

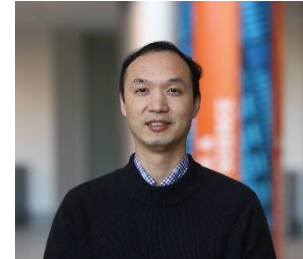


Department of
Mechanical Engineering
The University of Hong Kong



Mechanics of Multistable Elastic Structures and Magnetic Actuation

Date: 6 August, 2024 (Tuesday)
Time: 11:00 a.m.
Venue: Room 7-34/35, Haking Wong Building
HKU



Speaker: Professor Teng Zhang
Department of Mechanical and Aerospace Engineering
Syracuse University

Abstract:

Multistable elastic structures exhibit multiple stable equilibria and undergo transitions among different states under external stimuli. With unique snap-through behavior and substantial shape changes, these structures offer unprecedented advantages compared to traditional ones, finding applications in fields like soft robotics, morphing wings, and logic units. Here, I will present our recent advancements on the energy landscape analysis of the multistable structures, and the reconfiguration process achieved through remote magnetic actuations.

The first part of the talk focuses on addressing the challenge of quantitatively predict the minimum energy barrier and an energy-efficient transition path between two stable states. To overcome this, we will integrate energy landscape exploration algorithms into the finite element method (FEM), where we first utilize the binary image transition state search (BITSS) method to identify the saddle points and then perform nudged elastic band (NEB) calculations with an initial guess based on the BITSS results. This integrated strategy greatly helps the convergence of the highly nonlinear minimum energy path (MEP) computations, which are demonstrated with benchmark problems in fields, including bistable buckled beams and bistable units of mechanical metamaterials. The second part of the talk focuses on the modeling and simulations of magnetic actuation to drive the structure reconfiguration. I will introduce a robust and powerful simulation framework for describing magnetic elastic structures interacting with complex environments through examples of metachronal wave modulated locomotion in magnetic cilia carpets, such as rolling and crawling. By shedding light on the energy landscape of multistable structures and the magnetically driven remote reconfiguration, our studies can potentially contribute to the advancement of these innovative structures and their applications.

Biography:

Dr. Teng Zhang is an Associate professor in the Department of Mechanical and Aerospace Engineering at Syracuse University. Prior to joining Syracuse, he was a Postdoctoral associate in the Department of Mechanical Engineering at MIT and received his PhD degree at Brown University. He received his bachelor's and master's degrees at Dalian University of Technology, China. His current research focus is mechanics of interface, instability, and morphing, examples including adhesion and elasto-capillarity, multistable structures, wrinkling patterns, shape changing pasta, and bioinspired seeds. Dr. Zhang has received the NSF CAREER Award and Soft Matter Emerging Investigator. He enjoys working with people with various backgrounds, such as design, physics, materials science, and bioengineering to address interdisciplinary challenges.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Y. Lin at 3917 7955.