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VORTRAGSANKÜNDIGUNG

Im Rahmen unseres gemeinsamen Oberseminars

„Numerische Mathematik, Optimierung und Dynamische Systeme“

spricht

Prof. Boris Houska, ShanghaiTech University, China

am Donnerstag, 20.07.2023 um 09:00 Uhr im Raum S 80, Gebäude NW II

über das Thema

**"Recent Advances in Optimal- and Model Predictive Control:
Theory and Algorithms"**

Abstract. Optimal- and model predictive control theory and numerical algorithms for constrained linear control systems have reached a high level of maturity. This is in contrast to both optimal control algorithms for nonlinear systems as well as general systems with structural, bounded, or stochastic uncertainties. For such systems one often has to tradeoff between the numerical accuracy and the computational run-time of the optimal- or robust control algorithm. Therefore, the first part of this talk reviews recent algorithmic solutions for robust control with a strong focus on set-theoretic computing methods. We discuss both the most recent approaches on applying dissipativity theory for analyzing the stability of robust and stochastic model predictive controllers [1,2] as well as modern polytopic computing methods for implementing and tuning robust control algorithms [2]. Moreover, the second part of this talk focuses on reformulating and analyzing nonlinear control systems by using modern methods from the field of PDE-constrained optimization and control. We aim at an overview of recent advances regarding the development of efficient algorithms for nonlinear optimal control based on Koopman operators [4] as well as Fokker-Plank-Kolmogorov operators [5]. The talk concludes with an assessment of the state of the art and highlights important avenues for future research..

Selected References:

- [1] M.E. Villanueva, E. De Lazzari, M.A. Müller, B. Houska. A set-theoretic generalization of dissipativity with applications in Tube MPC. *Automatica*, Volume 122:109179, 2020.
- [2] F. Wu, M.E. Villanueva, B. Houska. Ambiguity tube MPC. *Automatica*, Volume 146:110648, 2022.
- [3] M.E. Villanueva, M.A. Müller, B. Houska. Configuration-constrained tube MPC. *Automatica*, 2023. (provisionally accepted; preprint at <https://arxiv.org/abs/2208.12554>)
- [4] M.E. Villanueva, C.N. Jones, B. Houska. Towards global optimal control via Koopman lifts. *Automatica*, Volume 132:109610, 2021.
- [5] B. Houska. Convex operator-theoretic methods in stochastic control, <https://arxiv.org/abs/2305.17628>, 2023. (submitted to *Automatica*)

gez. Lars Grüne