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

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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).