

学术报告



Model-based Controller Design Approaches For Chemical Processes with Complex Dynamics



报告人: Prof. Antonios Armaou
Chemical Engineering Department,
Pennsylvania State University, USA

时间: 7月24日 星期五 11:00 AM
地点: 浙江大学工控新楼105室
联系人: 倪 东 电话: 87952771

Abstract:

Many industrially relevant chemical processes exhibit complex dynamic behavior. Typical examples include plug flow, fluidized-bed and packed-bed reactors in chemical industry; rapid thermal, plasma and chemical vapor deposition reactors in microelectronics industry. A common trait is that the states vary dynamically in time and space due to coupled transport mechanisms and chemical reactions (even when neglecting particle behavior). With ever-tighter requirements on process operation, the problem of feedback control becomes complicated since we now need to account for this relationship between actuation and control output.

To address the control problem, we embark on the design of model-based controllers to better predict process behavior. In this endeavor, constitutive equations (either first-principals or phenomenological) are employed; but they come at the cost of high computation. We will first focus on the development of methods for computational acceleration of the needed calculations and the derivation of low-order model that are specifically tailored for controller and observer design. We will then synthesize advanced output feedback controller and observer pairs that can successfully control the chemical process. We illustrate the effectiveness of the proposed approaches through representative examples of CSTR and diffusion-reaction catalytic processes.

Biography:

Antonios Armaou was born in Athens, Greece. He received the Diploma in Chemical Engineering from the National Technical University of Athens, Greece, in 1996, and the Ph.D. in Chemical Engineering from the University of California, Los Angeles, in 2001. He is currently an associate professor of the Chemical Engineering department at Pennsylvania State University. He is also a visiting scholar at Wenzhou University with the Mechanical And Electrical Engineering department. He has received numerous awards including twice the O. Hugo Schuck Best Paper Award given by the American Automatic Control Council in 2000 and 2014, awards by the American Chemical Society-Petroleum Research Fund and the National Science Foundation; he has also received the High-end Foreign Experts Program, Chinese national fund award in 2015 and 2014 and the Thousand Foreign Talents Program, Zhejiang Provincial award in 2014. He is a reviewer for the NSF, DoE, ERC and ESF and a member of the Editorial Advisory Board for Industrial & Engineering Chemistry Research, and of the Steering committee of IEEE-CSS healthcare and medical systems and distributed parameter systems groups. He is currently an IEEE and AIChE senior member and a SIAM member.

His research interests lie on model order reduction (MOR) approaches, optimization and control algorithms. Open questions on HIV infection and tumor growth, and advanced materials processing and nanofabrication motivate his interests. The mathematical descriptions of these complex chemical and biomedical dynamic processes form the foundation for his work.

浙江大学 工业控制研究所