

Optimal design of structures and metamaterials: innovative techniques for engineering applications

Simona Perotto^{*}, Nicola Ferro^{*} and Raffaele Ferrante[†]

^{*} MOX – Dipartimento di Matematica, Politecnico di Milano
Piazza Leonardo da Vinci, 32, I-20133 Milano, Italy
e-mail: {simona.perotto, nicola.ferro}@polimi.it

[†] Dipartimento di Ingegneria Civile ed Informatica, Università Tor Vergata
Via del Politecnico, 1, I-00133 Roma, Italy
email: raffaele.ferrante@medere.it

ABSTRACT

Goal of this Invited Session is to provide the state of the art on recent advances in the design of structures and innovative materials for the application in different scientific and industrial fields.

The common scenario to structural and material design is the identification of an optimal material distribution within a given design domain, according to prescribed design requirements, and under given constraints related to the application. For this purpose, a wide variety of both trial-and-error and more rigorous optimization procedures has been proposed in the scientific community.

The design of structures is generally driven by shape and topology optimization techniques, which minimize a certain cost functional under, for instance, mass, stiffness, or stress constraints. The methodologies for the design of structures can be adopted also to produce materials characterized by target performances in different multifunctional applications (e.g, biomedical, acoustics, photonics). Moreover, the need for new paradigms in structural design finds an additional motivation in the recent development of advanced manufacturing technologies, such as additive manufacturing.

This Invited Session is meant to foster a technical discussion on new ideas to support the scientific advancement as well as the development of innovative engineering technologies, including numerical methods and algorithms; macro-, multi-, and micro-scale modelling; production processes, verification and validation.