

Special Session Proposal for the Polish Control Conference 2026

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Session title: “Active Disturbance Rejection Control (ADRC): Between Principles and Practice”

Abstract:

At the heart of any control architecture lies the capability to regulate key attributes of a dynamic system, whether engineered or natural. Within this broad and profoundly impactful domain, Active Disturbance Rejection Control (ADRC) has reshaped the relationship between control theory and practice by reframing the core design challenge. ADRC is built on two foundational principles: real-time estimation of the *total disturbance*—the combined effect of unknown dynamics and external perturbations—and its subsequent online compensation. This perspective leads to a streamlined controller design, where feedback is applied to an effectively disturbance-free nominal model, emphasizing performance without reliance on high-fidelity plant knowledge. The seminal development of bandwidth-based parameterization more than two decades ago established a critical bridge between ADRC theory and classical frequency-domain engineering practice. In hindsight, this advancement enabled ADRC to transition from conceptual novelty to practical methodology—widely adopted in industry, actively investigated in research, and increasingly embedded in academic education. ADRC has since evolved into not only a control scheme, but a framework for thinking about uncertainty, modeling, and robustness. This special session aims to capture the next stage of this evolution. By bringing together contributions that advance ADRC principles, explore new frequency-domain and time-domain interpretations, and address emerging challenges in modern applications, the session seeks to highlight new connections: between theory and implementation, understanding and engineering action, and foundational concepts and their contemporary extensions.

Description:

This special session aims to bring together experts to discuss the latest advancements, challenges, and opportunities in ADRC. Topics include, but are not limited to:

- interpretations and reformulations of ADRC
- theoretical foundations and analysis
- practical implementation and real-time deployment
- emerging and cross-domain applications
- ADRC for nonlinear and complex dynamical systems
- ADRC in the context of Industry 4.0
- comparative insights with other control paradigms