AAE SPECIAL SEMINAR

Mechanical Intelligence for Deployable and Adaptive Space Structures

WEDNESDAY, OCTOBER 14TH, 2026

INDIANA MANUFACTURING INSTITUTE RM 129 3:00PM-4:00PM

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Abstract

Spacecraft structures such as large antenna apertures and robotic systems must operate under extreme, uncertain, and resource constrained environments. Embodying mechanical intelligence in these structures can enable operation where electronics have limited functionality, allow structures to 'learn' new behaviors in-situ in changing environments, and can reduce size, weight, and power by integrating load-carrying, sensing, and computing functionalities directly into structural components.

This talk presents our work on deployable and adaptive space structures with embedded shape change, control, and self-sensing, through three projects. First, we show how shape morphing in thin fiber-reinforced polymer structures can be leveraged for reconfigurable antennas and soft robotics. Second, we demonstrate how such structures can learn new mechanical behaviors in response to environmental stimuli without pre-programming. We introduce physical learning where programmable metamaterials iteratively adapt their properties through interaction with their environment. Lastly, we turn to thermally-induced deformation in large tensioned-membrane structures and show how elastic wave propagation can be used for self-sensing of wrinkling. Together, our research motivates a new class of spacecraft structures that sense, compute, and adapt through their own deformation with reduced reliance on electronics.

Biography

Maria Sakovsky is an Assistant Professor in the Aeronautics and Astronautics Department at Stanford University. She received her BSc in Aerospace Engineering from the University of Toronto and MSc and PhD in Space Engineering at Caltech, where she developed a deployable satellite antenna based on composite material origami. She concurrently worked with NASA's Jet Propulsion Laboratory on developing cryogenically rated thin-ply composite antennas for deep space missions. After her PhD, she was awarded the ETH Zürich postdoctoral fellowship to investigate reconfigurable antennas based on mechanical metamaterials. She received the DARPA Young Faculty Award and the ASME SMASIS Outstanding Contribution Award for her work in shape morphing structures.

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