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Automatic Control and Systems Engineering

The Department of Automatic Control & Systems Engineering is pleased to announce the following seminar:

Algorithmic Verification of Stability of Hybrid Systems

Professor Pavithra Prabhakar
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Spain

Friday, 29th November 2013 at 14:00
LT02, Sir Henry Stephenson Building

Abstract

Hybrid systems refer to systems exhibiting mixed discrete-continuous behaviors and arise as a natural byproduct of the interaction of a network of embedded processors with physical systems. Hybrid systems manifest in safety critical application domains including aeronautics, automotive, robotics and power systems. Reliability is of utmost importance and a grand challenge in the area is the development of techniques and tools to aid the development of high-confidence hybrid systems.

Formal methods is an area of computer science which deals with mathematical techniques for analysis of systems. There are two broad categories of verification techniques, namely, algorithmic and deductive. Algorithmic techniques depend on an exhaustive state-space exploration of the system to deduce a proof of correctness, where as, deductive verification reduces the problem to a theorem proving task. Algorithmic verification is fully automatic, but limited to finite state systems and rely on approximation techniques for infinite state systems. In contrast, deductive verification techniques cater to a large class of systems, but are not completely automatic and require substantial input from the users.

In this talk, we focus on the verification of stability of hybrid systems. Stability is a fundamental property in control system design and captures the notion that small perturbations to the initial state or input to the system result in only small variations in the eventual behavior of the system. We present foundations for approximation based analysis of stability and predicate abstraction based approximation methods for stability analysis. In contrast to the well-known methods for automated verification of stability based on Lyapunov functions, which are deductive, we present algorithmic techniques for stability analysis.

Biography

Pavithra Prabhakar obtained her doctorate in Computer Science and a masters in Applied Mathematics from the University of Illinois at Urbana-Champaign in 2011 and 2010, respectively. She has been on the faculty of IMDEA Software Institute since 2011 and spent the year between 2011-2012 as a CMI postdoctoral fellow at the California Institute of Technology. Her main research interest is in formal analysis of cyber-physical systems with emphasis on both foundational and practical aspects related to automated and scalable techniques for verification and synthesis of hybrid systems.