



Universität Stuttgart

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**Kolloquium
Technische
Kybernetik**

Einladung zum Vortrag im Kolloquium Technische Kybernetik

Interplay between linear integral and discontinuous relay feedback: challenging issue for standard PI/PID controllers in presence of Coulomb friction

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Institut für Systemdynamik – Seminarraum 1.01

Waldburgstraße 19 – Stuttgart-Vaihingen

Abstract

We consider linear time invariant system plants with an unbounded integral control action and discontinuous relay in feedback. Examples for that are the standard PI/PID controllers, widely used in various types of robotic and mechatronic systems. Inherent challenge of a discontinuous relay feedback can be directly associated with presence of the Coulomb friction and mechanical setups, that downgrades the convergence performance of motion control systems for set-point stabilization tasks. Other application examples in which a relay non-linearity in the loop represents part of the plant dynamics are also conceivable. As a matter of fact, a slowly converging stick-slip behavior with continuously growing periods appears in such systems, owing to an interplay between the integral feedback and relay nonlinearity. In this talk, we will look into analysis of the convergence behavior and highlight the appearance of sticking phases and set of possible trajectories in vicinity to the globally stable equilibrium and associated region of attraction. A novel solution to convergence analysis of such systems, based on the classical sliding mode principles, will be presented. Some aspects of estimating upper bound of the convergence time will also be treated at the edge. The talk will also include several motivating numerical examples and experimental observations known from the other published works.

CV:

Michael Ruderman received his Diploma degree in computer and electrical engineering from TU Dortmund, Germany, in 2005 and his PhD degree from the Faculty of Electrical Engineering and Information Technology of TU Dortmund in 2012. After positions as Associate professor at Nagoya Institute of Technology and Nagaoka University of Technology, Japan, he changed to the University of Agder, Norway, in 2015 as Associate Professor and holds the position of Full Professor there since 2020.

He is a member of several Editorial Boards and Committees of renowned scientific journals. From 2017 to 2022 he was a Marie Skłodowska-Curie fellow.

His main research interests are motion control, robotics and mechatronics, nonlinear systems with memory, hybrid and robust control.