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MULTISCALE COMPUTATIONAL DESIGN OF ENGINEERING MATERIALS

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ABSTRACT

Computational analysis and design of the nowadays increasingly sophisticated structural materials, with highly complex microstructures, demands reliable mechanical multiscale formulations taking into account the more relevant physics at the smaller length scales as well as a breakthrough of current computational techniques in order to remove the barriers established by the involved high computational cost. Efficient models and numerical techniques might be developed by combining three complementary tools: computational multiscale analysis, reduced order models and microstructure design using shape and topological optimization methods.

The goal of this symposium is to provide a forum for discussion of current and future trends in the field of structural material design based on multiscale analysis. Topics aiming at the development of advanced numerical techniques to increase robustness and feasibility of solution to this problem while keeping the computational cost into affordable limits will be considered. Typically, although not limited to, we think of those contributions exploring the combined developments of two of the following topics:

- Multiscale computational strategies and homogenization in space and time for inelastic heterogeneous media, with complex micro and mesostructures, including failure and degradation mechanisms, under quasi-static or dynamic conditions;

- Reduced order models; dimension reduction techniques; neural network and surrogate models or other methodologies which are designed to increase the computational efficiency of musicale simulations.
- Shape and topological optimization of microstructured materials. Model reduction-based optimization schemes.