



IEEE Control Systems Society Presents



# Workshop on Active Disturbance Rejection Control

Organizers: Zhiqiang Gao and Lili Dong  
Center for Advanced Control Technologies, Cleveland State University

Aug. 10-11, 2017, 9:00 am - 4:30 pm; Location: Fenn Hall 325, Cleveland State University

## Session I: Principles and Methodologies

Aug. 10<sup>th</sup>, 9:00 am to 12:00pm

Panel: Drs Zhiqiang Gao, Lili Dong, Baozhu Guo, Xuejun Wang, YangQuan Chen, Zhongsheng Hou

**Description:** There are three parts to this sessions: 1) a critical reflection on the foundation of automatic control and the exposition of the history and principles of a different paradigm, symbolized by ADRC; 2) the methods of estimating internal and external disturbances, with or without a model of the physical process; 3) the impacts of ADRC in asking a different set of questions in research and in creating a disruptive technology in industrial control.

## Session II: Technologies and Applications

Aug. 10<sup>th</sup>, 1:30 pm to 4:30pm

Panel: Drs Jianbo Su, Wen Tan, Zhiqiang Pu, Peng Yan, Zhen Zhang, Kang Song

**Description:** ADRC as originally proposed by J. Han has three components: tracking differentiator, nonlinear feedback control, and nonlinear extended state observer. The combination of the three proves to be a powerful tool for disturbance rejection control. As an industrial control technology, however, it has been streamlined, simplified and parameterized so that it can be easily deployed across various hardware-software platforms and easily tuned by factory personnel, leading to explosive growth in its applications that transcend engineering disciplines. In this session we show how this is accomplished and how an advanced principle is married into a domain of engineering applications that often leads to an order of magnitude improvement. Most importantly, it will be shown that the key in application of ADRC is the reformulation of the control problem as that of disturbance rejection, as shown in applications in several key technology areas such as internal combustion, power generation, space applications, aeronautics, process control, and high energy physics.

## Session III: Theoretical Investigations

Aug. 11<sup>th</sup>, 9:00 am to 12:00pm

Panel: Drs Zhiliang Zhao, Wenchao Xue, Qing Zheng, Huiyu Jin, Sally Shao, Lei Wang, Ruiqing Zhang

**Description:** This session is designed to answer critical questions about the theoretical foundation of ADRC and stability. It will be shown that rigorous mathematical proof has been recently established in all three parts of Han's theory: tracking differentiator, nonlinear ESO and nonlinear feedback. For practitioners familiar with the language of frequency response, the bandwidth of the observer and of the control loop is analytically related to the tracking error. Frequency response of a typical ADRC loop is shown to have unsurpassed quality in robustness of performance and stability. The fascinating questions is where do we go from here to develop another kind of control theory: the theory of disturbance rejection? Initial principles and methods are examined. The structural outlook of a reconstructed control theory is presented in the context of active disturbance rejection.

## Session IV: Open Problems and Research Directions

Aug. 11<sup>th</sup>, 1:30 pm to 4:30pm

Graduate students present their research problems, solutions, or both. Workshop attendants present their preliminary findings, based on what they learnt at the Workshop, and future work. More discussions and interactions.

**RSVP or additional information: Dr. Lili Dong, [L.Dong34@csuohio.edu](mailto:L.Dong34@csuohio.edu), or 216-687-5312**

**CPD: One credit available for each hour of presentation seat time (Maximum of 10 hours available).  
Bring your flyer for credit.**

**This is to certify that \_\_\_\_\_ attended this workshop and earned \_\_\_ CPD hours. Certified by \_\_\_\_\_.**  
**Certificates of attendance and other evidence of CPD activity should be retained by the attendee for auditing purposes.**