alex Karl, Rolls-Royce Corporation, Chairman, USA
- Jack Reijmers, Nevesbu, The Netherlands
- Louise Wright, National Physical Laboratory, UK
- Ramesh Rebba, General Motors, USA
- Dietmar Vogt, Airbus Group Innovation, Germany
- Patrick Koch, SAS, USA
- Gordon May, Rolls-Royce PLC, UK
- Matteo Broggi, Leibniz Universität Hannover, Germany
- David Riha, Southwest Research Institute, USA
- Peter Qian, SmartUQ, USA



# Stochastics Working Group

## KEY Achievements:

- **Publication:** 'Stochastics and its role in Robust Design'  
[https://www.nafems.org/publications/resource\\_center/r0107/](https://www.nafems.org/publications/resource_center/r0107/)
- **Flyer:** 'What is uncertainty quantification?'  
[https://www.nafems.org/publications/resource\\_center/wt08/](https://www.nafems.org/publications/resource_center/wt08/)
- **Challenge problems:**
  - 'Challenges in Uncertainty Quantification' (Benchmark, October 2014)  
[https://www.nafems.org/publications/resource\\_center/bm\\_oct\\_14\\_5/](https://www.nafems.org/publications/resource_center/bm_oct_14_5/)
  - 'Stochastic Challenge Problems' (Benchmark, April 2019)  
[https://www.nafems.org/publications/resource\\_center/bm\\_apr\\_19\\_8/](https://www.nafems.org/publications/resource_center/bm_apr_19_8/)



# Chair Bio

Alexander Karl holds a PhD and MSc in Aerospace technology from the University of Stuttgart in Germany. He has 21+ years of work experience with Rolls-Royce. During this period, Alexander was working in several major sites and sectors (Dahlewitz, Derby and Indianapolis). Alexander's background is thermo-mechanical analysis but for the last 18+ years Alexander has been working actively in the area of multi-disciplinary optimization, Robust Design (Design for Six Sigma) and Systems Engineering. His main focus is the application of these tools, methods and processes to real engineering challenges.

Alexander's current focus within Rolls-Royce is the global pervasive implementation of Robust Design within the company. Alexander is an Associate Fellow for Robust Design and Systems Engineering and a Master BlackBelt within Rolls-Royce. He is also an active member of NAFEMS and ERCOFTAC promoting a wider application of these methods, processes and tools.



# Systems Modeling & Simulation

a NAFEMS / INCOSE\* joint Working Group



## Systems Modeling and Simulation\*\*:

*'The use of interdisciplinary functional, architectural, and behavioral models (with physical, mathematical, and logical representations) in performing MBSE to specify, conceptualize, design, analyze, verify and validate an organized set of components, subsystems, systems, and processes'*

\* INCOSE: International Council on Systems Engineering

\*\*SMSGWG – Terms & Definitions: [https://www.nafems.org/about/technical-working-groups/systems\\_modeling/smstermsdefinitions/s-u/](https://www.nafems.org/about/technical-working-groups/systems_modeling/smstermsdefinitions/s-u/)

# Systems Modeling and Simulation

- The Systems Modeling & Simulation Working Group (SMSWG) is a joint working group, formed under an agreement between the International Council on Systems Engineering (INCOSE) and the International Association of the Engineering Modelling, Analysis and Simulation Community (NAFEMS). The group's activities began in January 2013. The focus of the SMSWG is on the merging of engineering analysis with overall systems analysis to perform more realistic, accurate and lifelike behaviour modelling and simulation.
- The mission of the joint NAFEMS/INCOSE Systems Modeling & Simulation Working Group (SMSWG) is:
  - Develop a **vendor-neutral, end-user driven** consortium that not only promotes the advancement of the technology and practices associated with integration of engineering analysis and systems engineering, but also acts as the **advisory body to drive strategic direction for technology development and standards in the space of complex engineering**.
  - This group will support activities that bridge engineering analysis and systems engineering to provide digital solutions to represent real life experiences; and optimize the integration of systems engineering and simulation solutions for both OEM and supplier.
  - This includes education, communication, promotion of standards, and development of requirements that will have general benefits to the simulation and analysis community with the identification of benchmarks and major strategic issues (grand challenges).
- Monthly online meetings via WebEx and regular face-to-face meetings.
- **Chair:** Roger Burkhart, John Deere  
**Co-Chair:** Frank Popielas, SMS\_ThinkTank
- A list of organisations represented in the SMSWG can be found at [www.nafems.org/community/working-groups/systems\\_modelling/smswg](http://www.nafems.org/community/working-groups/systems_modelling/smswg)
- Information about the Systems Modeling and Simulation Working Group can be found on the NAFEMS website at [www.nafems.org/community/working-groups/systems\\_modeling](http://www.nafems.org/community/working-groups/systems_modeling)
- To enquire about joining this working group complete the online form at [www.nafems.org/community/working-groups/systems\\_modeling/get\\_involved](http://www.nafems.org/community/working-groups/systems_modeling/get_involved)

# Systems Modeling and Simulation

- Due to its size, the working group is coordinated through a Steering Committee representing various industries.
- Member status:
  - Members: around 188
  - Companies: around 108
- Focus teams have been created to coordinate specific activities and create materials.

