

Colloquium

When structures become materials: mechanical metamaterials with tailored and adaptive performance

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Abstract

In this seminar, we will discuss recent progress made in the prediction and realization of metamaterials with interesting, peculiar, and beneficial mechanical properties, drawing inspiration from nature and adopting material design principles at the structural level. We demonstrate lightweight examples whose scale-bridging designs offer stiffness, strength, and toughness usually not found in natural materials. Moreover, we show how the large, nonlinear deformation of soft architectures reveals qualitative and quantitative analogy to phase transformations in solids. This latter class of metamaterials enables reconfigurable and adaptive structures as well as mechanical diodes and wave guides. Besides surveying recent progress, we also highlighting open challenges and opportunities.

Literature

1. Stable propagation of mechanical signals in soft media using stored elastic energy (2016 – [link](#))
2. Multiscale modeling and optimization of the mechanics of hierarchical metamaterials (2019 – [link](#))

Brief Bio

Dennis M. Kochmann received his Diploma and doctoral degree in Mechanical Engineering from Ruhr-University Bochum as well as a Master's in Engineering Mechanics from the University of Wisconsin-Madison. He was a postdoc and Fulbright fellow at Wisconsin and a Feodor Lynen fellow at Caltech, before joining the Aerospace Department at Caltech as Assistant Professor in September 2011. From 2016 to 2019 he was Professor of Aerospace at Caltech. In April 2017 he became Professor of Mechanics and Materials at ETH Zürich, where he is currently Head of the Institute of Mechanical Systems and Deputy Head of the Department of Mechanical and Process Engineering. His research focuses on the link between structure and properties of a variety of (meta)materials, which also includes the development of new theoretical, computational and experimental methods to bridge across scales from nano to macro.

11 December, 2019, 15:00-16:15 p.m.

FIT, Georges-Köhler-Allee 105, 79110 Freiburg

Seminar room, ground level