The Department of Mechanical Engineering
College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

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From Patterned Sheets to Functional Morphing Structures

Friday, November 20 at 2:00 PM

Zoom: https://stonybrook.zoom.us/j/92018472902?pwd=M1o3M25RdkU0QkdpVUkyTFN2OEdLdz09

Abstract

Shape-changing structures are designed to predictably achieve large shape changes in response to applied loads. Their applications range from everyday objects like foldable chairs, to drug delivery capsules and to large-scale civil and space structures. Some of the recent efforts in this realm have been directed towards: (i) expanding the range of achievable shape changes; (ii) reducing the part count of these often-complex systems; (iii) exploring non-mechanical actuation strategies.

Our first objective is to answer the curiosity-driven question of finding a simple strategy to design flat sheets that can be transformed into 3D surfaces with non-zero Gaussian curvature. After illustrating a method to achieve this goal via frustrated mechanisms, I will present the subsequent steps we took to try and bridge the gap between a strategy that is only bound to work at the tabletop scale using rubbery materials, and larger-scale structural applications. Along the way, I will make mechanistic considerations on how to construct metallic shape-changing structures by resorting to assemblies of twisted ribbons, and on how to leverage displacement-amplification mechanisms to create structures that morph in response to temperature changes.

Biography

Paolo Celli is an Assistant Professor in the Department of Civil Engineering at Stony Brook University. Prior to joining SBU in January 2020, he was a postdoc at Caltech. There, he worked in the lab of Chiara Daraio and collaborated extensively with NASA JPL's Materials Development and Manufacturing Technology Group. Trained as a mechanical engineer in Italy, he obtained his PhD in civil engineering from the University of Minnesota in 2017. Paolo's research interests are in solid mechanics, dynamics/vibrations/waves, and smart structures. Using a combination of experiments and numerical models, his main goal is to use mechanics principles to develop "dynamic" structural systems that can adapt in response to environmental cues.

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