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Editorial: Mechanical Metamaterials: Cutting-Edge Metastructures

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Editorial on the Research Topic

Mechanical Metamaterials: Cutting-Edge Metastructures

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While organizing this special topic, we invited papers on mechanical metamaterials that are artificially designed material systems with exotic properties rarely found in nature. The exciting features of mechanical metamaterials are usually defined by their topological architecture and microstructural connectivity rather than composition. We received three papers on mechanical metamaterials—two for fundamental research (static and dynamic) and one for applied research: 1) Anigbogu et al., *Layered Metamaterial Beam Structure With Local Resonators for Vibration Attenuation: Model and Experiment.*, 2) Challapalli et al., *Discovery of Cellular Unit Cells With High Natural Frequency and Energy Absorption Capabilities by an Inverse Machine Learning Framework*, and 3) Xiao et al., *A New Architecture of Morphing Wing Based on Hyperelastic Materials and Metastructures With Tunable Stiffness.*

Anigbogu et al. investigated vibration attenuation of layered metamaterials with local resonators, demonstrating an increase and shift of the low-frequency bandgap with local resonators. Their work opens a new strategy for vibration mitigation by using local resonators.

Challapalli et al. utilized machine learning to find cellular (lattice) structures with a high natural frequency to avoid resonance and high impact energy, demonstrating a 30%–100% higher natural frequency and a 300% improvement in energy absorption. Their work shows the potential impact of machining learning on the design of metamaterials.

Xiao et al. studied a new metastructure for morphing wing design to break through the technical challenge of small-scale aircraft. Their morphing wing design with soft pneumatic actuators and modified pantographic metastructures demonstrates spanwise and chordwise morphing capabilities, showing an engineering breakthrough of prototyping.

These papers highlight some current engineering challenges of metamaterial design. This community will grow fast and impact the world through scientific findings and

engineering breakthroughs. We hope that readers will enjoy reading these papers specially solicited for the community.

AUTHOR CONTRIBUTIONS

JJ drafted the initial manuscript. X-LG edited the manuscript.

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