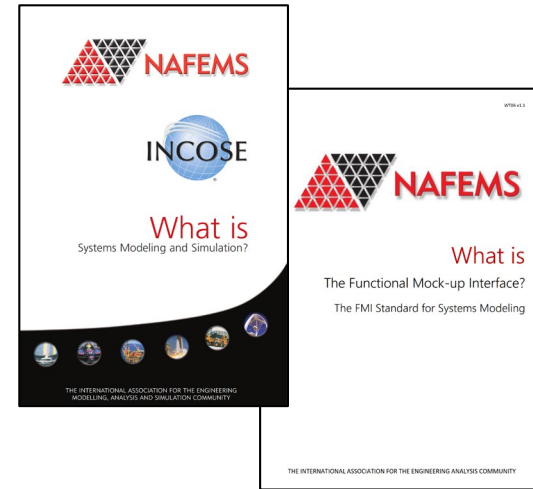
## **Focus Groups:**

- SMS Roadmap and Best Practices (Lead – Frank Popielas, SMS\_ThinkTank)
- Terms & Definitions (Lead – Ed Ladzinski, SMS\_ThinkTank)
- Emerging Standards Ecosystem for SMS (Lead – Don Tolle, CIMdata)

# Systems Modeling and Simulation

## Major Activities

- What is Flyers
  - FMI in 2018
  - SMS in 2019 (first co-branded flyer)
  - More to follow covering model-based topics
- Terms and Definition
  - First published in 2016 on website (over 500 were evaluated)
  - New definitions are being works on
- Supporting organization of events
  - Automotive Days in Troy, MI, USA (annually)
  - MBE Day in Columbus, OH, USA (first on 10/1/2019)
- Close participation annually at the IW Workshops from INCOSE
- Roll out of SMS Presentation Topics and combine with company experiences (use cases from end users)



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S-U

Home About Technical Groups Systems Modeling & S... Terms & Definitions S-U

### Systems Modeling & Simulation Working Group

The following was compiled by members of the Systems Modeling & Simulation Working Group to provide the model-based systems engineering community with a common set of shared terms and definitions.

A-C | D-F | G-I | J-L | M-O | P-R | S-U | V-X | Y-Z

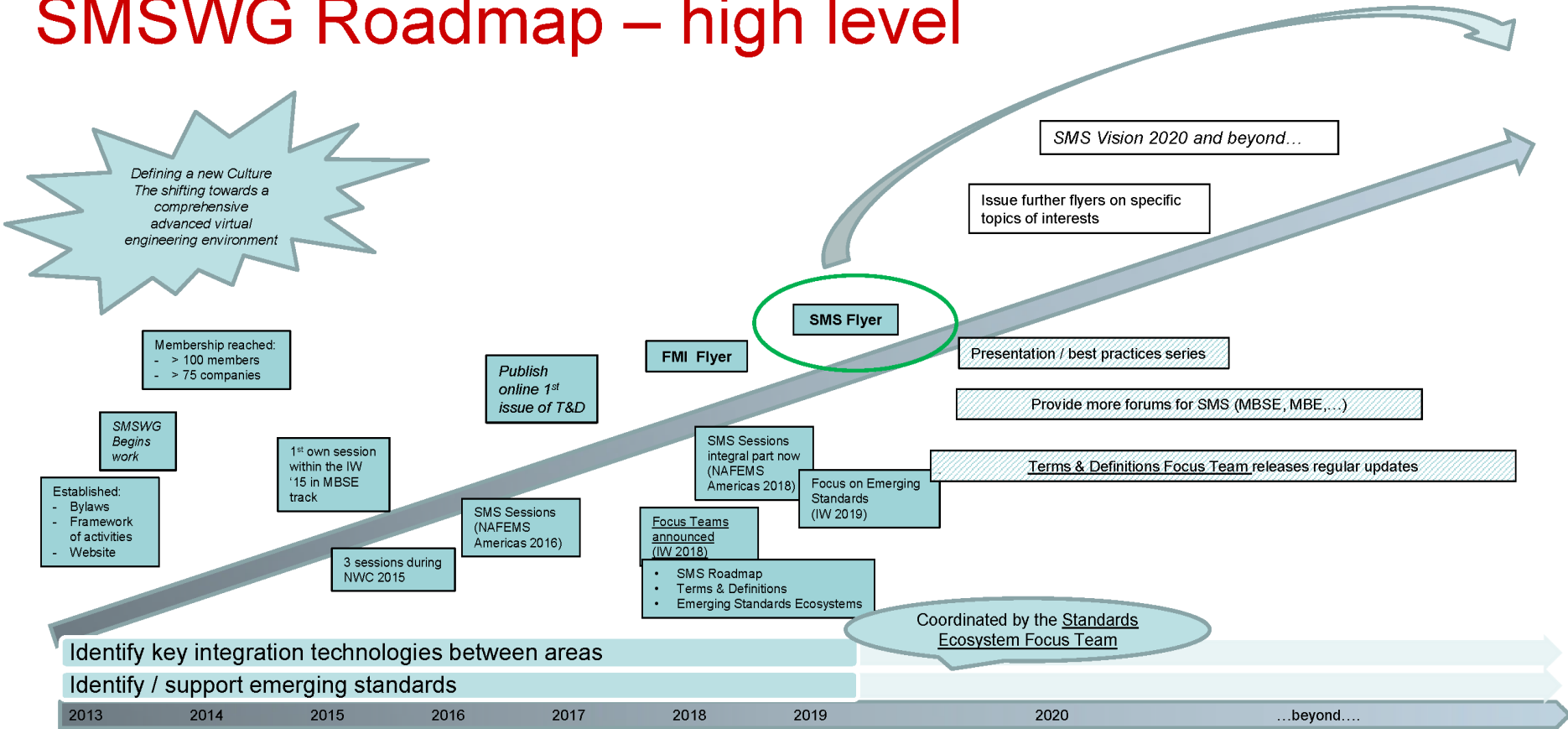
#### Terms & Definitions (S-U)

