Amgen Seminar Series in Chemical Engineering

in

Cherry Auditorium, Kirk Hall, 1 PM

Presents on September 21, 2017

Bioinspired Design & Additive Manufacturing of Soft Materials, Machines, Robots, and Haptic Interfaces

By

Dr. Robert Shepherd
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This talk will present multidisciplinary work from material composites and robotics. We have created new types of actuators,[1] sensors,[2] displays,[3] and additive manufacturing techniques for soft robots and haptic interfaces.[4] For example, we now use stretchable optical waveguides as sensors for high accuracy, repeatability, and material compatibility with soft actuators. For displaying information, we have created stretchable, elastomeric light emitting displays as well as texture morphing (Pikul et al., in preparation) skins for soft robots. We have created a new type of soft actuator based on molding of foams, new chemical routes for stereolithography printing of silicone and hydrogel elastomer based soft robots, and implemented deep learning in stretchable membranes for interpreting touch (Larson et al., in preparation). All of these technologies depend on the iterative and complex feedback between material and mechanical design. I will describe this process, what is the present state of the art, and future opportunities for science in the space of additive manufacturing of elastomeric robots.

1. Mac Murray, B.C., et al., *Poroelastic Foams for Simple Fabrication of Complex Soft Robots.* Advanced Materials, 2015. **27**(41).
2. Zhao, H., et al., *Optoelectronically innervated soft prosthetic hand via stretchable optical waveguides.* Science Robotics, 2016. **1**(1).
3. Larson, C., et al., *Highly stretchable electroluminescent skin for optical signaling and tactile sensing.* Science, 2016. **351**(6277).
4. Peele, B., et al., *3D Printing Soft Actuators via Digital Mask Projection Stereolithography.* Bioinspiration & Biomimetics, 2015. **5**(055003).

Bio: Rob Shepherd is an assistant professor at Cornell University's Organic Robotics Lab (ORL), which focuses on using synthetic adaptation of natural physiology to improve machine function and autonomy. Our research spans three primary areas: bioinspired robotics, haptic interfaces, soft sensors and displays, and advanced manufacturing. We use soft materials, mechanical design, and novel fabrication methods to replicate sensory organs such as dermal papillae, replicate organs that rely on actuation such as the heart, and to power soft actuators and robots. He is the recent recipient of an Air Force Office of Scientific Research Young Investigator Award, and an Office of Naval Research Young Investigator Award. His work has been featured in popular media outlets such as the BBC, Discovery Channel, and PBS's NOVA science documentary series.

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