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Model-Free control theory and application based on the uncertainty and disturbance estimator

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ABSTRACT:

Many systems have unknown dynamics, modeling errors, and various sorts of disturbances, and noise. “Building reliable systems from unreliable parts” is one of the key challenges facing the field of control. In this talk, the speaker will present her research on model-free control to deal with uncertainties and disturbances, focusing on her recent work on uncertainty and disturbance estimator (UDE)-based control to provide the flexibility and performance of advanced control methodologies with the conceptual simplicity of classical proportional-integral-derivative control. Two practical applications, including hysteresis accommodation on a piezoelectric-driven nanopositioning stage and the full degree-of-freedom control of a quadrotor platform under extreme conditions, will be presented to demonstrate the effectiveness of the proposed method. At the end of this talk, the overview of her other research projects, including station keeping and vibration control of marine mooring systems, positioning of marine installation systems in harsh ocean environments, laser pulse shaping for optimization of energy gains in laser systems for photolithography, and control of power electronics in smart grid integration will be covered.

BIOGRAPHY:

Dr Beibei Ren received her B. Eng. and M. Eng. degrees in Mechatronics Engineering from Xidian University, Xi’an, China, in 2001 and in 2004, respectively, and her Ph.D. degree in Electrical and Computer Engineering from the National University of Singapore, Singapore, in 2010. She was a research fellow at the Center for Offshore Research and Engineering, National University of Singapore, Singapore in 2010 and a postdoctoral scholar in the Department of Mechanical & Aerospace Engineering, University of California, San Diego, CA, USA from 2010 to 2013.She joined the Department of Mechanical Engineering,Texas Tech University, Lubbock, TX, USA,in 2013, as an Assistant Professor.She has published one research monograph “Modeling, Control and Coordination of Helicopter Systems” withSpringer, and about50 research papers in scientific journals and international conferences. Her main research interests include nonlinear systems, adaptive control, neural networks, distributed parameter systems, extremum seeking and their applications to helicopter systems, MEMS, laser systems, marine/offshore systems, wind energy systems and smart grid integration.