

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

**DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING**

Seminar announcement

Thursday 5 Dicembre 2024, Time: 13:30 – 14:30

Seminar Room, Floor 1, Building 3, DIETI - Via Claudio, 21 - NAPOLI



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Shaping robustly control loop: look into stability margins & uncertainties

Abstract: The design of feedback control today benefits simultaneously from different paradigms when considering dynamic systems (plants and controllers) in terms of the mathematical structure, parameters and states, and (perhaps most important for the applications) in formulating stability and performance criteria for an appropriate operation. Apart from the well-established and widely used state-space methodologies, energy shaping and power-port system concepts, Lyapunov based analysis and design, the signal-processing viewpoint with the corresponding norms and transfer functions, remains still one of the most common control design techniques. Having the roots and origins in electrical circuits, this signal processing perspective enjoys a wide acceptance in engineering practice and is often interpreted as analysis and design in frequency

domain, with the corresponding use of Laplace and Fourier transformations and frequency response functions. Control loop shaping and the so-called sensitivity functions play here always one of the most important roles for robustness and performance when designing feedback controllers for a given (nominal) input-output system representation. This seminar talk is dedicated to the loop shaping with aspects of robustness in view of the system uncertainties, and even varying structures in the interaction of a system plant with its environment. First, some basic loop shaping criteria and formalisms will be recalled. Then, an illustrative case study of a reshaped motion- and impedance-control will be shown along with the experimental results for a robust and stable contact transition in unforeseen and contact-critical environmental conditions.

Lecturer short bio: *Michael Ruderman received Dr.-Ing. degree at TU-Dortmund, Germany, in 2012, and after holding different academic positions in Germany and Japan he is recently a Full Professor at University of Agder (UiA), Norway. He serves, correspondingly served, on several editorial boards and technical committees, including being Technical Editor of IEEE/ASME TMECH in 2019-2020, in Management Committee of IEEE/ASME TMECH in 2020-2023, Associate Editor of IFAC Mechatronics since 2015, Associate Editor of IFAC Control Engineering Practice since 2024, Associate Editor of IEEE Transactions on Control Systems Technology since 2025, and Member of Executive Committee of TC VSSMC of IEEE-CSS since 2018. He was/is Technical Program Co-Chair of IEEE AMC2018, ICM2019, ICM2021, AMC2022, AMC2024, and ICM2025, and he was General Chair of IEEE AMC2020 and ICM2023 conferences. He chaired the IEEE-IES TC on Motion Control in 2018-2019 and 2020-2021 terms and was IEEE-IES AdCom member until 2023. His current research interests are in motion control, robust and hybrid control, mechatronics and robotics, and nonlinear dynamic systems.*

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