MODELING, OPTIMIZATION AND COMPUTATIONAL ANALYSIS OF METAMATERIALS

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MINISYMPOSIUM

Advanced engineered materials like mechanical and acoustic/elastic metamaterials exhibit remarkable engineering attributes that are absent in natural materials. Elastodynamic metamaterials, in particular, showcase distinctive dynamic and mechanical characteristics owing to their intricate internal structure, composed of an arrangement of unit cells. Over the past few decades, there has been a notable upswing in research endeavors within these realms, leading to captivating and stimulating discoveries.

The forthcoming phase of research is centered around the development of responsive and adaptive artificial structures, imbued with the ability to be programmed, reconfigured, and tuned in terms of their metamaterial properties. This entails the pursuit of properties that can be finely tuned and altered, reminiscent of biological structures. Leveraging innovative manufacturing techniques alongside advanced multiscale structural optimization methods, researchers are now able to design and produce metamaterials with unit cells that are adaptable and optimized for specific regions. Origami and Kirigami metamaterials are some examples.

Such metamaterials possess the capability to seamlessly adopt or modify their wave dispersion and mechanical properties when exposed to external stimuli, following a predetermined blueprint. This brings to mind the adaptability observed in biological entities. In most applications, effective tunability and switching the quasi-static and dynamic properties are highly desirable.

This minisymposium focuses on discussing the mechanics of advanced metamaterials governing robust physical phenomena that goes beyond the notion of lightweight structures. The goal of this minisymposium is to promote discussions between researchers working on the methods itself and researchers or practitioners applying those methods in new applications. This minisymposium welcomes, but not limited to, the following focused areas in mechanical and elastic metamaterials:

· mechanics of acoustic/elastic metamaterials and phononic crystals;
· architected structures/mechanical metamaterials including origami and kirigami based metamaterials;
· mechanics and physics of acoustic/elastic metasurfaces;
· new applications of acoustic/elastic metamaterials and mechanical metamaterials;
· finite element analysis in mechanical and acoustic/elastic metamaterials;
· modelling, numerical analyses and experiments on topologically protected interphase modes;
· wavefront control on bi-stable and multi-stable metamaterials, particularly for origami and kirigami metamaterials;
· modelling and computational simulations of seismic metamaterials; and

- modelling, optimization and manufacturing metastructures for low frequency wave manipulation