

BIOENGINEERING

PRESENTS

Less is More: Design and Additive Manufacturing of Multi-functional Micro-Architectures and Microsystems



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12:00 – 1:00 PM

Zoom Link:

<https://ucla.zoom.us/j/3578398609>

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ABSTRACT:

Material properties are governed by their chemical composition and intrinsic crystalline structures. This fundamentally limits material properties and their applicability creating trade-offs for selecting materials for product applications, from structural components to sensors and antennas.

Metamaterials represent the concept of utilizing artificial material building blocks to create desirable properties derived from three-dimensional layout and compositions. While novel topologies can now be realized via additive manufacturing, the lack of processable materials, multi-material gradients, speed and scalabilities have stymied its further adoption.

In this talk, I will outline a suite of new material design and manufacturing routes, enabled by additive manufacturing of topologies, multi-scale features and multi-material cues. Attention is focused on how additive manufacturing techniques will enable processing the unprocessable, from structural composites to functional and stimuli-responsive multi-materials. This unleashes new design freedoms for rapid material property discovery and product realizations; where electrical, thermo, mechanical behaviors and their couplings can be inversely designed and tailored by an end-user at will. I will present a few examples, where structural, electronic and energy transduction materials are 3D architected into a compact form factor, without requiring multiple processing stages such as printing, embedding or wiring. Next, we will present their new applications, such as ultralight and strong materials, self-sensing materials, microsystems for robotics, air and maritime sensing, transducers, wave guiding and telecommunications.

BIOGRAPHY:

Dr. Xiaoyu “Rayne” Zheng is an Assistant Professor at the Civil and Environmental Engineering, and the Mechanical and Aerospace Engineering at UCLA, and directs the Advanced Manufacturing and Metamaterials Laboratory. His group develops the next generation additive manufacturing processes, material designs and synthesis approaches to create multi-functional materials and all-in-one devices with controlled topologies, compositions and multi-scale features. Their work on scalable additive manufacturing approaches for ultralight, ultrastrong and resilient materials was featured on MIT Technology Review Top 10 Innovations and on the Cover of Science Magazine and Nature Materials. Zheng received his Ph.D. degree in Mechanical Engineering from Boston University with the Best Dissertation Award and subsequently worked as a research engineer at the Lawrence Livermore National Laboratory (LLNL). Zheng has over 40 publications and multiple patents including multiple

publications in Science, Nature Materials and Nature Electronics. He has received multiple awards and recognitions, including a DARPA Young Faculty Award, Office of Naval Research Young Investigator Award, Air Force Office of Scientific Research Young Investigator Award, Outstanding Assistant Professor Award, 3M Non-Tenured Faculty Award, Solid Freeform Fabrication and Additive Manufacturing Excellence (FAME) Award, and the Director's Award for Publication Excellence from LLNL.