



Spring 2010 CIS Colloquium

Taming Networking Challenges with Feedback Control for Cyber Physical Systems

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11 AM - 12 PM, Friday, March 5
Wachman Hall 447
(4th Floor Conference Room)

ABSTRACT:

Cyber physical systems (CPS) are the co-joining of computing and networking with the physical processes. Research advances in CPS enhance systems for medical care, first responder, zero-net energy building, autonomous vehicle, etc. In these CPS applications, wireless networking is a core technology. And, it is life-critical for wireless networks to be highly reliable for CPS applications. For example, wireless networks in medical care systems must deliver a patient's physiological data to doctors with high reliability. However, wireless communication quality suffers from environmental changes and various interferences in real systems. To address communication realities and achieve high quality end-to-end energy-efficient wireless networking becomes a challenging task.

My feedback control based wireless networking solutions address this research challenge. My hierarchical control framework design has local control and global control. The local control maintains specified link quality with approximate models and low cost, while the global control achieves desired end-to-end performance with distributed coordination of link control. Feedback control based designs can achieve better stability and adaptability under stochastic disturbances than existing heuristic approaches. Evaluation results show that the control based solutions improve reliability of existing solutions by 10% to 40% in real systems. They also improve energy efficiency of existing solutions by 18% to 30%.