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RECENT ADVANCES IN MECHANICAL MODELLING OF MICROSTRUCTURED COMPOSITE MATERIALS AND METAMATERIALS

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ABSTRACT

In several industrial sectors, ranging from mechanical, civil, naval, aerospace, up to biomedical, robotics, and sport engineering, one of the most challenging topics is the optimal design of microstructured composite materials and metamaterials, often used in multifunctional systems for cutting-edge and smart applications. This important objective cannot be achieved without the proper definition of theoretical and numerical tools, as well as experimental set-ups, both aimed at the reliable prediction of the physical-mechanical behaviour of such microstructured materials. In this framework, innovative engineered materials have been developed so far, characterized by customized enhanced properties with respect to natural ones, responsible for extreme and exotic performances.

The Mini-Symposium aims to provide an international forum for the dissemination and discussion of the latest advances in the physical-mechanical modelling of composite materials and metamaterials, with complex and/or hierarchical microstructures. Focus is on theoretical, numerical and experimental research outputs, with emphasis on multiscale and multi-physics techniques, that can involve the homogenization theory, inherently suitable to a synthetic and accurate description of the overall constitutive behaviour of such complex materials. Particular attention is devoted to multi-field approaches, crucial in in the presence of multi-physics, static or dynamic, coupling phenomena (thermo, diffusive, chemo, and electro mechanical, among others), but also to innovative computational methods, especially conceived to treat very complex topologies.

The topics of the Mini-Symposium include, but are not limited to: 1) Modelling and experimental testing of periodic materials and metamaterials; 2) Identification of equivalent homogeneous solids via advanced homogenization techniques; 3) Local and nonlocal constitutive modelling; 4) Mechanics of defects, plasticity, strain localization phenomena and material instabilities; 5) Multi-field problems; 6) Sonic wave propagation control, polarization, scattering and energy transfers; 7) Parametric and topological optimization.