



## Recent Advances in Structural Integrity of Engineering Composite Materials

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Innovative research in the area of *Structural Integrity of Composite Materials* draws upon the work of a significant number of researchers worldwide, mainly due to the growing trend of new lightweight engineering design structures aiming at a greener future. This Special Issue of *Applied Composite Materials* journal entitled *Scientific Challenges of the 2020s: Structural Composite Materials*, originated from the international conference on *Structural Integrity—ICSI2019*, which took place on the Island of Madeira, Portugal in September 2019. This biennial ICSI conference established a source of inspiration for researchers alike that want to keep cutting edge research at the forefront of advancements in composite materials technology thereby bringing together the latest developments of reference research groups around the globe. From this conference gelled the idea of a special issue of *ACMa*, whereby invited Guest Editors would choose from amongst the leading key speakers of the conference to publish their latest work.

By way of background, in 2019, in its third edition, ICSI delegates had the privilege to listen to invited talks from prominent researchers, such as Professors Xiaosu Yi, Aleksander Sedmak, Nicolaos Alexopoulos, Constantinos Soutis, and Øystein Grong. Delegates responded with much enthusiasm and aplomb from the presentation of 200 papers. These papers focus on the application of the fundamentals of the materials science and the principles of micro-mechanics across a wide range of *size scale of structural integrity*, from events that occur in the material at the smallest level of size to future trends in the predictive design of large-scale engineering structures. In the papers that resulted, special emphasis is placed on *multi-scale modelling* and *multi-physics modelling* connecting the simultaneous design of the engineered composite material on the one hand and large-scale structural composite application on the other.

In the opening paper of this special issue the author presents a perspective on designing composite materials and composite structures having structural integrity. It introduces the major themes to be covered in subsequent papers: on mathematical and computer-based

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modelling, physical modelling and micro-mechanics, and reconciling them with each other thereby utilising these predictive powers to arrive at effective design codes and methods of optimisation.

Successive papers define the hierarchy of discrete analytical methods of design across a wide length scale and embrace contributions from materials science and engineering, fabrication and processing technology, non-destructive testing inspection methods (NDI) and structural health monitoring techniques (SHM), micro-mechanics, fracture (damage) mechanics, physical modelling, and computer simulation. This route takes a path that leads to an understanding of what structural integrity of engineering composite materials is all about.

We take this opportunity to thank the writers and the reviewers of these papers. We thank them for their support and giving of their time in writing their papers. Some of them participated in earlier residential meetings on *Structural Integrity*: at Cambridge and overseas supported by the EPSRC in the UK and NSF in the USA; at our Royal Society meeting in February 2016 at Chicheley Hall, Buckinghamshire, the country residence of The Royal Society.

Also, we thank Peter Beaumont, Editor (Special Issues) and Maria Kashtalyan, the new Editor-in-Chief of *Applied Composite Materials* for their continuing support throughout the assembly of these papers and compilation of this special issue.



Professor Costas Soutis (left) with some of the authors attending ICSI2019

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