

The NAFEMS Composites Working Group

An Overview

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Outline

- **Introducing NAFEMS**
 - Formation and Aims
 - Membership
 - Activities
 - Working Groups
- **The NAFEMS Composites Working Group**
 - Introduction
 - Mission and Vision
 - Activities
 - Current topics of interest



Introducing NAFEMS – Formation and Aims

- **Formation**

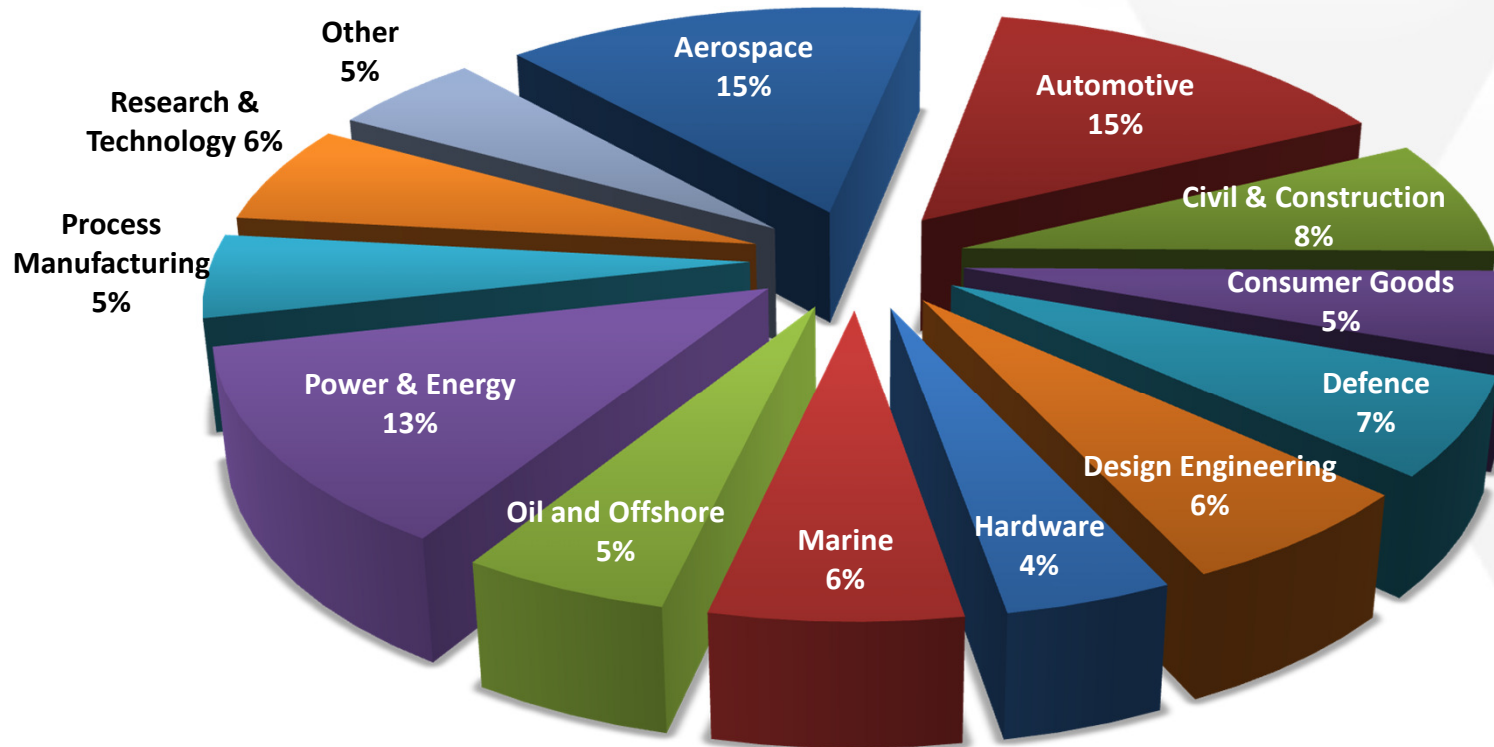
- *National Association for Finite Element Methods & Standards*
- To promote the safe and reliable use of finite element and related technology

- **Principal Aims**

- Be recognised as a **valued independent authority** that operates with neutrality and integrity
- Establish **best practice**
- Continuously improve **education and training**
- Provide a focal point for the **dissemination and exchange of information and knowledge**
- Promote **collaboration** and communication
- Act as an **advocate** for the deployment of simulation
- Improve **professional status**

