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ADVANCES IN THE DESIGN OF ARCHITECTURED METAMATERIALS

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ABSTRACT

Architected metamaterials have received significant attention in recent years due to their remarkable properties and wide-ranging applications across various industrial sectors. These materials are designed with tailored internal structures to achieve specific mechanical, acoustic, electromagnetic, and thermal responses not commonly found in natural materials. As a result, the optimal design of architected metamaterials is crucial for fully unlocking their potential and enabling practical applications. This Mini-Symposium will emphasize innovative theoretical, numerical, and experimental approaches to modeling and analyzing architected metamaterials.

Key areas of focus include homogenization methods, multiscale and multiphysics techniques, multi-field coupling effects, and advanced computational approaches developed to predict the unique behaviors of these materials and optimize their design. Researchers will share recent progress in simulation techniques that fine-tune the properties of architected metamaterials, promoting their adoption in diverse engineering applications. Participants will explore how these materials have revolutionized fields such as mechanical, civil, and naval engineering, as well as aerospace, biomedical engineering, robotics, and sports technology.

The Mini-Symposium topics include, but are not limited to: 1) innovative fabrication techniques for architected metamaterials, including 3D printing and nanofabrication; 2) computational and simulation methods for evaluating these materials under complex loading conditions; 3) wave propagation in metamaterials; 4) case studies demonstrating the successful implementation of architected metamaterials in real-world engineering solutions; 5) local and nonlocal constitutive modeling techniques; 6) parametric and topological optimization for material design and performance improvement; and 7) multi-field challenges involving coupled physical phenomena.