MULTI-SCALE MODELLING OF GENERALISED CONTINUA AND METAMATERIALS

1600 - MULTISCALE AND MULTIPHYSICS SYSTEMS

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ABSTRACT

Cauchy continuum-based theories typically employed to model conventional solids may not be able to capture the complex or exotic behaviour of certain materials. In particular, materials exhibiting size effects or atypical mechanical behaviour, like architected materials, metamaterials, and materials undergoing rather complex microscopic phenomena, require models that include additional information concerning their microstructure. For instance, generalised continua theories and multi-scale approaches may be employed to predict the behaviour of this type of materials.

This mini-symposium intends to provide a place for discussion and exchange of ideas regarding the modelling, design and analysis of materials, taking into account their microstructure and their (possibly) non-classical behaviour at different scales. On the one hand, recent advances on the numerical description of this class of materials are foreseen, with focus on the multi-scale modelling through homogenisation schemes, techniques for optimal design of macro or microstructure and constitutive modelling based on generalised continua (Cosserat, micromorphic, strain gradient, ...). On the other hand, there is also place to share the application of this sort of techniques to specific classes of materials, like multi-phase materials, metamaterials, fibre reinforced composites, polycrystalline materials, biological structures, and architected materials, not to be exhaustive.

Contributions addressing but not limited to the topics listed in what follows are welcomed:

- Multi-scale models based on second-order homogenisation, micromorphic homogenisation, and homogenisation of generalised continua;
- Analysis of size effects across the scales;
- Data-driven and reduced-order-models for generalised continua;
- Constitutive modelling and parameters calibration in second-gradient continua, micromorphic continua or Cosserat continua;
- Multi-scale design and topology optimisation of high-performance materials and metamaterials;
- Analysis of the influence of strain gradients in materials behaviour;
- Numerical methods to solve generalised continua and multi-scale problems.