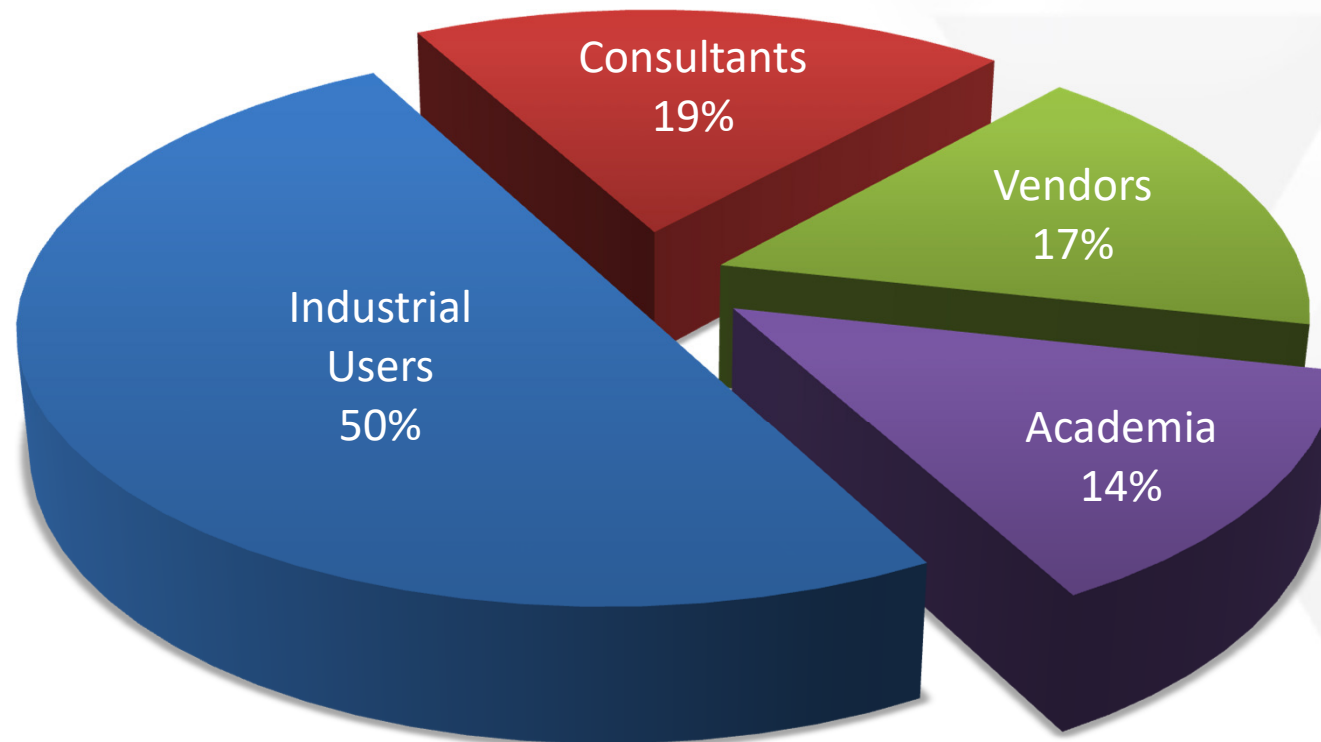
Introducing NAFEMS – Membership

- **NAFEMS is a member owned organization**
- **Encompassing many industries ...**



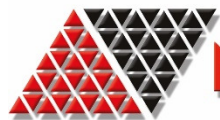
Introducing NAFEMS – Membership

- **Across four sectors ...**



Introducing NAFEMS – Membership

- In over 50 countries ...
- ... with Staff and Regional Steering Committees



NAFEMS

United Kingdom Americas DACH France Iberia India Japan Nordic

Introducing NAFEMS – Activities

World Congress

Conferences

Seminars

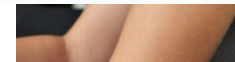
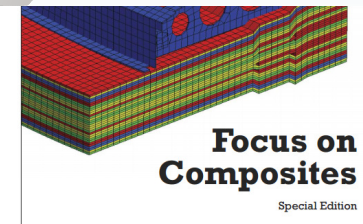
Webinars

