ME Seminar

MECHANICAL ENGINEERING
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Advancing 3D Printing using Control Theory

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ABSTRACT

Basis functions (BFs) are used extensively in control engineering. The standard practice is to solve a given control problem by pre-selecting a set of BFs (from a wide range of available options) based on user preference or engineering intuition. Rather than the standard practice of arbitrarily selecting BFs, in this talk, I will present a rigorous framework for selecting optimal BFs that minimize control effort or maximize robustness for the filtered basis functions (FBF) approach, an emerging feedforward control method for tracking control of nonminimum phase systems. The optimal BFs have been shown in simulations and experiments on 3D printers to yield orders of magnitude improvement in control efficiency and robustness compared to popular BFs like B-splines.
Extensions of my work to control of nonlinear systems and learning control and its application to polymer-based, metal-based and big area additive manufacturing, will also be discussed.

ABOUT THE SPEAKER

Dr. Keval S. Ramani is a Research Fellow at the University of Michigan, Ann Arbor, USA. He completed his Ph.D. and M.S. from University of Michigan in 2019 and 2015, respectively, and B.E. from BITS Pilani, Goa Campus, India, in 2012. From 2012 to 2013, he worked with Ingersoll Rand, based in Bengaluru, India, as an Engineering Trainee. His research interests are in dynamic systems and control, with application to 3D printing automation. He is a co-author of the best student paper award winning paper on FBF at the 2015 ASME Dynamic Systems and Control Conference. He is also a member of the IEEE/ASME Transactions on Mechatronics Junior Reviewer Program.

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