ADVANCES IN MULTI-SCALE, MULTI-MATERIAL, AND MULTI-COMPONENT TOPOLOGY OPTIMIZATION

Federico Ferrari[1] and Julian A. Norato[2] and James K. Guest[3]*

[1]Technical University of Denmark
[2]University of Connecticut
[3]Johns Hopkins University

MINISYMPOSIUM

Multi-scale and multi-material Topology Optimization (TO) is a driving force in the design of lightweight, extreme structures and materials. The multi-scale concept leverages scale effects, expanding the components' performance beyond that of single-scale designs. For instance, recent works on de-homogenization TO achieved stiffness and stability performances matching the theoretical bounds [1]. Moreover, the use of TO for designing multi-material components and novel composites such as variable stiffness laminates, allows tailoring their response and use in multiphysics applications [2].

The foregoing TO methods have been recently infused by approaches that employ high-level representations of geometrical primitives, providing several advantages in the design of components, architected materials and structural assemblies. Feature mapping [3], and discrete object projection [4] techniques provide better geometrical control, allowing a straightforward implementation of certain manufacturing constraints, and facilitating a CAD interpretation of the optimized design. These methods are nowadays used for applications such as multi-component design, two-scale and multi-material truss lattice design, structures made of fiber-reinforced components, and optimal layout of inclusions in functional material, fulfilling non-trivial geometric restrictions.

This minisymposium aims at bringing together experts in the field, to discuss recent advances in the vast plethora of topology optimization methods used in multi-scale, multi-material, and multi-component TO. Topics of the MS include, but are not limited to:

- TO of multi-scale and/or multi-material structures, including those with nonlinear, dynamic, and transient responses.
- TO of architected materials, including multi-scale lattices, woven materials, and others.
- Homogenization and de-homogenization based TO.
- Design of structures made of composite materials (e.g., fiber-reinforced polymers, reinforced concrete, etc.)
- Integration of manufacturing requirements and process modelling within TO
- Geometry representation/parametrization and linking of TO with CAD/CAE software
- Industrial applications and case studies

REFERENCES

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