

OPTIMIZATION PROBLEMS IN COMPUTATIONAL MECHANICS: FROM MATERIAL DESIGN TO STRUCTURAL ANALYSIS

TRACK NUMBER 1700

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Key words: Limit analysis, Structural optimization, Optimal microstructures, Material Design

ABSTRACT

Optimization problems are central to many fundamental research areas within applied mathematics and computational mechanics, with significant applications in limit analysis, shape and topology optimization, and material design. On the one hand, limit analysis allows a reliable estimation of the ultimate load-bearing capacity of masonry, reinforced concrete, or steel structures and is also employed in geotechnical problems such as assessing soil slope stability and foundation bearing capacity. On the other hand, boosted by the development of additive manufacturing technologies, which allow the realization of objects with arbitrarily complex geometries at affordable production costs, shape and topology optimization techniques can be exploited to enhance the mechanical performances of materials and structures and lead to innovative advancements in multiple domains. The universality of optimization problems has prompted the emergence of various numerical methods that include conventional approaches, such as gradient-based or gradient-free optimization algorithms, and modern meta-heuristic approaches or data-driven techniques exploiting neural networks and deep learning.

This mini-symposium aims at inspiring the scientific community to tackle the numerous challenges associated with optimization problems in both established and new, rapidly growing fields of computational mechanics. While contributions in all aspects related to the aforementioned fields are invited, some of the featured topics in this MS will include:

- limit analysis of structures under ordinary or extreme actions
- yield design
- microstructure optimization
- homogenization
- material design
- optimal structural design
- shape and topology optimization
- multi-objective optimization with uncertainties.

Exploring and advancing research in these areas will enhance the understanding and further increase the impact of optimization techniques in computational mechanics.