Term	Definition	Source	Link
Simulation Data Management (SDM)	A technology which uses database solutions to enable users to manage structures of simulation and process data across the complete product lifecycle. SDM artifacts can be data, models, processes, documents and metadata relevant to modeling, simulation, and analysis.	NAFEMS SDMWG	/about/tech/sdmwg/
Simulation Exercise	An exercise that consists of one or more interacting simulation applications. (IEEE Std 1278.1-2012)	Modeling & Simulation Coordination Office	<a href="http://msco.mil/MSGlossary_TRM_S-W.html">http://msco.mil/MSGlossary_TRM_S-W.html</a>
Simulation Time	The shared time being simulated within a simulation exercise; it may advance faster, slower, or at the same pace as real time. (IEEE Std 1278.1-2012)	Modeling & Simulation Coordination Office	<a href="http://msco.mil/MSGlossary_TRM_S-W.html">http://msco.mil/MSGlossary_TRM_S-W.html</a>
SMS Tools	Software and / or hardware that implements and / or enables a model, simulation, activities or an adjunct tool, i.e. software and/or hardware that is either used to provide part of a simulation environment (e.g., to manage the execution of the environment) or to transform and manage data used by or produced by a model or simulation. Adjunct tools are differentiated from simulation software in that they do not	SM5WG	



# Systems Modeling and Simulation

## SMSWG Roadmap – high level



# Chair Bios

## **Roger Burkhart – SMSWG Chair**

Roger Burkhart is a Technology Architect at Deere & Company. He is one of the architects of the System Modeling Language (SysML) which extends the Unified Modeling Language (UML) from software to systems of all kinds. At both INCOSE and the Object Management Group (OMG), he helped drive the development of SysML to enable adoption of Model-Based Systems Engineering (MBSE). At OMG he has served as co-chair of the SysML Revision Task Force and the Systems Engineering Special Interest Group. At INCOSE, he is active in the MBSE Initiative and the Systems Modeling and Simulation Working Group (SMSWG). Roger assumed the role of SMSWG Chairman in July 2016.



Roger's research work seeks to expand the use of computer-based models to collaborate across diverse business and technical concerns. Previously at Deere, he developed databases and decision-support systems, with applications from factory design to production agriculture. He has developed research tools for agent-based modeling and simulation, managed a software tools group, and introduced the use of object-oriented programming and distributed computing within Deere. He began at Deere as a summer intern in the 1970's while studying mechanical engineering at MIT.

## **Frank Popielas – SMSWG Co-Chair**

Frank Popielas is Managing Partner and Co-Founder of SMS\_ThinkTank™. He has over 20 years of global experience in engineering and R&D product and materials development, IP management, as well as testing, with a specific focus on the development and application of simulation tools, and the establishment of the required supporting infrastructure at Dana Holding Corporation. His expertise includes technology exchange and transfer, business assessments in engineering and manufacturing focusing on the virtual aspect, as well as process development and democratization of its application in this area.



In Addition, Frank is a member of the NAFEMS Americas Steering Committee since 2011 and became founding chairman of the joint Systems Modeling and Simulation Working Group (SMSWG) between NAFEMS and INCOSE in 2013 and continues his leading role in the SMSWG as Co-chair since August 2016. He joined the COE organization as volunteer in 2017 and is section chair within the Engineering, Analysis and Simulation Division responsible for CAE and SPDM (Simulation Process and Data Management). His activities and achievements include over 35 granted patents globally on the areas of sealing, shielding and fuel cells, over 30 publications globally covering all the mentioned areas with the main focus on the past decade on virtual engineering, its tools and practices, presentations and speaking engagements at conferences and various companies, interviews, case studies and teaching engagements. Mr. Popielas received his MSc degree in Engineering, majoring in Theoretical Physics from the Technological University (MIS&A – Institute for Steels and Alloys) in Moscow, Russia. Frank is fluent in English, German and Russian.