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Integrated Design of System Architecture and Control Law

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ABSTRACT:

Performance of a control system critically depends on the available sensors and actuators. Traditionally, the accuracy and location of these components are decided prior to the controller design. The control designer tries to determine the best performance within this predetermined system architecture. This approach has several shortcomings. The limits of performance due to the system architecture may prevent the designer from achieving the required performance. Even if architecture changes were allowed, it is not clear which components to change or add that will contribute to the desired performance. Many of the components may be unnecessary or may have more than required precision. This results in poor use of system resources and yields an unnecessarily expensive design. Thus, the predetermined system architecture is an impediment in the optimal control system design, especially for large distributed systems. In this talk, we will present an integrated approach that determines the optimal location and precision of the components to achieve a desired system performance, in the presence of system uncertainty. The codesign problem is solved as a convex optimization problem in the H2/H-infinity framework. We will look at tensegrity systems as a motivating application and demonstrate how the system-control codesign framework can benefit several aerospace systems

BIOGRAPHY:

Raktim Bhattacharya received his M.S. and PhD in Aerospace Engineering from the University of Minnesota in 2000 and 2003 respectively. He was a postdoctoral researcher in Control & Dynamical Systems at Caltech from 2003 to 2004. He spent 2004-2005 at United Technologies Research Center, East Hartford, CT, as a research scientist in the Controls and Embedded Systems Group. He joined Texas A&M University in 2005 and is currently an Associate Professor in the Department of Aerospace Engineering at Texas A&M University. He has published several journal & conference papers and book chapters in the area of probabilistic robust control, nonlinear estimation, UQ in hypersonic flight problems, nonlinear trajectory generation, anytime control algorithms, and receding horizon control methodologies. His research is funded by NASA, AFOSR & NSF.