

modeling and control of hybrid systems

lecturers

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objective

Recent technological innovations have caused a considerable interest in the study of dynamical processes of a mixed continuous and discrete nature. Such processes are called hybrid systems and are characterized by the interaction of time-continuous models (governed by differential or difference equations) on the one hand, and logic rules and discrete-event systems (described by, e.g., automata, finite state machines, etc.) on the other. A hybrid system also arises in practice when continuous physical processes are controlled via embedded software that intrinsically has a finite number of states only (e.g., on/off control). This course will offer a brief overview of the field of hybrid systems ranging from modeling, over analysis and simulation, to verification and control. We will particularly focus on modeling, analysis, and control of tractable classes of hybrid systems.

contents

1. General introduction. Examples of hybrid systems & motivation. Modeling frameworks (automata, hybrid automata, piecewise-affine systems, complementarity systems, mixed logic dynamical systems, ...);
2. Properties and analysis of hybrid systems (well-posedness, Zeno behavior, stability, liveness, safety, ...);
3. Control of hybrid systems (switching controllers, model predictive control, ...);
4. Control of hybrid systems (continued). Verification. Tools.

lecture notes

B. De Schutter and W.P.M.H. Heemels, "Modeling and Control of Hybrid Systems", Lecture Notes for the DISC Course. Revised edition 2014. These lecture notes will be made available electronically.

prerequisites

Basic undergraduate courses in systems and control.
Basic programming skills (Matlab).

homework assignments

Three homework assignments will be handed out. The assignments will be graded and the average grade will be the final grade for this course.

course website

http://www.dcsc.tudelft.nl/~disc_hs/course/