

Special Seminar
06/13 (Monday) at 10:30 am – 11:30 am in ME 2054

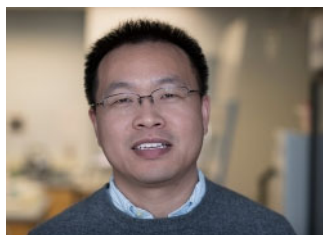
Mechanics-driven Extreme Manufacturing

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Abstract: Over the last few decades, manufacturing has evolved radically from its earliest forms, as labor-intensive exercise in craftsmanship, to a fully automated, information-rich digital process. This accelerating trend will continue to transform the means for creating products across length scales, from the mega-scale (e.g. buildings and bridges) to human-scale (e.g. furniture and cars) to the micro/nanoscale (e.g. integrated circuits and biomedical sensors). Meanwhile, the ever-growing demands of multifunctional structures in well-defined, often three-dimensional, layouts, together with the rapid emergence of new materials, will further call for innovative strategies and approaches to manufacturing with precisely-controlled, environmentally sustainable processes at low cost. At the root of manufacturing, its elementary steps rely critically on material/structural deformation and assembly, underpinned by mechanics. Understanding and utilizing principles of mechanics will not only lead to refinements of existing manufacturing techniques, but will also enable explorations of entirely new ones. In this talk, I will present two unusual manufacturing strategies. The first one is the transfer printing technology in a non-corrosive liquid environment for producing film-based functional structures and electronic devices, and the second one is the crumpling and assembly technology by droplet drying for printing deformable nanomaterials into bulk quantities with controllable structures. Both approaches are driven by mechanics of materials with strong couplings to liquid environments and stimuli means, termed as mechanics-driven extreme manufacturing (MEM), where the adjective “extreme” aims to highlight a central, driving role of mechanics in the origins of these two strategies. For each example, I will talk about the establishments of mechanics theories and their leading guidance to drive explorations of manufacturing approaches in detail and will also demonstrate their applications in manufacturing functional structures and electronics in a broad variety of materials and environments.



Bio: Dr. Baoxing Xu is currently an associate Professor in the Department of Mechanical and Aerospace Engineering at The University of Virginia (UVA). He received his PhD in Mechanics and Materials from Columbia University in 2012 and was a Beckman Postdoctoral Fellow at the University of Illinois at Urbana-Champaign from 2012 to 2014. He joined the faculty of UVA in the fall of 2014 and was promoted to associate professor in 2020. Dr. Xu’s group research interests have been focused on mechanics-driven extreme design and manufacturing of functional materials, structures and devices, in particular, low-dimensional nanomaterials, liquid-porous structures, bioinspired stretchable devices and structures, soft-hard material integrated systems. He received the ONR-Young Investigator Award in 2020 and 2020 ASME- Sia Nemat-Nasser Early Career Award.