Advanced Topics in Systems and Control

Lectures and Short Courses

online, by Jiangsu University of Science and Technology

November/December 2023

Advanced Topics in Systems and Control

Location	online, hosted by *Jiangsu University of Science and Technology*
Dates	November/December 2023
Times	08:00–12:00 / 15:00–19:00 (Berlin / Beijing time)
Organizer	Jan Heiland (MPI Magdeburg, Germany), Pengfei Zhi (JSUST, Jiang Su, China)
Audience	Open for everyone, designed for Master Students of *Automation* and *Electrical Engineering*
Speaker	Jan Heiland, Timm Faulwasser, Ion Victor Gosea, Matthias Voigt, Karl Worthmann, Enrique Zuazua

Sounds interesting? Subscribe to our :envelope: **mailing list** :envelope: to get a weekly summary of the upcoming topics, to be informed about changes, and to get access links to supporting material

Zoom details: Meeting ID: 673 6265 8571 – Passcode: 055966

Schedule

Nov 20–24 – Introductory Research Talks

A session of talks that introduces the speakers, one of their research topics, and gives an outlook on their lectures.

Date	German Time	Chinese Time	Topic	Speaker	Link
Thursday, Nov 23	08:00 (CET)	15:00 (CST)	eDMD-based predictive control in the Koopman framework with guarantees	Karl Worth-mann	
Thursday, Nov 23	08:50 (CET)	15:50 (CST)	A Historical Introduction to Control and Machine Learning	Enrique Zuazua	
Thursday, Nov 23	09:40 (CET)	16:40 (CST)	Optimization-Based Methods in Model Reduction and Control of Port-Hamiltonian Systems	Matthias Voigt	
Friday, Nov 24	08:00 (CET)	15:00 (CST)	LPV Approximations for Efficient Nonlinear Feedback Control of Flow Equations	Jan Heiland	
Friday, Nov 24	08:50 (CET)	15:50 (CST)	~~Dissipativity, Optimal Control and MPC~~	~~Timm Faulwasser~~	
Friday, Nov 24	08:50 (CET)	15:50 (CST)	Distributed optimization and control with ALADIN	Boris Houska	
Friday, Nov 24	09:40 (CET)	16:40 (CST)	A novel data-driven reinterpretation of a classical model reduction method: quadrature-based balanced truncation	Ion Victor Gosea	

Nov 27–Dec 01 – Learning, Control and Systems

Date	German Time	Chinese Time	Topic	Speaker	Link
Monday, Nov 27	08:00 (CET)	15:00 (CST)	**L1A**: Introduction to control of finite dimensional systems	Enrique Zuazua	
Monday, Nov 27	08:50 (CET)	15:50 (CST)	**L1B**: Supervised Learning by Control Methods 1	Enrique Zuazua	
Monday, Nov 27	09:40 (CET)	16:40 (CST)	**L1C**: Supervised Learning by Control Methods 2	Enrique Zuazua	
Friday, Dec 01	08:00 (CET)	15:00 (CST)	**L2A**: Linear time-invariant (LTI) systems	Jan Heiland	
Friday, Dec 01	08:50 (CET)	15:50 (CST)	**L2B**: Frequency domain representation of LTI systems	Ion Victor Gosea	
Friday, Dec 01	09:40 (CET)	16:40 (CST)	**L2C**: Frequency domain representation of nonlinear systems	Ion Victor Gosea	
Friday, Dec 01	10:30 (CET)	17:30 (CST)	**Research talk**: Operator Inference with Nonlinear State-space Decodings	Jan Heiland	

Dec 04–08 – (e)DMD and port-Hamiltonian Systems

Date	German Time	Chinese Time	Topic	Speaker	Link
Monday, Dec 04	08:30 (CET)	15:30 (CST)	**L3A**: (e)DMD: introduction	Manuel Schaller	
Monday, Dec 04	09:30 (CET)	16:30 (CST)	**L3B**: eDMD with control	Karl Worth-mann	
Tuesday, Dec 05	10:30 (CET)	17:30 (CST)	**L3C**: kernel-based eDMD	Friedrich Philipp	
Wednesday, Dec 06	07:30 (CET)	14:30 (CST)	**L4A**: Introductory lecture: port-Hamiltonian systems?	Manuel Schaller	
Wednesday, Dec 06	08:30 (CET)	15:30 (CST)	**Research talk**: nonlinear MPC and the mobile robot: Homogeneity is the key.	Karl Worth-mann	
Friday, Dec 08	09:00 (CET)	16:00 (CST)	**L4B**: (optimal) control of pH systems	Friedrich Philipp	
Friday, Dec 08	10:00 (CET)	17:00 (CST)	**L4C**: Adaptive building control	Manuel Schaller	

