

Origami and Topology: Two Powerful Ingredients for Designing Mechanical Metamaterials

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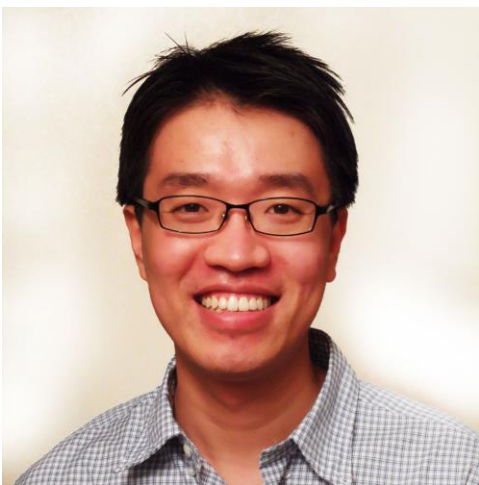
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Friday, October 15, 2021; 2:00-3:00 pm; Location: CLSSRM 110

Abstract

Mechanical metamaterials are emerging as an enabling technology for manipulating mechanical energy flow at will. The unique mechanical properties of these metamaterials are derived from structural architectures rather than their base materials. A natural question is how we design these architectures in a clever way to realize novel mechanical properties unprecedented in nature. In this presentation, I will talk about two powerful tools for designing mechanical metamaterials: origami and topology. First, I will show how origami design principles can be exploited to construct metamaterials that mitigate structural impact in an efficient way. Specifically, I will demonstrate a counter-intuitive mechanism of converting external compressive impact to tensile waves by using origami-based metamaterials. Second, I will talk about how the mathematical concept of topology can be applied to the design of mechanical waveguides. Inspired by the recent advent of topological insulators, I will show how these topological waveguides can generate a defect-immune robust propagation of stress waves. Throughout the talk, I will place the computational and experimental results in the context of potential engineering applications.

Biography



Jinkyu Yang is an Associate Professor in Aeronautics & Astronautics at the University of Washington. He received his Ph.D. degree in Aeronautics and Astronautics from Stanford University (2005) and BS degree in Aerospace Engineering from KAIST (2000). His research has been directed towards developing novel engineered materials and structures, e.g., metamaterials, phononic crystals, and nonconventional composites, for aerospace and mechanical applications. His research has been featured in news media, such as Reuters, NSF News, and U.S. Public Broadcasting Service, and he has received the NSF CAREER, University of South Carolina's Rising Star, and Samsung Think Tank Team Awards.