



DESIGN AUTOMATION FOR CYBER-PHYSICAL SYSTEMS: CHALLENGES AND OPPORTUNITIES

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2016年12月6日 星期二 10:00am

理科五号楼410会议室



ABSTRACT: Cyber-physical systems (CPS) such as autonomous and semi-autonomous vehicles, smart buildings, and industrial automation systems, are poised to bring immense economic and societal benefits. However, the design of these systems faces tremendous challenges from the rapid increase of system scale and heterogeneity, the close interaction with dynamic environment and human activities, the employment of multicore and distributed architectural platforms, and the stringent (and often conflicting) requirements on various design metrics. To address these challenges, it is critical to have a new set of design automation methods and tools for the modeling, synthesis and verification of cyber-physical systems.

In this talk, I will discuss some of the unique challenges in CPS design, and introduce the design automation methods we developed for addressing them, including 1) a software architecture synthesis framework for generating correct, predictable and efficient software implementations from functional models, while optimizing metrics including control performance, schedulability, extensibility, fault tolerance, memory usage, modularity and reusability; 2) a cross-layer design framework for CPS security and its application in automotive electronic systems and vehicular networks; and 3) co-design and co-scheduling methodologies for energy-efficient building management and their integration with grid-level optimization.

BIOGRAPHY: Dr. Qi Zhu is an Assistant Professor at the Department of Electrical and Computer Engineering in University of California, Riverside. Prior to joining UCR, Dr. Zhu was a research scientist at the Strategic CAD Labs in Intel from 2008 to 2011. Dr. Zhu received a Ph.D. in EECS from University of California, Berkeley in 2008, and a B.E. in CS from Tsinghua University in 2003. His research interests include model-based design and software synthesis for cyber-physical systems, CPS security, energy-efficient buildings and infrastructures, and system-on-chip design. He received the National Science Foundation (NSF) CAREER award in 2016. He received best paper awards at the Design Automation Conference (DAC) 2006, DAC 2007, International Conference on Cyber-Physical Systems (ICCPS) 2013, and ACM Transactions on Design Automation of Electronic Systems (TODAES) 2016. Dr. Zhu has served on the technical program committees and as session organizer and chair for a number of international conferences, including DAC, ICCAD, DATE, ASP-DAC, CODES+ISSS, RTSS, RTAS, SAC, SIES, MEMOCODE, etc. He is a member and the education committee chair of the IEEE Technical Committee on Cyber-Physical Systems. He received the ACM SIGDA Service Award in 2015.