

You are cordially invited to our:
Department Seminar

Topic: Formal Methods for Discrete-Time Linear Systems
Speaker: Dr. Calin Belta
Date: Tuesday, 5 February 2013
Time: 11.00am to 12.15pm
Venue: E3-06-03 (map of NUS can be found at <http://map.nus.edu.sg/>)

Abstract

In control theory, "complex" models of physical processes, such as systems of differential equations, are usually checked against "simple" specifications, such as stability and set invariance. In formal methods, "rich" specifications, such as languages and formulae of temporal logics, are checked against "simple" models of software programs and digital circuits, such as finite transition graphs. With the development and integration of cyber physical and safety critical systems, there is an increasing need for computational tools for verification and control of complex systems from rich, temporal logic specifications.

The formal verification and synthesis problems have been shown to be undecidable even for very simple classes of infinite-space continuous and hybrid systems. However, provably correct but conservative approaches, in which the satisfaction of a property by a dynamical system is implied by the satisfaction of the property by a finite over-approximation (abstraction) of the system, have received a lot of attention in recent years.

Some classes of systems allowing for computationally efficient verification and control from temporal logic specifications are reviewed. The focus is on discrete-time linear systems, for which it is shown that finite abstractions can be constructed through polyhedral operations only. By using techniques from model checking and automata games, this allows for verification and control from specifications given as Linear Temporal Logic (LTL) formulae over linear predicates in the state variables.

The usefulness of these computational tools is illustrated with various examples such as verification and synthesis of biological circuits in synthetic biology and motion planning and control in robotics.

About the Speaker

Dr Calin Belta is an Associate Professor in the Department of Mechanical Engineering, Department of Electrical and Computer Engineering, and the Division of Systems Engineering at Boston University, where he is also affiliated with the Center for Information and Systems Engineering (CISE), the Bioinformatics Program, and the Center for Biodynamics (CBD). His research focuses on dynamics and control theory, with particular emphasis on hybrid and cyber-physical systems, formal synthesis and verification, and applications in robotics and systems biology. Calin Belta is a Senior Member of the IEEE and an Associate Editor for the SIAM Journal on Control and Optimization (SICON). He received the Air Force Office of Scientific Research Young Investigator Award and the National Science Foundation CAREER Award.

**** Admission is free. All are welcome to attend. ****