MIDWEST MECHANICS SEMINAR

DESIGN OF ARCHITECTED MATERIALS

DENNIS KOCHMANN

MONDAY, JANUARY 26TH
11:30AM-1:00PM, WALC B093

BIO: Dennis M. Kochmann is Professor of Mechanics and Materials and Head of the Department of Mechanical and Process Engineering at ETH Zürich in Switzerland. He studied Mechanical Engineering at Ruhr-University Bochum (Germany) and Engineering Mechanics at the University of Wisconsin-Madison. After postdoc positions at Wisconsin and Caltech, he became Assistant Professor of Aerospace at the California Institute of Technology in 2011, and Professor of Aerospace in 2016, a position he held through 2019. In April 2017 he joined ETH Zürich as Professor of Mechanics and Materials. His research focuses on the link between microstructure and properties of natural and architected materials, which includes the development of theoretical, computational, and experimental methods to bridge across scales from nano to macro. His research has been recognized by, among others, IUTAM's Bureau Prize in Solid Mechanics, GAMM's Richard von Mises Prize, an NSF CAREER Award, ASME's T.J.R. Hughes Young Investigator Award, an ERC Consolidator Grant, and IACM's John Argyris Award. He serves as Associate Editor for ASME's Applied Mechanics Reviews and Archive of Applied Mechanics, as Vice-Chair of the Swiss Community for Computational Methods in Applied Sciences (SWICCOMAS) and on the Board of Directors of the Society of Engineering Science (SES).

ABSTRACT*:* Architected materials (also known as metamaterials) have become not only a popular solution for applications that require materials with superior, peculiar or extreme properties, but they also continue to present challenges for optimization and design across scales: given a combination of target properties, what structural realization offers exactly those target properties? This inverse challenge has been tackled by a variety of approaches – from classical topology optimization to machine learning-based generative design. Here, we will discuss several topical challenges in the inverse design of architected materials and present approaches for their design. This includes the multiscale optimization of elastic architected materials, the design of spatially graded metamaterials for wave guidance based on ray tracing, and the generative design of architected materials by methods of machine learning. For each example, we demonstrate how theory and simulations have enabled new design frameworks of architected materials for various applications, and how this field is still offering many challenges and opportunities.

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