Training

Publications

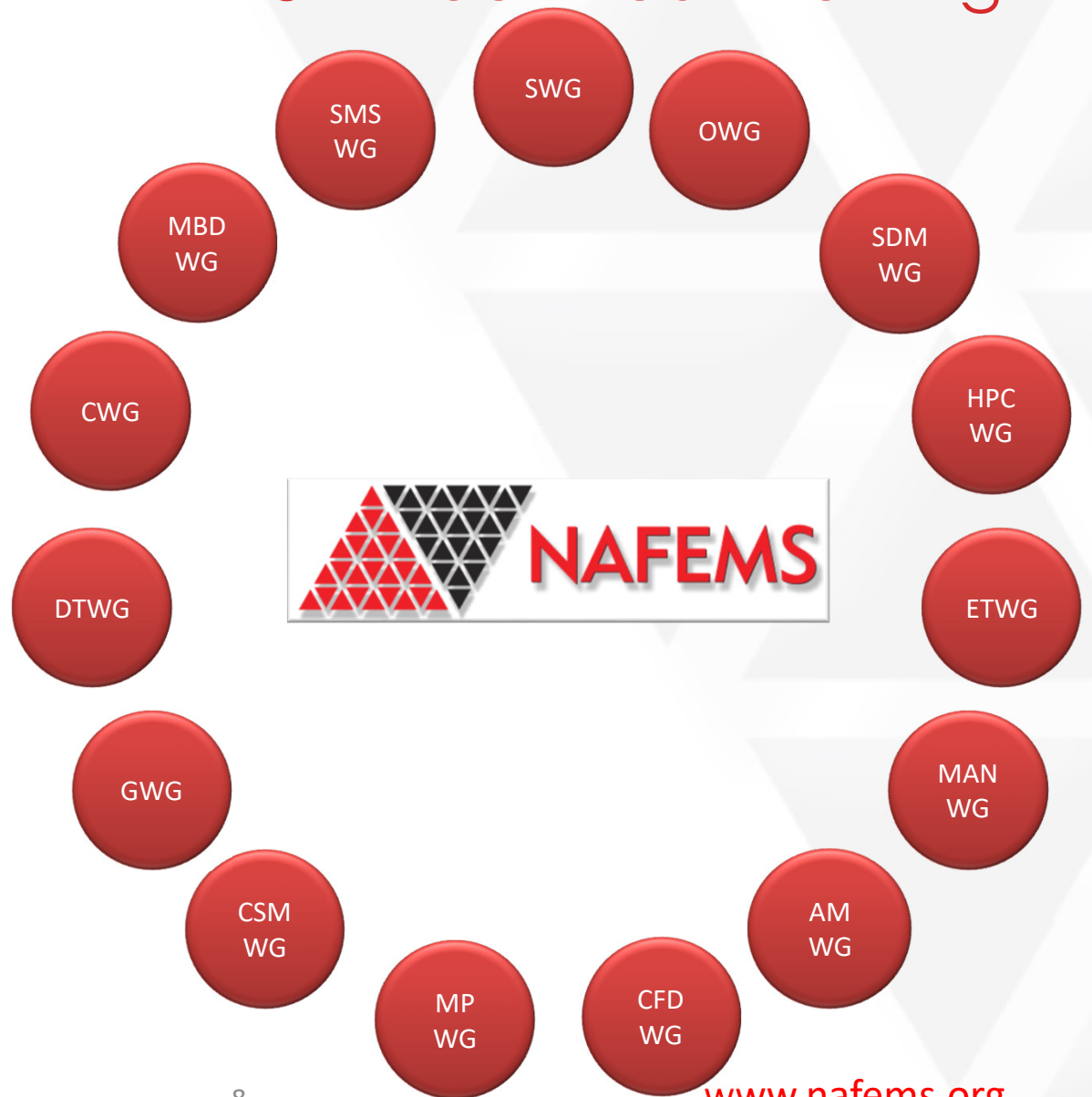
Projects

PSE-Competency



Introducing NAFEMS – Technical Working Groups

- Analysis Management
- **Composites**
- Computational Fluid Dynamics
- Computational Structural Mechanics
- Dynamics & Testing
- Education and Training
- Geotechnical
- High Performance Computing
- Manufacturing Process Simulation
- Multibody Dynamics
- Multiphysics
- Optimisation
- Simulation Data Management
- Stochastics
- Systems Modelling & Simulation



The NAFEMS Composites Working Group

Introduction

- **History**

- Established in the fall 2010
- Several web meetings
- First meeting at the NAFEMS WC in Boston 2011
- Since then monthly web meetings

- **The Team**

- Chairman: Ronald Krueger
- Vice-Chairman: Roger Assaker
- Currently 37 International experts from research, industry and academia

- **Website**

<https://www.nafems.org/about/technical-working-groups/composites/>



The NAFEMS Composites Working Group

Mission and Vision

MISSION

The mission of the NAFEMS Composites Working Group is to create awareness and education for the simulation of composites by gathering independent information and providing independent analysis of composites simulation capabilities and needs.

The mission includes education, communication, promotion of standards, and identification of simulation requirements that will have general benefit.

