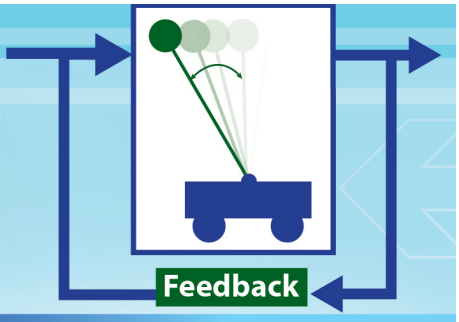
COLLEGE OF ENGINEERING

Control Seminar



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A Remarkable Feedforward Tracking Control Technique and its Application to 3D Printing

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Friday, March 9, 2018

3:30 – 4:30 pm • 1500 EECS

ABSTRACT: An engineer once noted that if controls were a parent with two kids, feedback control would be the troubled kid who receives lots of attention while feedforward control would be the well-behaved kid who receives little attention. There is some truth to this observation: feedforward is a very important but often underappreciated branch of controls. It is commonly used for tracking control, which has broad applications in robotics, manufacturing, automotive, aerospace, etc. However, feedforward control is not exactly well-behaved. It "throws tantrums," especially when applied to systems with non-minimum phase (NMP) zeros. In this talk, I will present a so-called filtered basis functions (FBF) feedforward technique which has shown remarkable success where most other methods have failed. In particular, I will show the FBF method's ability to maintain consistent tracking accuracy independent of NMP zero location in the complex plane. I will also present a simple metric we have developed to facilitate the analysis and design of linear-time varying tracking controllers, and some interesting insights it has given us into the FBF method. Lastly, I will show how we have used the FBF technique to boost the speed and precision of 3D printers at low cost.

BIO: Chinedum Okwudire received his Ph.D. degree in Mechanical Engineering from the University of British Columbia in 2009 and joined the Mechanical Engineering faculty at the University of Michigan in 2011. Prior to joining Michigan, he was the mechatronic systems optimization team leader at DMG Mori USA, based in Davis, CA. Chinedum has received a number of awards including the CAREER Award from the National Science Foundation; the Young Investigator Award from the International Symposium on Flexible Automation; the Outstanding Young Manufacturing Engineer Award from the Society of Manufacturing Engineers; the Ralph Teetor Educational Award from SAE International; and the Department Achievement Award from the Mechanical Engineering Department, University of Michigan. He has co-authored a number best paper award winning papers at Precision Engineering and Dynamic Systems and Control Conferences, including the 2016 ASME Dynamic Systems and Controls Division's Best Paper on Mechatronics Award.

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