OVERLAY Workshop on Hybrid Systems

28 October, 2019 -- Fondazione Bruno Kessler, Sala Stringa

9.30 - 10.20	**Cinzia Bernardeschi**	***Co-simulation and verification of a non-linear control system for cogging torque reduction in brushless motors***
	This work aims at demonstrating the benefits of integrating co-simulation and formal verification in the standard design flow of a brushless power drive system for precision robotic applications. A sufficient condition on controller gain for system stability is derived from the system's mathematical model, including a control algorithm for the reduction of cogging torque.Then, using co-simulation and design space exploration, fine tuning of the controller gain parameters has been executed, exploiting the results from the formal verification.	
10.20 - 10.50	**Anna Becchi**	***Revisiting Polyhedral Analysis for Hybrid Systems***
	Thanks to significant progress in the adopted implementation techniques, the recent years have witnessed a renewed interest in the development of analysis tools based on the domain of convex polyhedra. In this paper we revisit the application of this abstract domain to the case of reachability analysis for hybrid systems, focusing on the lesson learned during the development of the tool PHAVerLite. In particular, we motivate the implementation of specialized versions of several well known abstract operators, as well as the adoption of a heuristic technique (boxed polyhedra) for the handling of finite collections of polyhedra, showing their impact on the efficiency of the analysis tool.	
10.50 - 11.10	Coffee break	
11.10 - 12.00	**Tiziano Villa**	***Reachability Analysis of Nonlinear Hybrid Systems***
	This talk will provide an introduction to the problem of reachability analysis of nonlinear hybrid systems modeled by hybrid automata. The software library Ariadne will be used as a reference tool for this presentation, and its current and upcoming capabilities will be discussed.	
12.00 - 12.50	**Massimo Benerecetti**	***Solving infinite games on graphs with Quasi-Dominions***
	The abstract notion of game has proved to be a useful metaphor in theoretical computer science. Several decision problems can, indeed, be encoded as path-forming games on graph, where a player willing to achieve a certain goal, usually the verification of some property, has to face an opponent whose aim is to pursue the exact opposite goal. Among the most prominent instances of this connection are Parity and Mean-Payoff Games. These are two-player turn-based games played on directed graphs, whose nodes are labeled with numerical values. The importance of these games stems from the numerous applications in system verification. Finding efficient algorithms to solve these games in practice is widely acknowledged as a core problem in formal verification, as it leads to efficient solutions of model-checking and synthesis problems. In this talk, novel solution techniques, based on the notion of Quasi-Dominion, for both Parity Games and Mean-Payoff Games will be presented. The introduction of Quasi-Dominions in the solution of these games can often reduce solution times of orders of magnitude compared to the state of the art, suggesting that these approaches may be very effective in practical applications.	

About the Speakers

Cinzia Bernardeschi

Cinzia Bernardeschi is an Associate Professor with the Department of Information Engineering at Pisa University, Italy. She graduated in Computer Science in 1987 and received her Ph.D. degree in Information Engineering in 1996. Her main research interests are in the area of software engineering, dependable systems and application of formal methods for specification and verification of safety-critical systems. Recent work includes reliability and security issues of cyber-physical systems. She is member of the ERCIM Working Group on Formal Methods for Industrial Critical Systems (FMICS) and of the IEEE SMC (Systems, Man, and CyberneticsSociety) Technical Committee on Homeland Security, and in the Editorial Boards of the Journal of Computer Virology and Hacking Techniques, and of the Journal of Critical Computer-Based Systems.

Anna Becchi

Anna Becchi is a master student of the University of Udine and research assistant in the Embedded Systems Unit in FBK. After receiving her undergraduate degree at the University of Parma with a thesis on Not Necessarily Closed Polyhedra, she continued to work with her former supervisor Enea Zaffanella, developing PPLite, a new library for polyhedral computation: this has been used to address static analysis tasks and verification of hybrid systems. Recently she received the Radhia Cousot Young Researcher Best Paper Award for the paper "Revisiting Polyhedral Analysis for Hybrid Systems" presented at the 26th International Static Analysis Symposium (SAS 2019).

Tiziano Villa

Tiziano Villa received a B.A. in Mathematics from the State University of Milano (Italy) and took the Mathematical Tripos Part III at the University of Cambdrige (UK). In 1995 he received a Ph.D. in Electrical Engineering and Computer Sciences from the University of California, Berkeley (USA). From 1980 to 1985 he was a computer-aided design specialist at the Integrated Circuits Division of CSELT Laboratories (Torino, Italy), and from 1986 to 1996 he was a research assistant at the Electronics Research Laboratory, University of California, Berkeley (USA). From 1997 to 2002 he worked as a research scientist at the PARADES Laboratories (Roma, Italy). In November 2002 he joined the University of Udine (Italy) as an associate professor at DIEGM (Department of Electrical, Industrial and Mechanical Engineering). Since October 2006 he is a professor with the Department of Computer Science (DI, Dipartimento d'Informatica), University of Verona (Italy). His research interests are in computer-aided design of electronic systems, with emphasis on logic synthesis and Boolean methods, on formal methods for the analysis and synthesis of cyberphysical systems, on automata theory and models of computation, on discrete event systems and supervisory control. He served in the technical program committees of various conferences, including ICCAD, DATE, DAC, ASPDAC, HSCC (Hybrid Systems: Control and Computation), IWLS (International Workshop on Logic and Synthesis), GandALF (International Symposium on Games, Automata, Logics and Formal Verification). He co-authored many papers in journals and refereed conferences, and the books "Synthesis of FSMs: Functional Optimization" (Kluwer/Springer, 1997, reprint 2010), "Synthesis of FSMs: Logic Optimization" (Kluwer/Springer, 1997, reprint 2012), and "The Unknown Component Problem: Theory and Applications" (Springer, 2012). Tiziano Villa was awarded the Tong Leong Lim Pre-doctoral Prize at the EECS Department, University of California, Berkeley, in May 1991.

Massimo Benerecetti

Massimo Benerecetti is Associate Professor in Computer Science at the Department of Electrical Engineering and Information Technologies of the University of Naples "Federico II". His research activity in Formal Verification has focused primarily on specification languages, computational logic, model-checking and synthesis for discrete and hybrid systems.