***Topic:***

***Automation in and through Reconfigurable Structures with Embodied Modular Programmability and Mechano-Intelligence***

**Prof. Kon-Well Wang,**

A. Galip Ulsoy Distinguished University Professor of Engineering and Stephen P. Timoshenko Professor of Mechanical Engineering

Department of Mechanical Engineering, University of Michigan
Ann Arbor, MI, USA

**Abstract**

In recent years, the concept of reconfigurable matter developed based on nature-inspired modular architectures has been explored to create advanced engineering systems. For example, inspired by the observation that some of skeletal muscle's intriguing macroscale functionalities result from the assembly of nanoscale cross-bridge constituents with metastability, the idea of synthesizing metastructures from the integration of metastable modules has been pursued. In another example, inspired by the physics behind the plant nastic movements and the rich designs of origami folding, a class of metastructures is created building on the innovation of fluidic-origami modular elements. Overall, the modules are designed to be reconfigurable in their shape, mechanical properties, and stability features, so to produce synergistic and intriguing dynamic functionalities at the system level, such as programmable phononic bandgap control and nontraditional wave steering.

More recently, with the rapid advances in high-performance automation, we are witnessing a prominent demand for the next generation of mechanical matter to have much more built-in intelligence and autonomy. An emerging direction is to pioneer and harness the metastructures’ high dimensionality, multiple stability, and nonlinearity for mechano-intelligence via physical computing.  That is, we aim to concurrently embed computing power and functional intelligence, such as perception, learning, memorizing, decision-making and execution, directly in the mechanical domain, advancing from conventional systems that solely rely on add-on digital computer to achieve intelligence. This presentation will highlight some of these advancements in harnessing reconfigurable matter for structural dynamics tailoring, from adaptive wave/vibration controls to self-learning-self-tuning intelligence and autonomy.