

Advanced Methods for the Geometrically Nonlinear Analysis and Optimisation of Lightweight Composite Structures

TRACK NUMBER 1700

P.M. WEAVER^{*}, A. MADEO[†], G. ZUCCO^{*} AND F.S. LIGUORI[†]

^{*}, School of Engineering and Bernal Institute, University of Limerick
Castletroy, Co. Limerick, V94 T9PX, Limerick, Ireland
paul.weaver@ul.ie, giovanni.zucco@ul.ie

[†] Department of Computer Science, Modelling, Electronic and Systems Engineering, University of Calabria
Calabria
Ponte P. Bucci, 87036, Rende (CS), Italy
antonio.madeo81@unical.it, francesco.liguori@unical.it

Key words: composite structures, geometrically nonlinear analysis, numerical methods, structural stability, numerical optimization techniques.

ABSTRACT

Composite lightweight structures are used in a wide range of applications in mechanical, marine, and aerospace engineering. They have several advantages, such as exhibiting high buckling loads and being lightweight. However, for some of these structures, compressive stresses might lead to unstable post-buckling behaviours influenced by an elevated imperfection sensitivity and consequent dangerous load capacity reductions.

On the other hand, the geometrically nonlinear behaviour of lightweight composite structures does not necessarily represent an adverse structural response. In fact, for some applications where a structural shape change is required, this behaviour can be exploited to achieve complex shape reconfigurations and realise structures that can be quickly deployed.

In all those cases, using methods to evaluate the geometrically nonlinear response of lightweight composite structures with high accuracy and short times is crucial.

In light of these premises, this mini-symposium aims to bring together scientists worldwide working on advanced methods for tracing and optimising the geometrically nonlinear response of lightweight composite structures. Therefore, contributions may involve the following:

- Enhanced computational methods to evaluate the stability behaviour of lightweight composite structures as path-following methods or reduced order models.
- Novel computational methods to study the structural stability considering other physical phenomena, such as inelastic deformation, multiphysics systems (e.g. magneto-electro-thermo-mechanical problems, fluid-structure interactions).
- Multi-level and multi-scale analysis of geometrically nonlinear composite structures.
- Discretisation methods as: strong formulations (i.e., collocation and differential quadrature method, inverse differential quadrature method), weak formulations (i.e., finite element method, boundary finite element method, Galerkin methods, isogeometric analysis).
- Optimisation algorithms to solve convex and non-convex problems with single or multi objectives for composite structures dominated by a geometrically nonlinear behaviour.