

## Structural Integrity Assessment of Aerospace Composite Structures



Chair: Fulvio Romano (F.Romano@cira.it)

The focus is on technological and numerical methods for structural diagnostics and prognostics of aerospace composite structures. New design approaches, advanced inspection techniques, SHM, testing and numerical simulations, carried out to overcome the traditional design practises and criticalities related to the composite structures and trying to take full advantage of the benefits and potential of composite materials, will be the object of this session.

## Structural Health Monitoring

Papers from all aspects of structural health monitoring and non-destructive evaluation are welcome in this session. Papers are invited on topics including, but not limited to, the following:

- Aging, New and Future Naval and Aerospace Structures
- Civil Infrastructure (bridge, buildings, roads, pipelines etc.)
- Microelectric and Electronic Components and Infrastructure
- Applications of MEMS and other integrated or embedded multifunctional sensors
- Applications to energy industry (Nuclear, conventional & Green Technology - windmill, solar)
- Robotics, Automation and Smart Structures (e.g., crawlers, wireless, multimedia, internet)
- Real time sensing and testing at extreme environments (temperatures, pressure and vacuum, radiation hazards, toxic and hazardous conditions, etc.)
- Emerging and Futuristic Techniques and Issues – NEMS, energy harvesting, additive manufacturing etc.
- Elastic and Acoustic Metamaterials for SHM/NDE applications
- Application of Guided waves for SHM
- Vibration based SHM
- Acoustic Source Localization for SHM applications
- Ultrasonic and Electromagnetic Techniques for SHM

Organizer: Prof. Tribikram Kundu, University of Arizona, USA tkundu@email.arizona.edu

## Auxetic Materials and Structures

Organizers: Zafer Kazanci (Z.Kazanci@qub.ac.uk), Pietro Russo (pietro.russo@unina.it)

In order to meet the requirements of future's world, engineers must design extremely efficient structures. Different approaches towards the development of more efficient materials have led to an interest in auxetic structures. Auxetic materials have rapidly gained an outstanding interest in many advanced fields as for biomedical, aerospace and sport applications essentially thanks to the novel behaviour they exhibit under deformation. Auxetic refers to a negative Poisson's ratio which is a meta-material property. Consequently, when a compressive load is applied to auxetic materials and structures, they will contract (expand) transversely. A conventional material, when subjected to an

impact loading, tends to reduce its density, lowering the indentation resistance. An auxetic material, instead, contracting and, thus, densifying under impact, leads to an increased indentation resistance. With the advent of these meta-materials and their potential use in the industry, there is a need to reconsider the dynamic behaviour of composite structures utilizing auxetic materials and structures. Thus, this mini-symposium focuses on the auxetic meta-materials and structures in engineering applications in general. It is devoted to new approaches in the analysis and computational design of such structures. The Auxetic Material section aims to outline the state of the art about the current knowledge on the mechanism that determine their special behaviour and most recent applications. Contributions including, but not limited to, recent advances in research, development and modeling of auxetic materials are also welcome.

## **SMC**

Simulating reality – from Material to System

Interested authors are kindly invited to submit their contributions by e-mail to Armando Mete and Claudio Bruzzo (armando.mete@hexagon.com, claudio.bruzzo@hexagon.com)

## **Dynamic Behaviour of Green Composites**

Dr Fabrizio Sarasini and Dr Jacopo Tirillò, Sapienza-Università di Roma are organizing a Session on the “Dynamic behaviour of green composites”.

Global awareness of environmental issues has resulted in the emergence of “green” composites. These new materials offer eco-friendly and sustainable alternatives to classical synthetic composites, such as glass fibre reinforced polymer materials. They have a lower carbon footprint and they already constitute attractive substitutes for semi-structural applications. However, their dynamic behaviour has received little coverage in the available literature. Potential topics include: low and high velocity impact of natural fibre composites and sandwich structures, crash tests, high strain rate mechanical characterization, fatigue and cyclic behavior, laser shocks, NDT for damage analysis.

Interested authors are kindly invited to submit their contributions by e-mail to fabrizio.sarasini@uniroma1.it, jacopo.tirillo@uniroma1.it

## **Aerospace**

Modern composite and metallic lightweight structures are extensively used as primary load carrying structures and are often more complex, more integrated and more critical than in the past. For this reason there is a stringent need to improve simulation tools, experimental approaches and update inspection and maintenance procedures. Within the aerospace fields, as well as in any transportation engineered system, one of the most critical focus is to guarantee the safety for both persons and components at the minimum cost.

The aerospace session organized within the DRAF2022 conference is aimed at presenting up-to-date research on the most challenging applications for aerospace applications and in general for other transportation vehicles. Contributions on theoretical, numerical, and experimental issues are all welcome. Papers showing examples of structural design, verification and testing are particularly encouraged.

### Topics

More specifically, suitable topics for this Special Session include but are not limited to:

- Modeling, Simulation, and Optimization of Structures and Materials
- Design / Calibration / Performance of Ground Test Facilities & Subsystems
- Advances in Test Techniques & Test Management
- Non Destructive Testing and Characterization
- Structural Health Monitoring and Management
- Dynamic testing techniques; sensors and actuators
- Design, Analysis and Certification of Aerospace Structures
- Advanced Computational Models for Composite Structures
- Buckling, Fatigue and Fracture of Structures
- Impact Damage and Crashworthiness in Composite Structures
- Impact dynamics and crashworthiness
- Composite Laminate and Structural Optimization
- Other Topics in Structures

Interested authors are kindly invited to submit their contributions by e-mail to Francesco Marulo (marulo@unina.it) and Fabrizio Ricci (fabricci@unina.it)

## **Joining and Integration of Ceramics and Ceramic Matrix Composites (CMC)**

Ceramics and Ceramic Matrix Composites (CMC) are now being used as effective and reliable materials with excellent high temperature resistance coupled to low density. Some civilian aircraft engines are now equipped with CMC parts; new generation nuclear plants are now working on CMC based accident tolerant fuels to increase safety; high performance car brakes are based on CMC. However, several improvement in their preparation, characterization, mechanical testing and joining/integration processes are still under investigation.

*Potential topics include:* mechanical properties modelling and characterization of ceramics and CMC, novel applications of CMC in extreme environment, advanced integration/joining of CMC, design of CMC joined components, etc...

Interested authors are kindly invited to submit their contributions by e-mail to monica.ferraris@polito.it.

## **Automotive**

Prof. G. Belingardi from Politecnico of Turin and Prof. S. Boria from Univ. of Camerino are organizing a session on Composites in Cars: **New design practices to make vehicles lighter and safer.**

Composite materials, with their high strength to weight ratio, provide an excellent platform upon which to develop the next generation of lightweight vehicles. The integration of composites into the vehicle and many of its components satisfies multiple purposes: together with the weight reduction able to contribute to fuel efficiency, there are improvements in terms of crashworthiness and durability. These objectives can be pursued through significant modifications to many of the vehicle design and analysis practices, where new material models able to capture the dynamic response and failure of composite materials must be considered.

Interested authors are kindly invited to submit their contributions by e-mail to giovanni.belingardi@polito.it and/or simonetta.boria@unicam.it

## **POSTER SESSION AND AWARD**

An interesting Poster session is planned for Draf2022. The Template will be soon available on the “Submit your Abstract” page.

The most interesting Poster presented by a young researcher will receive an award at the end of the poster session.

The interested authors are invited to contact the Secretariat.

Soon more details on the website.