Dec 11–15 – System Identification, Model Reduction, Data-driven MPC

Date	German Time	Chinese Time	Topic	Speaker	Link
Monday, Dec 11	08:00 (CET)	15:00 (CST)	**L5A**: Introductory Lecture: why is complexity reduction important? Identification vs reduction of dynamical systems - an overview.	Ion Victor Gosea	
Monday, Dec 11	08:50 (CET)	15:50 (CST)	**L5B** Methods in the time domain: SI + RoM	Ion Victor Gosea	
Monday, Dec 11	09:40 (CET)	16:40 (CST)	**L5C** Methods in the frequency domain: SI + RoM	Ion Victor Gosea	
Friday, Dec 15	08:00 (CET)	15:00 (CST)	**L6A**: The fundamental lemma and deterministic data-driven MPC	Philipp Schmitz	
Friday, Dec 15	08:50 (CET)	15:50 (CST)	**L6B**: The stochastic extension to the fundamental lemma	Timm Faulwasser	
Friday, Dec 15	09:40 (CET)	16:40 (CST)	**L6C**: Stochastic data-driven MPC	Timm Faulwasser	

Dec 18–22 – Numerical Methods in Linear Control Theory

Date	German Time	Chinese Time	Topic	Speaker	Link
Monday, Dec 18	09:00 (CET)	16:00 (CST)	**L7A**: The ADI Method for Large-Scale Lyapunov Equations (Idea/Derivation)	Matthias Voigt	
Monday, Dec 18	09:45 (CET)	16:45 (CST)	**L7B**: The ADI Method for Large-Scale Lyapunov Equations (Low-Rank ADI)	Matthias Voigt	
Monday, Dec 18	11:00 (CET)	18:00 (CST)	**L7C**: The ADI Method for Large-Scale Lyapunov Equations (Real Version and Application to BT)	Matthias Voigt	
Friday, Dec 22	08:00 (CET)	15:00 (CST)	**L8A**: Linear time-invariant Systems	Jan Heiland	
Friday, Dec 22	08:50 (CET)	15:50 (CST)	**L8B**: Balanced Realizations and Truncations	Jan Heiland	
Friday, Dec 22	09:40 (CET)	16:40 (CST)	**L8C**: LQG Balanced Truncation	Jan Heiland	
Friday, Dec 22	10:30 (CET)	17:30 (CST)	**Informal Talk**: PhD and Master Opportunities in Germany	Jan Heiland	

> Links for *Study Opportunities in Germany*: English programmes at OVGU – Official agency for applying at German universities – Our math graduate school

Dec 25–Dec 29 – Robust and Nonlinear Control with Linear Methods

Date	German Time	Chinese Time	Topic	Speaker	Link
Monday, Dec 25	08:00 (CET)	15:00 (CST)	**L9A**: Linear-Quadratic Regulator and Riccati	Jan Heiland	Zoom
Monday, Dec 25	08:50 (CET)	15:50 (CST)	**L9B**: H_∞-robust Control	Jan Heiland	Zoom
Monday, Dec 25	09:40 (CET)	16:40 (CST)	**L9C**: Numerical Solution of Large-scale H_∞ Riccati Equations	Jan Heiland	Zoom
Friday, Dec 29	08:00 (CET)	15:00 (CST)	**L10A**: State-dependent Riccati Equations	Jan Heiland	Zoom
Friday, Dec 29	08:50 (CET)	15:50 (CST)	**L10B**: Linear Parameter-varying Systems	Jan Heiland	Zoom
Friday, Dec 29	09:40 (CET)	16:40 (CST)	**L10C**: Applications in Flow Control	Jan Heiland	Zoom

Lectures and talks (2 Lecture Units)

Speaker Information

Name	Institution	Lectures
Enrique Zuazua	FAU Erlangen-Nuremberg, Erlangen, Germany	L1
Jan Heiland	Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg	L2, L8, L9, L10
Ion Victor Gosea	Max Planck Institute for Dynamics of Complex Technical Systems, Magdeburg	L2, L5
Karl Worthmann	TU Ilmenau, Ilmenau, Germany	L3, L4
Matthias Voigt	FernUni Schweiz, Switzerland	L7
Timm Faulwasser	TU Dortmund, Dortmund	L6