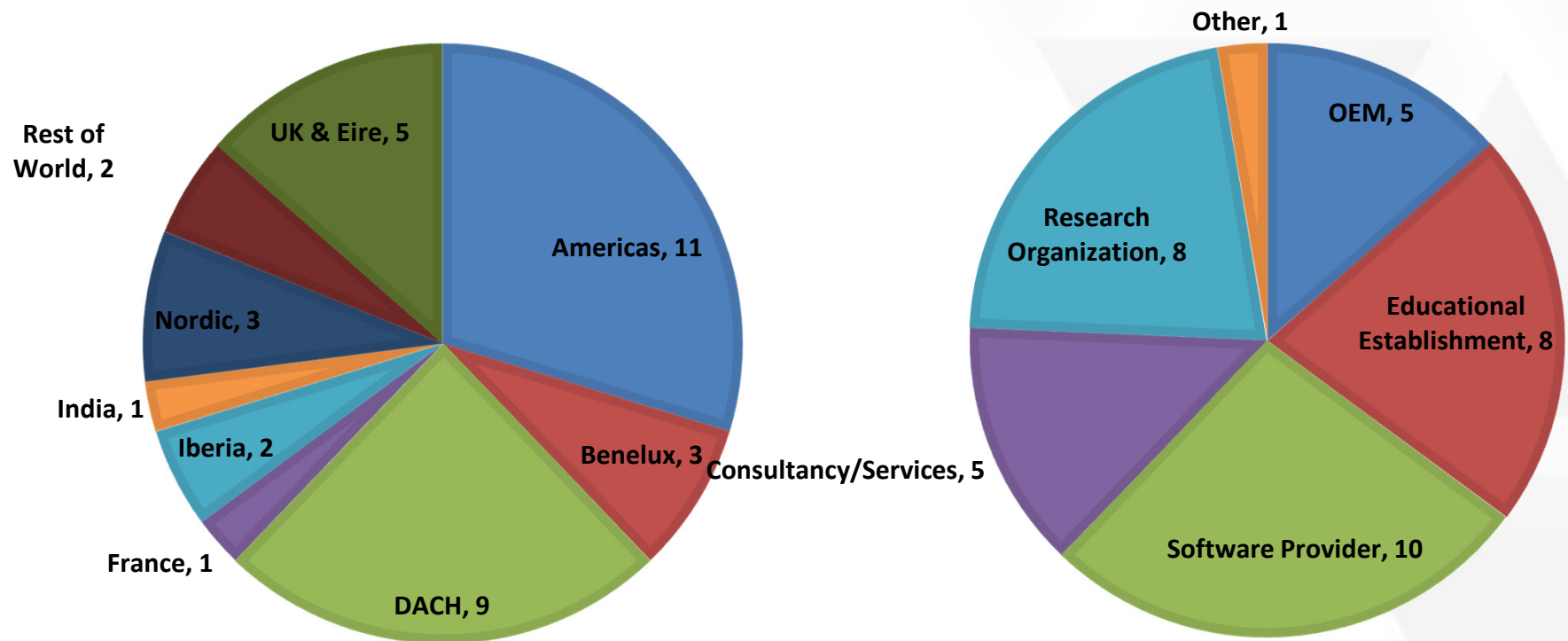
VISION

The vision of the NAFEMS Composites Working Group is to create a cross-industry consortium in a end-user driven, vendor-neutral arena for discussing, sharing, and evolving engineering techniques and practices in the simulation of composite materials.



The NAFEMS Composites Working Group

Membership



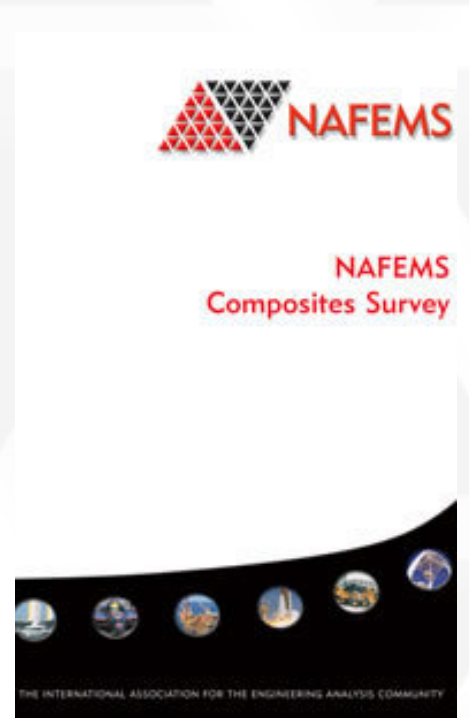
The NAFEMS Composites Working Group Activities

- **Starting point**
 - **Existing NAFEMS publications with focus on composites**
 - *How to Analyse Composites*, NAFEMS HT25, 2002.
 - *Composite Benchmarks*, NAFEMS R0031, 2001.
 - *Benchmarks for Composite Delamination*, R0084, 2002.
 - *Finite Element Analysis of Composite Materials*, NAFEMS R0003, 1992.
 - *Benchmarks for Membrane and Bending Analysis of Laminated Shells*
 - Part 1: *Stiffness Matrix and Thermal Characteristics*, NAFEMS R0092, 2005.
 - Part 2: *Strength Analysis*, NAFEMS R0093, 2005.
 - **Composites training offered by Tony Abbey**
 - e-learning course
 - runs over a four week period, single two hour session per week
 - https://www.nafems.org/e-learning/all_courses/el_composite/
- **New action items**
 - Upgrade existing publications and training
 - Generate new material based on the needs of the community

