Title: From Nanometer Precision Control to Quality Additive Manufacturing and Robotic Inspection Under Limited Sensing

Seminar speaker: Dr. Xu Chen (University of Washington)
Time: 2pm-3pm Monday, Feb 3, 2019
Location: ME south 205

Abstract:

Since the invention of microprocessors, fast sampling has been the dogma for building realtime systems in applications from healthcare to manufacturing. Increasingly prevalent data-intensive measurements such as imaging and streaming videos, however, remain widely separated from high-speed realtime applications. In powder bed fusion (PBF) additive manufacturing that can fabricate 3-dimensional metallic parts with complex geometries at low unit costs, for instance, quality assurance demands fast visual sensing beyond 10 kilo Herz, generating a prohibitively dense data flow of gigabytes per second. This talk discusses a system-theoretical framework for closed-loop controls under such mismatched sensing and actuation. Drawing from subfields of information science and sampled-data controls, we discuss (1) modeling and online signal processing that understand multi-scale thermomechanical interactions to reliably address the imperfect sensor feedback, and (2) the realization of control strategies that maximize performance beyond conventional bandwidth limits. Along the path, we share the hardware-control co-design of an in-house build PBF testbed and the broader relation to robotic inspection and collaborations.

Bio:

Xu Chen is an Assistant Professor in the Department of Mechanical Engineering at the University of Washington, Seattle. He received his M.S. and Ph.D. degrees in Mechanical Engineering from the University of California, Berkeley in 2010 and 2013, respectively, and his Bachelor’s degree with honors from Tsinghua University, China in 2008. His research interests include dynamic systems and controls, advanced manufacturing, robotics, and intelligent mechatronics. His work — funded by NSF, DOE, DOD, state, and industries — has led to four Best Paper Awards, patented and massively deployed servo algorithms in the information storage industry, 1st-ranked adaptive control methods in international benchmark evaluations, and the graduation of two University Scholars. Dr. Chen is a recipient of the National Science Foundation CAREER Award, the Young Investigator Award from ISCIIE / ASME International Symposium on Flexible Automation, the inaugural UTC Institute for Advanced Systems Engineering Breakthrough Award in 2016, and the 2017 UConn University Teaching Fellow Award Nominee. He is Chair of the Vibration Technical Committee in ASME Dynamic Systems and Control (DSC) Division, News Editor of the DSC Magazine, Publicity Chair of the 2020 IEEE/ASME International Conference on Advanced Intelligent Mechatronics, Industrial Outreach and Local Coordination Chair of the 2020
ASME DSC Conference. He was Editor of the DSC Newsletter, and Student and Young Members Chair of the 2016 ASME DSC Conference.