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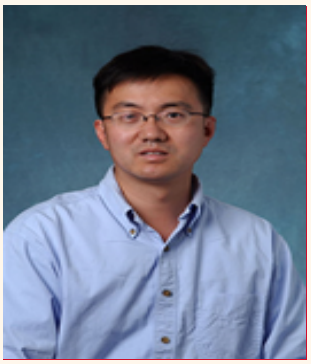
Multimaterial Additive Manufacturing toward Shape Changing Structures and 4D Printing



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ABSTRACT:

3D printing (additive manufacturing, AM) where materials are deposited in a layer-by-layer manner to form a 3D solid has seen significant advances in the recent decades. 3D printing has the advantage in creating a part with complex geometry from a digit file, making them an idea candidate for making architected materials. Multimaterial 3D printing is an emerging field in recent years in additive manufacturing. It offers the advantage of placement of materials with different properties in the 3D space with high resolution, or controllable heterogeneity. In this talk, we present our recent progress in developing multimaterial additive manufacturing methods. In the first approach, we present a new development where we integrate two AM methods, direct-ink-write (DIW) and digit light processing (DLP) into one system. In this system, the DLP can be used to print complex bulk parts while DIW can be used to print functional inks. In the second approach, we recently developed a grayscale DLP)g-DLP) 3D printing method where we can print a part with gradient material properties. We further explore on how to use multimaterial 3D printing to fabricate architected materials and demonstrate their advantage, including direct 4D printing of 2D lattice structures, lattice structures with changing shape driven by liquid crystal elastomers, and 3D lattice structures by gradient materials.

BIOGRAPHY:

Dr. H. Jerry Qi is a professor in the School of Mechanical Engineering at Georgia Institute of Technology and is the site director of NSF IUCRC on Science of Heterogeneous Additive Printing of 3D Materials (SHAP3D). He received his undergraduate and graduate degrees from Tsinghua University and a ScD degree from MIT. After one-year postdoc at MIT, he joined University of Colorado Boulder as an assistant professor and moved to Georgia Tech in 2014. Prof. Qi's research is in the broad field of nonlinear mechanics of polymeric 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, healing, reprocessing, and recycling. In recent years, he has been working on investigating integrating active materials with 3D printing. He and his collaborators pioneered the 4D printing concept. Prof. Qi is a recipient of NSF CAREER award (2007) and was elected to an ASME Fellow in 2015.