Johns Hopkins University
Department of Mechanical Engineering
2021 Fall Seminar Series: Class 530.803

Thursday, September 16, 2021 | 3:00 PM – 4:00 PM
REGISTRATION LINK | ZOOM LINK | Passcode: 156138
In-person Class Held in Malone G33/35 (open to first 50 people)

"Origami Concepts for Sensing, Actuation and Logic"

Presented by Philip R. Buskohl
U.S. Air Force Research Laboratory

Movement and shape change are key enablers for living systems to sense, assess and respond to environmental stimuli. For example, actuating mechanisms are utilized in natural systems for diverse operations, such as arms and legs for locomotion, skin wrinkling for camouflage, or multistable snapping to catch prey. Mapping these behaviors to synthetic systems is highly desirable for applications such as morphing aircraft and agile robotics, however robust physical reconfiguration methods are needed to program and control the interaction of the physical shape with its environment. Origami, the art of paper folding, presents a strategy to address this challenge, by converting complex 2D to 3D shape changes into a series of folding operations. In addition, multistable origami mechanisms can also be realized through the combined tuning of the fold topology and the stiffness mismatch between stretch, bend and fold deformation modes in the structure. In this seminar, we will investigate how origami-based shape change and multistability can serve as potential mechanisms for emulating sensing, actuation and logic in stimuli-responsive structures. Examples will include the analysis of an origami frequency selective surface for tunable blockage of electromagnetic waves, applying topology optimization to design origami actuators with specific symmetries, and the leveraging of a bistable origami pattern to demonstrate mechanologic. Collectively, the results highlight the versatile properties origami-based structures can embody and the potential opportunity space for foldable mechanisms.

Philip R. Buskohl is a Research Mechanical Engineer in the Functional Materials Division at the U.S. Air Force Research Laboratory. The Division delivers materials and processing solutions to revolutionize AF capabilities in Survivability, Directed Energy, Reconnaissance, Integrated Energy and Human Performance. Phil has authored over 36 peer-reviewed papers ranging from the chemical-mechanical feedback of self-oscillating gels, design of reconfigurable origami structures and mechanical computing concepts. His research interests include nonlinear elasticity, optimization methodology for material design, and mechanically adaptive materials.