

NAFEMS Technical Working Group Overview

Q3 2017

Analysis Management

- The focus of the AMWG 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 AMWG is specifically chartered by NAFEMS to be:
 - the NAFEMS focal for interpreting engineering Simulation Governance and Management including Verification & Validation (V&V) and Quality Assurance,
 - the NAFEMS focal for interpreting the overall role of Uncertainty Quantification (UQ) in performing engineering simulation,
 - the primary link between NAFEMS and the ASME V&V committees,
- and to capture and share knowledge and guidelines related to:
 - Engineering simulation governance, management and best practices,
 - Engineering analysis quality assurance procedures,
 - Engineering modeling and simulation quality management standards aligned with ISO 9001,
 - Verification & validation of engineering simulation methods and models,
 - Planning engineering simulation projects and tasks,
 - The overarching roles and assessments of Uncertainty Quantification associated with engineering simulation processes, and Competency requirements related to simulation management.

Analysis Management

- Twice monthly webex meetings
- Chairman – Chris Rogers, CREA Consultants
 - share knowledge & guidelines related to:
- Current Key Issues
 - Currently working on a unified validation definition that fits with both the NAFEMS and ASME perspective on engineering analysis and simulation
- Publications in Progress
 - What is Simulation Governance
 - What is VVUQ
 - Engineering Simulation Quality Standard (NAFEMS ESQS)
 - Engineering Simulation Quality Handbook
- Recent Publications
 - Simulation Verification and Validation for Managers

Composites

- 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.
- Monthly online meeting
- Chairman – Ronald Krueger, National Institute of Aerospace
- Vice-Chair – Roger Assaker, e-Xstream engineering SA/ MSC.Software
- Vice-Chair - Kim Parnell, PEC - Parnell Engineering and Consulting

Composites

- **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**

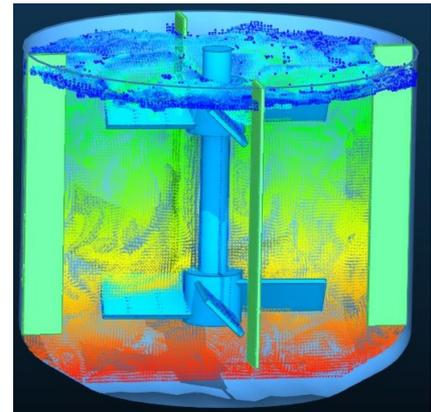
- NAFEMS benchmark magazine with 10 articles focussed on composites, June 2015
- Review of Composites Simulation Tools – online review on NAFEMS Website
- Composite Finite Element Analysis, NAFEMS e-Learning course
- Structure Genome: A Revolutionary Multiscale Approach to Bridging Materials Genome and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

Computational Fluid Dynamics

- The NAFEMS CFD 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.
- Roughly 6 weekly web-meetings with one or two face-to-face meetings each year, often coinciding with an event.
- Nearly 40 members from industry, consultancies, vendors and academia
- Many have been actively involved for more than a decade.
- Chairman: Althea de Souza



Computational Fluid Dynamics

- **Current topics of interest**
 - Second CFD Workbook of Examples
 - Why do Heat Transfer CFD
 - How to Validate Industrial CFD
 - Update of the CFD meshing book
 - Rotor Aerodynamics How To
 - Further volumes of CFD Benchmarks
 - CFD Primer
 - How to Analyse and Process CFD output – ITT issued
 - PSE competencies
 - Planning CFD: data management
 - International Journal of CFD Case Studies
 - Icons of CFD for Benchmark magazine
- **Oil and Gas sub-group**
 - How to undergo atmospheric dispersion using CFD
 - How to Undertake Erosion Modelling using CFD
 - Subsea UK simulation and modelling event
- **Outputs recently created**
 - How to Model Fluid Flow Systems: Computational Fluid Dynamics vs Fluid System Simulation (webinar also being planned)
 - Review of seminar: Hybrid RANS-LES for Industry
 - First volume of NAFEMS CFD Benchmarks
 - A Designers' Guide to CFD – undergoing review
 - Radiation Modelling for CFD – undergoing review
- **Events recently supported**
 - Seminar on High Fidelity CFD – Nov 2016
 - Iberia seminar on Thermal Simulations – Feb2017
 - Italian seminar on CFD – March 2016
 - Webinars planned on Multiphase Flow

