UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

PHD PROGRAM IN
INFORMATION AND TECHNOLOGY FOR HEALTH

PHD PROGRAM IN INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Seminar announcement

Wednesday 17 June 2026, Time: 11:00 - 13:00
Room I1, Floor 1, Building 3, DIETI - Via Claudio, 21 - NAPOLI

Dr. G. Lloyds Raja

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Model-Based Industrial Controllers Design for Time-Delay Processes: Challenges, Applications, and Recent Trends

Abstract: Many industrial plants such as chemical systems, networked control systems, pneumatic and hydraulic operations, rolling mills, distillation columns, heat exchangers, nuclear reactors, etc. are modeled as time-delay systems. Due to parametric uncertainties and disturbances, the aforementioned systems must be effectively controlled to track references and reject disturbances to achieve robust oscillation-free stable closed-loop performance. This lecture presents a systematic and engineering-oriented approach to simple model-based controllers design with particular emphasis on PI and PID structures (e.g., for voltage control in DC-DC Boost converters/pressure control in biomedical suction devices). Widely used process representations of stable, unstable, and integrating types are introduced. These models are interpreted not merely mathematically, but from a physical and engineering standpoint. Classical yet powerful design frameworks such as direct synthesis and internal model control are introduced. Attention is given to how tuning parameters influence setpoint tracking, disturbance rejection, control smoothness, sensitivity to model uncertainty and stability margins. Through simulation studies and results obtained through hardware validation, the lecture demonstrates the fundamental trade-off between performance and robustness in processes with delay. Towards the end, the discussion is extended to multivariable processes with delay, laying a practical foundation for robust controller deployment in process industries, power systems, and energy conversion applications.

Lecturer short bio: Dr. G. Lloyds Raja is Assistant Professor (Grade-I) in Electrical Engineering at the National Institute of Technology Patna, India. He earned his Ph.D. from Indian Institute of Technology Patna and was a Postdoctoral Research Fellow at Shanghai Jiao Tong University. His research focuses on model-based control of processes with time-delay of integrating and unstable type, with applications in biomedical, power electronics, and modern power systems. He has authored over 50 peer-reviewed journal articles in leading international journals, including IEEE Transactions, ISA Transactions, Applied Energy, and Chemical Engineering Science. He is a Co-Editor of three books related to industrial controllers and is listed among Stanford University's Top 2% Scientists (2024 and 2025). He has successfully supervised many doctoral dissertations and multiple students at graduate/post-graduate level. Dr. Raja is also an inventor with multiple granted patents in control systems, biomedical devices, and cyber-resilient frequency regulation in power systems.

For information: Prof. Laura Celentano – laura.celentano@unina.it *(organizer)*