

## The mechanics and applications of hierarchically multistable metastructures: from shape adaptation to information processing

Shape adaptation in materials and structures enables multifunctionality by leveraging different geometrical configurations. These multifunctionality and adaptability stem from the property, form, and function relationship in which any variation in one result in changes in the other. One avenue for exploiting this relationship leverages geometrical multistability, the property of a system to exhibit several stable states that depend solely on the architecture independently from the material constitution. Geometrically multistable systems (GMS) show shape and stiffness programmability by switching between the available stable states. We introduce metastructure class exhibiting multistable behavior at two scale levels, a phenomenon referred to as hierarchical multistability.

This seminar presents the mechanics responsible for the emergence of hierarchical multistability in metastructures and its applications in shape reconfiguration, soft robotics, and mechanically-driven information processing.

### Andres F. Arrieta, Ph.D.

Associate Professor of Mechanical  
Engineering  
Purdue University



**Biography:** Dr. Andres F. Arrieta is an Associate Professor of Mechanical Engineering at Purdue University, where he leads the Programmable Structures Lab. Previously, he worked as a Group Leader at ETH Zurich's CMAS Lab and as a Research Associate at the Dynamics and Oscillations Group at TU Darmstadt. He received his Ph.D. in Mechanical Engineering from the University of Bristol in 2010 and his BEng from the Los Andes University, Bogota, Colombia, in 2006.

Prof. Arrieta's work focuses on investigating instabilities and nonlinearity in structural mechanics. Current efforts are focused on the modeling and designing of programmable structures, embodied intelligence, soft robotics, nonlinear metamaterials, and morphing structures. The Programmable Structures Lab's work has been highlighted by several media outlets, including National Geographic and Nature's News and Views.

Prof. Arrieta has published 61 journal papers and 67 peer-reviewed conference papers. He received several awards, including the 2021 Emerging Leader Award in Smart Materials and Structures (IOP Publishing); NSF CAREER Award (2020); the ASME Gary Anderson Award (2018) for outstanding contributions to the field of Adaptive Structures; and the ETH Postdoctoral Fellowship (2012).

Friday, November 17, 2023 – 10:30 am – COB 110

Fall 2023 Seminar Series