Advanced Manufacturing Seminar

Materials, Mechanics, and Performance of Artificial Muscles in Robotics

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My group is developing a roadmap for elastic actuators inspired by natural muscles to replace bulky electric motors in miniature robots requiring large mechanical work output.

First, I will describe the material microstructure and geometric mechanics of polymeric coiled muscles made by twisting nylon fishing lines, and how these actuators use internal strain energy to achieve record breaking performance. Next, I will describe their use to actuate the dynamic snapping of insect-scale jumping robots. The combination of strong but slow muscles with a fast-snapping beam gives rise to dynamic buckling cascade phenomena leading to effective robotic jumping mechanisms.

These examples shed light on the future of robotics propelled by new bioinspired materials, nonlinear mechanics, and unusual manufacturing processes.

Sameh Tawfick is a Ralph A. Andersen Scholar and Associate Professor of Mechanical Science and Engineering at the University of Illinois. He studies advanced materials, nonlinear mechanics, and manufacturing processes. Sam obtained his PhD from the University of Michigan, was a Postdoctoral Associate at the Massachusetts Institute of Technology, and a Beaufort Visiting Fellow in St. John's College at the University of Cambridge in 2023. He is the recipient of young investigator awards from the US Air Force, ASME, SME, and The Dean's Award for Excellence in Research at Illinois. His teaching awards at the University of Illinois include The Everitt Award for Teaching Excellence, The Two-year Alumni Teaching Award, and The Engineering Council Stanley H. Pierce Award for Empathetic Student-faculty Cooperation.

Monday
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2-3PM

Rogers Hall 226
FREE
Refreshments Served

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