Institut für Systemtheorie und Regelungstechnik
Universität Stuttgart

Open Thesis (MA)

Event-based adaptive control: theory and applications

Description:

In a recent work, we developed a new control algorithm for the stabilization of discrete-time linear *time-varying* systems that does not require a-priori knowledge of the system evolution across time. The *online controller* for this task is defined as a linear state-feedback law whose gain is adapted to the plant changes in an event-based fashion using update rules inspired by event-triggered control. The novelty of the approach consists of using measured data to establish both *how* and *when* a new controller should be designed. The design and analysis of the controller leverages recent results from data-driven control and advanced nonlinear control tools. Specifically, the analysis of the adaptive feedback interconnection is based on hybrid systems and Lyapunov theories, which allow closed-loop guarantees for the interconnection to be studied.

The student will first familiarize with the relevant literature, and then work on one or more extensions that can be chosen during the project from the following (non-exhaustive) list:
* richer policy class beyond linear state-feedback
* nonlinear (time-invariant and possibly time-variant) plants
* different objectives than stabilization (e.g. optimal operation)
The project can also focus more on the application side and investigate implementation on promising engineering problems (e.g. transportation systems, energy infrastructures) with the goal of demonstrating prospective advantages of event-based adaptation with realistic simulation scenarios.

Prerequisites:

- *Concepts of Automatic Control* or similar
- Preferably advanced control courses, such as *Nonlinear control, Robust control*
- Interest in studying rigorous adaptive control mechanisms to enable autonomous systems

Supervisor:

Andrea Iannelli
Room 2.244

Area:

Adaptive control
Learning-based Control
Nonlinear control

Properties:

Type: **MA**

20% literature
50% theory
30% simulation

The project can also have more applied emphasis depending on the candidate's preference.

Beginning:

anytime

Further information: http://www.ist.uni-stuttgart.de/teaching/bama