INNOVATIVE APPROACHES AND OPEN CHALLENGES IN THE SIMULATION AND MODELLING OF COMPOSITE STRUCTURES

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ABSTRACT

To achieve sustainability in many industrial sectors, such as aeronautics and automotive, composite materials are increasingly favoured due to their potential to enable weight reduction, improve fuel efficiency, and lower emissions of transportation systems.

On the downside, due to their unique properties, composites also present significant challenges and require extensive efforts in experimental testing for material characterisation and in modelling and simulation. To address these issues, new numerical approaches are being developed to improve prediction capabilities while optimising computational costs. This session explores both innovative approaches and open challenges in computational design, modelling, and analysis of composites and laminated structures that are essential for applications in lightweight vehicles. The goal is to advance the understanding of composite materials and structures and to enhance prediction accuracy in various applications such as impact-resistant components.

This minisymposium provides a platform to present the latest research results, exchange ideas, and address critical barriers and challenges in the development and application of computational methods to composite structures. Topics of interest include, but are not limited to:

- multiscale modelling approaches for composites and laminated structures,
- specialised mathematical models and finite element techniques for composite analysis,
- comparative analyses of numerical methods for efficient simulation,
- modelling approaches for intralaminar damage and delamination,
- predictive modelling of composites under impact and crash loading,
- experimental-computational comparisons in composite performance testing,
- machine learning for predicting deformations, stress, and material properties.

By bringing together scientists and engineers across disciplines – from applied mathematics and computational mechanics to structural design – this minisymposium fosters collaboration to accelerate the development of novel solutions and address key challenges in composite modelling.