

Webinar: 11:10 am Friday, December 2

Link: <https://uconn-edu.zoom.us/j/93833155933?pwd=YWw5amNjZDN1bk5jSUdxWEoyWE1Fdz09>

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Irregular Architected Materials With Programmable Properties

Abstract: Structural irregularity grants materials unique functionalities, such as imperfection insensitivity, enhanced impact absorption and stress redirection. Understanding the role of irregularity in determining material properties offers a new path to engineer functional materials. I will discuss different approaches to design irregular architected materials and discover fundamental, probabilistic structure-property relationships regulating unusual properties, like robustness against damage and the ability to vary stiffness on demand. In one example, I will show how, using a biological growth-inspired program that mimics the formation of random architectures in natural systems, we can generate materials that exhibit a large variation in functional properties, starting from very limited initial resources. This "virtual growth" program imposes a set of adjacency rules on a limited number of local elements, echoing the synthesis rules and broad diversity found in biological systems. We establish a general, graph-based representation of material microstructures, which serves as novel framework to accounts for topological complexity, geometrical properties and constraints in metamaterials. In another example, I will show how disorder plays a pivotal role in the fabrication of materials, consisting of interlocking particles, that can dramatically vary their bending stiffness and shape reconfiguration ability.

Bio: Chiara Daraio is the G. Bradford Jones Professor of Mechanical Engineering and Applied Physics at Caltech. She received her undergraduate degree in Mechanical Engineering from the Università Politecnica delle Marche, Italy (2001) and her M.S. (2003) and Ph.D. degrees (2006) in Materials Science and Engineering from the University of California, San Diego. She joined the Aeronautics and Applied Physics departments of the California Institute of Technology (Caltech) in fall of 2006 and was promoted to full professor in 2010. Between 2013-2016, she served as the chair of Mechanics and Materials at ETH Zürich.

Chiara received numerous awards, among them, a Presidential Early Career Award from President Obama (PECASE) and an ONR Young Investigator Award. She was selected as a Sloan Research Fellow and she is a winner of the NSF CAREER award, of the Richard Von Mises Prize and of the Hetenyi Award from the Society for Experimental Mechanics. She was nominated by Popular Science magazine among the "Brilliant 10". She serves as a Board Editor for Science (AAAS) and as an Associate Editor for the journals Multifunctional Materials (IOP), Matter (Cell Press) and Frontiers in Materials (Frontiers).