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 and online in the interim for more focussed discussions on specific topics
- Chair: Adam Towse, Assystem; Vice Chair: Louise Wright, NPL;

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
- **Recent & forthcoming publications:**
 - How to model structural concrete using FEA
 - Determination and use of material properties for FEA
 - Why do manufacturing simulation
 - How to model bolted & riveted connections
 - What are meshless methods?
 - How-to assess welded structures
 - How-to model the welding process
 - Considerations when modelling extreme deformation
 - Simulating wave propagation from point explosive sources
 - Assessment of structures subject to blast loading
- **Looking to pull together topics for Special Interest Groups**

Education & Training

- The NAFEMS Education and Training Working Group is formed to examine the education and training needs for all numerical analysts and to provide information and documents to satisfy these needs
- The Education and Training Working Group are responsible for accrediting courses run by NAFEMS and other external agencies. In addition the working group support the NAFEMS Professional Simulation Engineer Scheme.
- Regular Meetings in person (London, UK) with webex to allow international participation
- Chairman – Adib Becker, Nottingham University

Education & Training

- **Areas of Activity**
 - Reviewing feedback from NAFEMS courses to ensure that standards are being maintained
 - Developing a self assessment process that can be used to inform engineers and analysts when they are read for PSE certification
- **Publications in Progress**
 - Why do Discrete Element Analysis
 - Finite Element Analysis – A Laymans Guide
- **Recent Publications**
 - How to perform linear dynamic Finite Element Analysis
 - How to perform electromagnetic Finite Element Analysis
 - The NAFEMS Benchmark Challenge Compilation
- **Proposed Publications**
 - How to model crack propagation with FEA
- **Other Activities**
 - The working group are encouraging academic institutions to gain NAFEMS Approval for the course with engineering analysis and simulation content.
 - The group have initiated a NAFEMS prize that is available to every academic NAFEMS member for the “Best Project in Engineering Simulation”

Geotechnical

- The NAFEMS Geotechnical Working Group formed with the aim of developing guidelines for the practical application of numerical method in geotechnical engineering.
- Numerical analysis using finite element and finite difference methods has become a main stream design tool within geotechnical in the last decade or so. This is due to the development of sophisticated yet accessible computer programs that can realistically model the ground and adjacent structures.
- Regular meetings in person (UK) with webex provide to allow international participation.
- Chairman – Peter Scott, Buro Happold

Geotechnical

- **Publications in Progress**

- How to model deep and shallow foundations with Finite Elements
- How to model concrete lined tunnels

- **Recent Publications**

- Validating Numerical Modelling in Geotechnical Engineering
- Obtaining Parameters for Geotechnical Analysis
- How to Undertake Finite Element Based Geotechnical Analysis

- **Recent Activities**

- Awareness seminar – Modelling soil structural interaction during tunnel excavation.
- Members of the working group were recently engaged with the COGAN project. This project is aimed at delivering an education base of around 1000 competence statements in the area of geotechnical analysis.

High Performance Computing

- The NAFEMS High Performance Computing Working Group aims to provide a vendor-neutral, end-user driven consortium that promotes the effective use of High Performance Computing in engineering simulation.
- High Performance Computing is used as an umbrella term for a range of technologies such as traditional supercomputing, grid computing, cloud computing, high throughput computing, hardware acceleration, data storage and visualization.
- Regular online meetings
- Chairman – Lee Margetts, University of Manchester

High Performance Computing

- **Areas of Interest**
 - NAFEMS high performance benchmarks
 - Cloudburst computing
- **Current Areas of Activity**
 - The group were responsible for the seminar titled “Improving HPC Adoption in Engineering Simulation”, Manchester UK, February 2016
- **Recent Areas of Activity**
 - The group were responsible for the seminar titled “Improving HPC Adoption in Engineering Simulation”, Manchester UK, February 2016
 - Survey – “Computing Platforms for Engineering Simulation”. The survey intended to take a snapshot of the type of computing platform used in industry today and also look at industries thoughts on what would be used in 5 years.

Manufacturing Process Simulation

Promote the development and use of virtual manufacturing tools within the product design and manufacturing cycle to improve outcomes in industrial manufacturing processes.

