3:00-4:00pm, Friday, October 28th, 2016
Frank H. Walk Design Presentation Room

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by Jerry Qi*D

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Recent advances in digital manufacturing allow the precise placement of multiple materials at micrometer resolution with essentially no restrictions on the geometric complexity of the spatial arrangement. Complex 3D solids thus can be created with highly non-regular material distributions in an optimal fashion, enabling the fabrication of devices with unprecedented multifunctional performance. This also enables the emerging concept of 4D printing. In this talk, we introduce the 4D printing paradigm of digital manufacturing for active composites where the shape of printed 3D object can change upon external stimuli as a function of time, the 4-th dimension of the shape forming process. We directly print a composite in its initial 3D configuration from a CAD file that specifies the shape memory fiber (SMF) architecture at the lamina and laminate level. After printing, the programmed action of the SMFs creates time dependence of the composite configuration change. This process has considerable design freedom to enable creation of composites with complex and controllable anisotropic thermomechanical behavior via the prescribed fiber architecture, shape, size, orientation and even spatial variation of these parameters to assume complex three-dimensional configurations, including bent, coiled, and twisted strips, folded shapes. We also show how the printed active composites can be used to create structures that can assemble itself, such as printed origami. Some of our recent progresses will be presented and the challenges for the future development of 4D printing will be discussed.

Dr. H. Jerry Qi is Professor and the Woodruff Faculty Fellow in the George W. Woodruff School of Mechanical Engineering at Georgia Institute of Technology. He received his bachelor degrees and graduate degree from Tsinghua University and a ScD degree from Massachusetts Institute of Technology. After one year postdoc at MIT, he joined University of Colorado Boulder as an assistant professor in 2004, and was promoted to associate professor with tenure in 2010. He joined Georgia Tech in 2014 as an associate professor and was promoted to a full professor in 2016. Prof. Qi s research is in the broad field of nonlinear mechanics of soft materials and focuses on developing fundamental understanding of multi-field properties of soft active materials through experimentation and constitutive modeling then applying these understandings to application designs. He and his collaborators have been working on a range of soft active materials, including shape memory polymers, shape memory elastomeric composites, light activated polymers, covalent adaptable network polymers, for their interesting behaviors such as shape memory, light actuation, surface patterning, surface welding, healing, and reprocessing. Recently, he and his collaborators pioneered the ή rin ⌈