9th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMA2024)
June 3-7, 2024, Lisbon, Portugal

ADVANCES IN THE DESIGN OF ARCHITECTURED METAMATERIALS

TRACK NUMBER 1600

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Key words: Design Criteria, Multiscale Homogenization, Nanoscale Architectures

ABSTRACT

Architectured metamaterials have obtained significant attention in recent years due to their unique properties and potential applications across various industrial sectors. These materials are developed with specific internal structures to achieve desirable mechanical, acoustic, electromagnetic, and thermal behaviours not found in natural materials. Therefore, the optimal design of architectured metamaterials is critical for opening their full potential and realizing their practical applications.

This Mini-Symposium will focus on innovative theoretical, numerical, and experimental approaches to model and analyse architectured metamaterials. Attention will be given to homogenization approaches, multiscale and multi-physics techniques, multi-field coupling phenomena, and innovative computational techniques tailored for predicting the unique behaviour of these materials and exploring the key aspects of optimizing their design. Researchers will present advancements in simulation methodologies to tune the properties of architectured metamaterials, facilitating their integration into several engineering applications. Participants will explore how these materials have revolutionized areas ranging from mechanical, civil, naval, aerospace, and biomedical to robotics, and sports engineering.

The topics of the Mini-Symposium are but not limited to: 1) innovative manufacturing techniques for architectured metamaterials, such as 3D printing and nanofabrication; 2) computational methods and simulation techniques for analyzing architectured metamaterials under complex loading scenarios; 3) wave propagation in metamaterials; 4) case studies and real-world applications showing the successful integration of architectured metamaterials into practical engineering solutions; 5) local and nonlocal constitutive modelling approaches; 6) parametric and topological optimization methods for material design and performance enhancement; 7) multi-field problems involving coupled physical phenomena.