- Monthly WebEx (online) meeting
- Chair – Peter Giddings (National Composites Centre, UK)
- Vice Chair – Anas Yaghi (Manufacturing Technology Centre, UK)
- Metallic Additive Manufacturing sub-group leader – Sjoerd Van der Veen (Airbus Aircraft)

Manufacturing Process Simulation

- **A Listing of any Current topics of interest for the working group**
 - Compiling an agreed presentation of “Why Do Manufacturing Process Simulation” for use at events
 - Defect prediction in metallic Additive layer manufacturing
 - Collating member and industrial topics of interest
- **A Listing of any outputs recently created by the working group**
 - Under review
- **A listing of any events recently support by the working group**
 - NAFEMS Iberia conference – Presentation from T Dutton (see item 1)
 - NAFEMS UK Practicalities of Analysing Composites – Presentation from Peter Giddings
 - NAFEMS World Congress – Presentation from Peter Giddings

Multiphysics

- The NAFEMS multiphysics working group 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
- Chairman – Henrik Nordborg, Microsoft Innovation Centre and the University of Eastern Switzerland

Multiphysics

- **Areas of Current Interest**

- A online repository for Multiphysics case studies
- Production of the NAFEMS Journal of Multiphysics Case Studies
- A webinar on Fluid Structural Interaction

- **Past Events**

- European Multiphysics Conference, Copenhagen November 2016
- European Multiphysics Conference, Manchester, October 2014

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
- Chairman – Nadir Ince, GE Power

Optimisation

- **Areas of Current Activity**
 - How to guide on process optimisation
 - How to guide on Design of Experiments and Surrogate Modelling
 - Development of optimisation benchmark cases
- **Recent Publications**
 - How to Perform Optimisation Under Uncertainty
 - Robust design optimisation in virtual product development

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 meeting via WebEx on the second Thursday (11:00 am-12:30 pm EST).
- Chairman: Laura Michalske (The Procter & Gamble Co.)
- Vice Chairman: Randy Cigel (The Boeing Corporation)

Simulation Data Management

Recent Activities

- **"How to Implement a Simulation Process and Data Management Capability"** paper is in the process of being written.
- A **"Spreadsheet Management"** survey is being developed to understand the ramifications of unmanaged/managed spreadsheets.
- **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.
- **NAFEMS SPDM Congress** – held in conjunction with the NAFEMS World Congress.

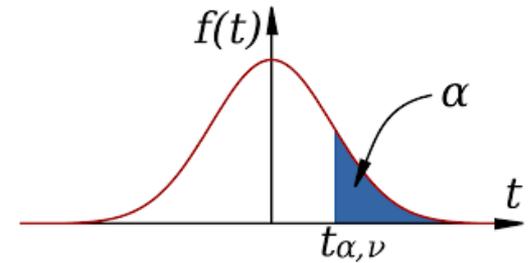
Recent Publications

- **"What is Simulation Management?"** can be downloaded from the NAFEMS SDM Publications site along with other past publications.

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

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.
- Monthly WEBEX meetings and link calls
- 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

- 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
 - 1st publication: Stochastics and its Role in Robust Design
 - "Challenges in Uncertainty Quantification" (Benchmark, October 2014)
 - Working on 2nd publication: topic area will be Uncertainty Quantification
- Events recently support 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.

Systems Modelling & Simulation

- The NAFEMS Systems Modelling and Simulation Working Group focus is on the merging of engineering analysis with overall systems analysis to perform more realistic, accurate and lifelike behaviour modelling and simulation
- The Systems Modelling & Simulation Working Group is a collaboration between NAFEMS and INCOSE (the International Council on Systems Engineering)
- Regular online and face to face meetings
- Chairman – Roger Burkhart, John Deere

Systems Modelling & Simulation

- **Areas of Current Activity**
 - Currently authoring a “What is Systems Modelling & Simulation” publication
 - White paper – FMI: The Enabling Technology for Systems Simulation.
- **Recent Activity**
 - The group have recently developed a glossary of terminology used in the area of systems modelling and simulation
 - What is FMI – NAFEMS Webinar
 - The group supported the seminar “Simulation & Systems Engineering in the Automotive Industry” in Troy MI