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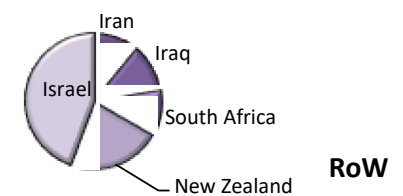
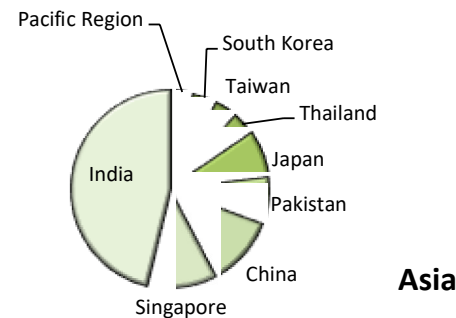
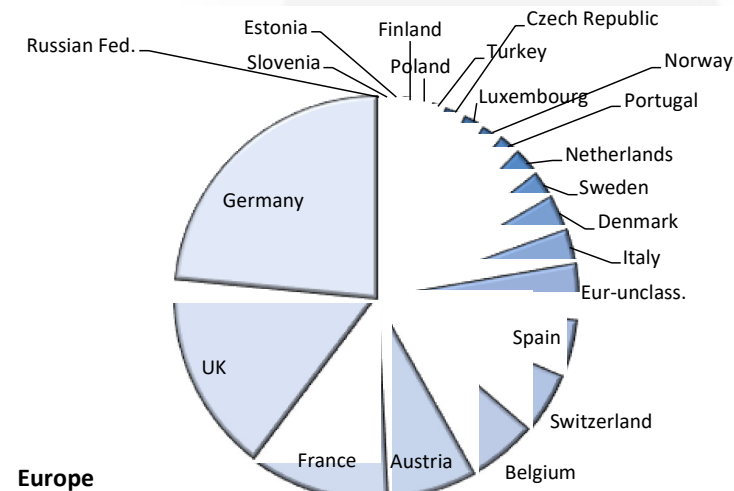
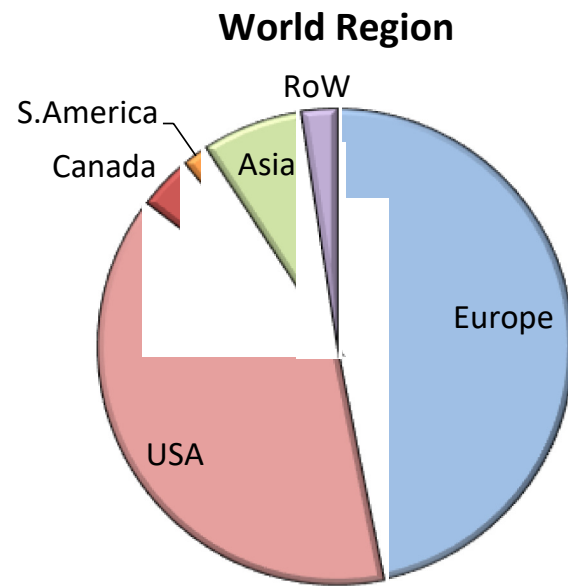
Composites Survey - Overview

- **Composites Working Group Survey 2012**
 - Objective: *To assess the state of the art and the needs of the community related to the simulation of composites*
 - Online survey using SurveyMonkey performed February 2012 – May 2012
 - 26 simulation related questions
 - 385 participants
 - Summary report emailed to participants in June 2012
 - emailed to participants in June 2012
 - available online
<https://www.nafems.org/about/technical-working-groups/composites/downloads/>
 - *NAFEMS Composites Survey, NAFEMS R0112, 2014.*



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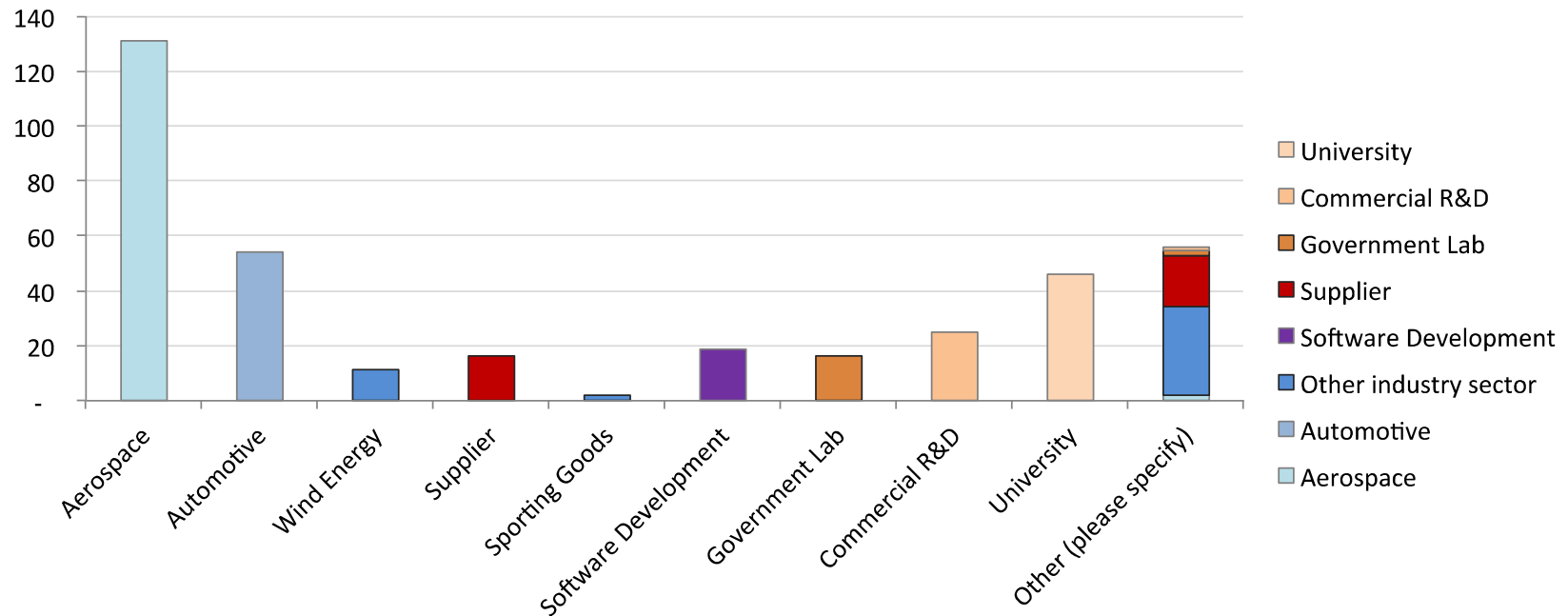
Composites Survey – Participant's location



