Controls in Coupled PDE-ODE Systems

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Abstract

Numerous physical systems are governed by partial differential equations (PDEs), such as battery management systems, water management systems, additive manufacturing systems and multi-agent systems. Over the past two decades, a continuum version of the backstepping approach has emerged and been applied to PDE-modeled control problems. This talk will first present the backstepping control design to stabilize a coupled PDE-ODE system. Then, two control results of coupled PDE-ODE systems will be briefly introduced, using backstepping. The first result is on improving state-of-charge estimation accuracy in lithium-ion batteries, which is important in electrified transportation and energy storage systems. The second one is on exponential anti-collocated regulation of the disturbed cage in a wave PDE-modeled ascending cable elevator. Based on resemblance in the systems, the control algorithm can also be used for the stick-slip oscillation suppression in deep offshore oil drilling process.

Bio

Shu-Xia Tang received her Ph.D. in Mechanical Engineering in 2016 from the Department of Mechanical & Aerospace Engineering, University of California, San Diego, USA. She is currently a postdoctoral research fellow at the Department of Civil and Environmental Engineering, University of California, Berkeley, USA and Inria Sophia Antipolis - Méditerranée, France. Her main research interests are stability analysis, estimation and control design of distributed parameter systems.