Mechanical & Materials Engineering

Pierson Graduate Seminar

Liquid Metal Elastomer Composites for Soft Robotics and Electronics

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Biological systems exhibit a unique combination of intrinsic functionalities that seamlessly integrate sensory perception, coordinated movement, energy management, and self-repair mechanisms. Engineering soft-matter counterparts that emulate the mechanical compliance and versatility of these systems requires new classes of soft materials and manufacturing techniques. This work aims to extend the range of physical properties and capabilities in multifunctional systems towards bridging the gap between traditional rigid systems and biological counterparts. In this talk, I will present several new techniques to create multifunctional soft materials that exhibit embodied sensing, actuation, and energy harvesting functionalities. This includes progress in the development of novel material architectures that contain room temperature gallium-based liquid metal alloys for passive thermal management, mechanically robust circuity, and the ability to steer cracks. Next, I will present recent work on direct ink writing 3D printing strategies to control liquid metal microdroplet microstructure in-situ to program mechanical, electrical, and thermal behavior to create robust soft multifunctional systems. Lastly, I will describe efforts to create integrated soft material systems with a bioinspired nervous system to detect and manipulate diverse underwater objects.

Bio: Dr. Eric Markvicka is an Assistant Professor in the Department of Mechanical and Materials Engineering at the University of Nebraska-Lincoln (UNL). There, he also holds a courtesy appointment in the School of Computing and the Department of Electrical and Computer Engineering. At UNL Eric directs the Smart Materials and Robotics Laboratory, an interdisciplinary research lab that is creating multifunctional soft materials that exhibit a unique combination of mechanical, electrical, and thermal properties. These materials are critical components for the emerging fields of wearable computing, soft robotics, and robotic materials. Prof. Markvicka has received the NSF CAREER award, 2024 COE Edgerton Innovation Award, 2023 COE Excellence in Research Award, and 2021 NUtech Ventures Emerging Innovator of the Year award. Before joining the faculty at UNL, Eric received his B.S. and M.S. in Mechanical and Materials Engineering from UNL and his M.S. and Ph.D. in Robotics from Carnegie Mellon University.

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