- **Survey biased:**
- **strong participation in**
 - **Europe**
 - **Americas**

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Composites Survey – Participant's area of business

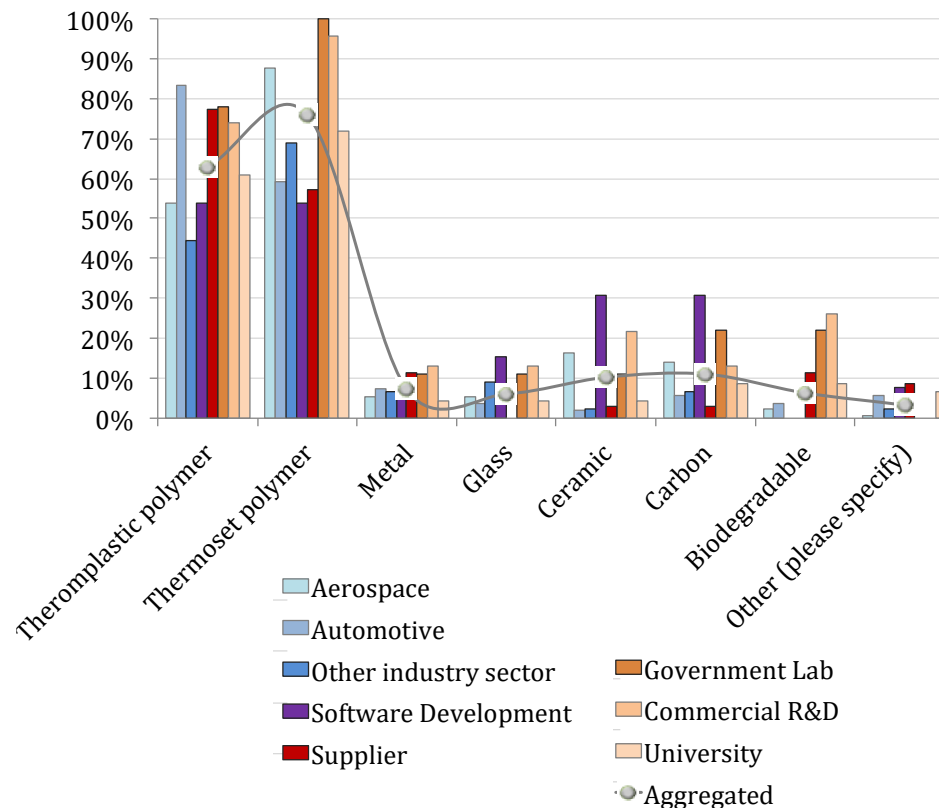


- **Survey biased:**
- **strong participation from**
 - Aerospace
 - Automotive

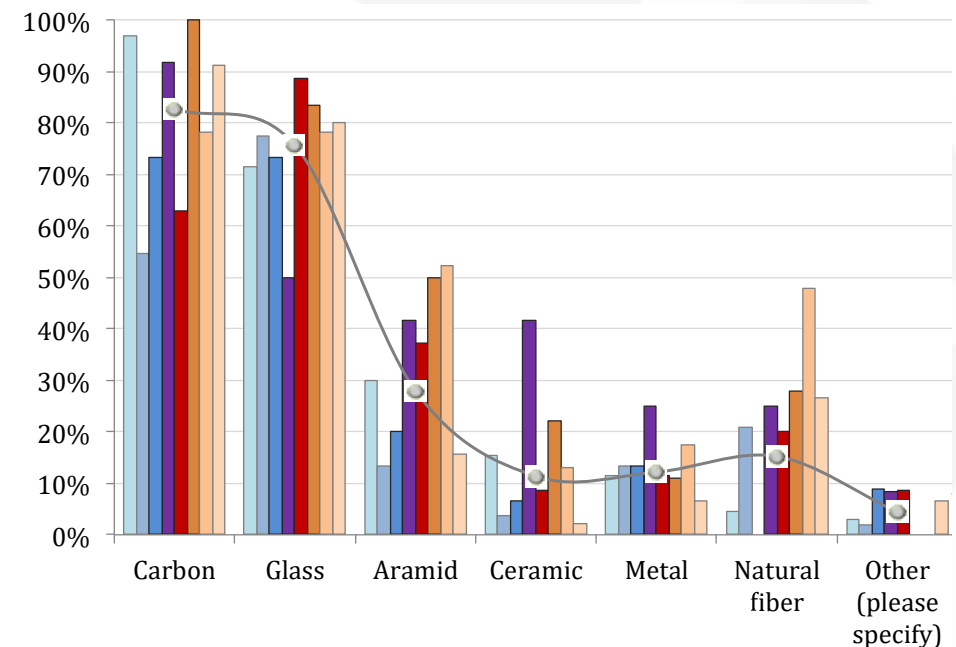
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Composites Survey – Selected example questions

What matrix material do you use? (Check all that apply)



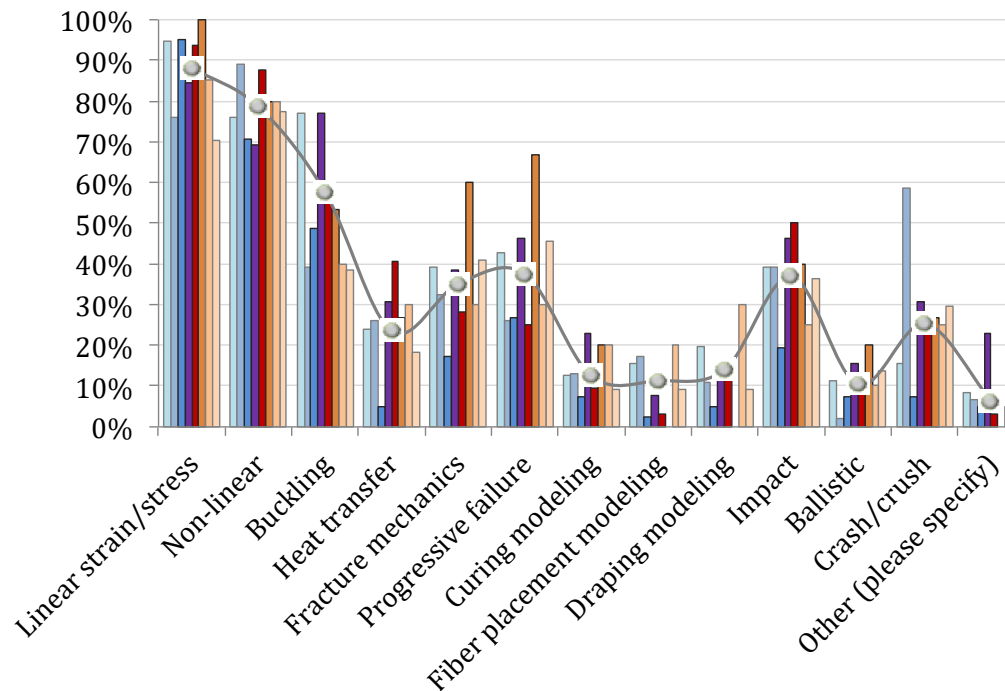
What type of fiber material do you use? (Check all that apply)



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Composites Survey – Outcome

- What type of analysis do you typically perform? (Check all that apply)



- Where do you need the most help when simulating composites

- | | |
|---|-----------|
| • Benchmark, modeling examples, go-to | 8 |
| • Comparison of analysis and experiment | 7 |
| • Failure modeling, criteria, prediction | 20 |
| • Fiber orientation | 8 |
| • Material properties, appropriate DB | 40 |
| • Model selection, shell, solid, combination | 6 |

