

Next Generation Manufacturing Faculty Candidate Seminar

DATE: Tuesday, March 20, 2018

TIME: 10:30 AM

LOCATION: Fu Room, POTR 234

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Towards Smart and Sustainable Manufacturing: Managing Structural Flexibility and Redundant Actuation

Abstract: Smart manufacturing combines information technologies with traditional manufacturing technologies, and encourages more flexible, agile, and data-driven management of manufacturing activities. This combination is advantageous in quick response to the market, and may significantly contribute to the development of sustainable manufacturing due to the visualization, analysis and sharing of information. One major technical challenge to smart manufacturing, from today's point of view, is the increasingly versatile demands from the information realm and the relatively limited variability / flexibility of current manufacturing tools. To address this challenge, flexible structures and redundant actuation are frequently employed in modern machines. In this presentation, advanced control methodologies for systems with structural flexibility and redundant actuation are discussed. Specifically, a filtered basis function (FBF) method that compensates the vibration due to structural flexibility is presented. The FBF method is shown to reduce the motion-induced vibration and quality degradation in commercial 3D printers. For redundantly actuated systems, a proxy-based (PB) control allocation framework is presented. The PB method dynamically allocates the control efforts in an energy optimal and computational efficient manner, and is validated on a redundantly actuated hybrid feed drive designed for sustainable machining. Significant enhancement of the energy efficiency without sacrificing positioning accuracy is shown.

Bio: Molong Duan is a PhD candidate in Mechanical Engineering department in University of Michigan, Ann Arbor. He received his B.S. degree from Peking University, Beijing, China, and his M.S.E. degree from the University of Michigan, Ann Arbor, in 2012 and 2013, respectively. His research interests are control of hybrid and redundantly actuated systems, sustainable manufacturing, and intelligent motion command generation. Mr. Duan was granted the Rackham Centennial Fellowship from University of Michigan in 2013. He received the best poster award at the 2014 International Forum on Sustainable Manufacturing and the best student paper award at the 2015 Dynamic Systems and Controls Conference.