The Department of Mechanical Engineering
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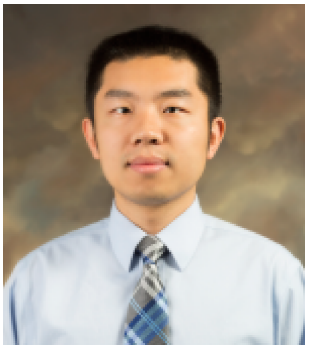
Mechanical Engineering Seminar



Electrohydrodynamic Inkjet Printing for in-space manufacturing: current progress and efforts

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Friday, October 28th at 10:30 am in Room 173, Light Engineering

Abstract

Long-duration exploration missions require a paradigm shift in the design and manufacturing of space architectures. The ability to perform in-space manufacturing (ISM) provides a solution towards sustainable, flexible missions (in-transit and on-surface) through on-demand fabrication and repair capabilities for critical systems, habitats, mission logistics and maintenance. ***How can we 3D print things in outer space under no gravity?*** Dr. Qin may have some answers!

Dr. Qin was selected to investigate how to integrate his electrohydrodynamic technique for NASA's in-space 3D printer to manufacture on-body wearable sensors. In this research seminar, Dr. Qin will first introduce his group's recent NASA parabolic flight test results. Electrohydrodynamic inkjet printing (EHD printing) is one novel type of inkjet printing technique utilizing high electrical force for the ink to overcome surface tension at the tip of micro nozzles. Via the parabolic flight tests, Dr. Qin validated and confirmed that EHD printing is a unique gravity-free 3D printing technique. His recent efforts in modeling, in-situ monitoring, data analytics, quality assurance, and control schemes for EHD printing will be introduced.

Dr. Qin built up his 'machine shop' trying to address challenges in advanced manufacturing, mainly focusing on 1) process development for in-space additive manufacturing and assembly, 2) new material characterization, 3) quality assurance and real-time inspection, 4) micro/nano scale prototyping. Some highlights are 'in-situ NDE for AM and data fusion', 'digital twin for micro/nano manufacturing systems, and 'origami design for manufacturing'. Dr. Qin will introduce some other ongoing projects and collaboration opportunities, including a) 3D concrete printing for civil infrastructures, b) 3D biomaterial printing for in-space plants, pharmaceutical and medical applications, c) 3D metal printing and in-process quality assurance, d) Virtual Reality engineering education laboratory (VReel), and e) in-space logistics and supply chain systems.

Biography

Dr. Hantang Qin is an assistant professor in the Department of Industrial and Systems Engineering at the University of Wisconsin – Madison. He worked at Iowa State University for five years before joining UW-Madison. He received his Ph.D. in Industrial Engineering at North Carolina State University in 2016. Dr. Qin's expertise covers in-space manufacturing, electrohydrodynamics, micro/nano 3D printing, advanced manufacturing for flexible electronics, biomedical applications, system design, control, and optimization. He has been working on engineering education via Virtual Reality (V.R.) pedagogy to train next-generation engineers. He has several U.S. patents, and has been sponsored by various agencies, such as NASA, NSF, US Army Corps of Engineers, Department of Energy, U.S. Army Research Laboratory, and industrial collaborators.

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