⇒ new publication

Authors are in the process of being commissioned for a publication titled

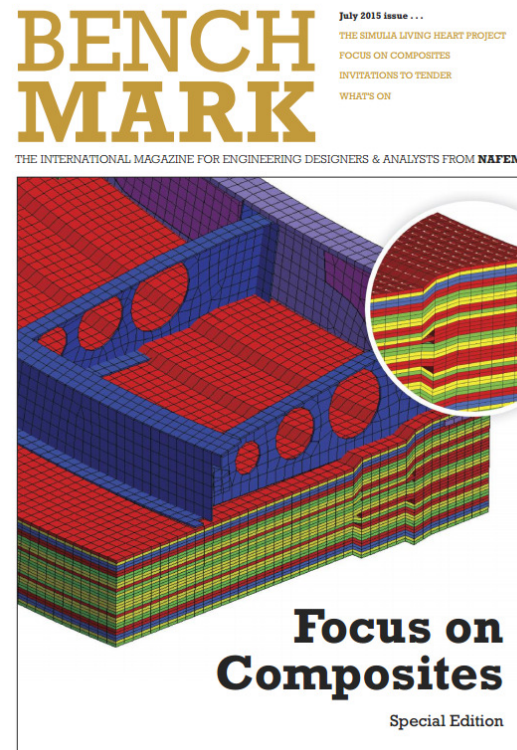
“How to Obtain Material Properties for Structural Analysis of Composites”

- Experimental methods
- Determination of the thermo-mechanical material properties

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Recent Activities

- The working group was responsible for the benchmark special edition on “composites”
- Technical Article Published in NAFEMS benchmark magazine “Development of Benchmarks Examples for the Assessment of Quasi-static Delamination Propagation Capabilities”
- Creation of a review of analysis tools used in the design and manufacture of composites



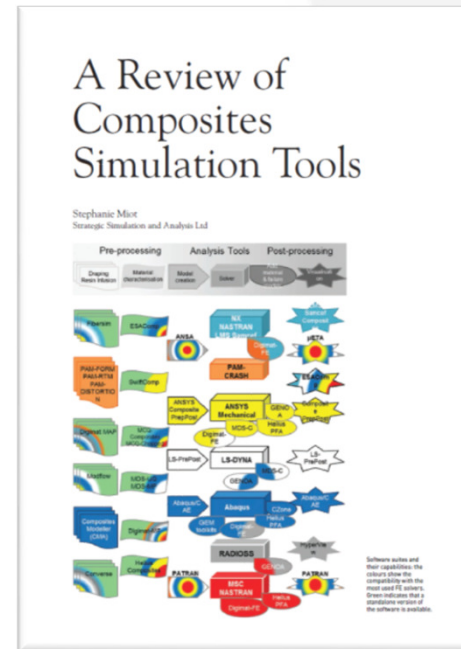
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Current Topics of interest

- **Review of Composites Simulation Tools**
 - Published in the special edition of Benchmark: *Focus on Composites*
 - Available online (regular updates)
 - https://www.nafems.org/about/technical-working-groups/composites/a_review_of_composites_simulation_tools/
 - Includes:
 - Pre- and Post-processors
 - FEA packages
 - Add-ons for FE codes
 - Material characterisation tools
 - Manufacturing process simulation
 - Material & failure models

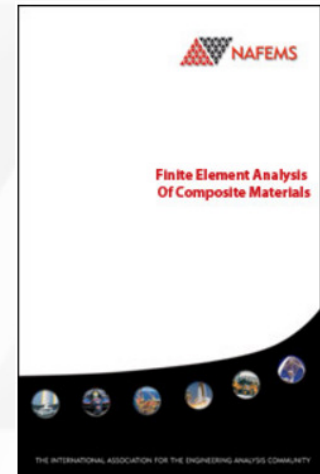


Review of Composites Simulation Tools
Background
AlphaSTAR
Altair
AnalySwift
ANSYS
AUTODESK
BETA CAE Systems
COMPONEERING Inc.
DASSAULT SYSTEMES
ESI Group
e-Xstream Engineering
GRM Consulting
LSTC
MSC Software
MultiMechanics
PZFlex
SIEMENS

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Current Topics of interest

- **FEA of composite materials: a review of engineering requirements and current facilities**
 - Needs to be updated
 - First publication 1992 included 9 simulation tools
 - Now 26 commercial software packages are referenced so far
 - New software capabilities and new engineering requirements include:
 - Multiscale analysis
 - Progressive failure analysis
 - Manufacturing process analysis
 - Crack propagation
 - Then 5 tests were used to assess the software capabilities
 - Additional benchmark cases are required



The NAFEMS Composites Working Group Summary

- The NAFEMS Composites Working Group is here to help addressing the needs of the composite simulation community
- We need your continued input
- Visit us and contact us
 - **Composites Working Group**
 - <https://www.nafems.org/about/technical-working-groups/composites/>
 - composite@nafems.org
 - **NAFEMS Americas**
 - <https://www.nafems.org/about/regional/americas/>
 - andrew.wood@nafems.org

Visit our booth!



Thank you!

NAFEMS – Benefits of Membership

Publications

- Complementary publication library of your chosen cutting edge NAFEMS textbooks, reports, how-to guides and benchmarks
- Copies of all new publications as they are produced
- Significant discounts on other publications
- Subscription to 'benchmark' magazine

Access to 'Members Area' of NAFEMS.org

- PDF versions of NAFEMS documents
- Presentations from previous seminars
- 'benchmark' magazine article archive
- Jargon guides
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