modelling 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 continuous-time 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 to model so called cyber-physical systems, e.g. when continuous physical processes are controlled via embedded software that intrinsically has a finite number of states only (e.g., on/off control).

contents

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

course materials

B. De Schutter and W.P.M.H. Heemels, "Modelling and Control of Hybrid Systems", Lecture Notes for the DISC Course. Revised edition. 2016.
These lecture notes will be made available electronically.
Course website: https://mmazojr.3me.tudelft.nl/teaching/DISC_hs

prerequisites

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

homework assignments

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