Safe and Efficient Reinforcement Learning for Energy Systems

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Abstract: Inverter-based resources such as solar and storage provide us with more flexibility in the control of power systems. Through their power electronic interfaces, complex control functions can be implemented to quickly respond to changes in the system. Recently, reinforcement learning has emerged as a popular method to find these nonlinear controllers. The key challenge with a learning-based approach is that stability and safety constraints are difficult to enforce on the learned controllers. In this talk, we show how model-based control theory can be used as useful constraints on reinforcement learning, allowing us to explicitly engineer the structure of neural network controllers such that they guarantee system stability. The resulting controllers only use local information and outperform conventional droop as well as strategies learned purely by using reinforcement learning.

Bio: Baosen Zhang is the Keith & Nancy Rattie Endowed Career Development Professor in the Department of Electrical and Computer Engineering at the University of Washington. He received his undergraduate degree in engineering science from the University of Toronto in 2008; and the Ph.D. degree in Electrical Engineering and Computer Science from the University of California at Berkeley in 2013. Before joining UW, he was a postdoctoral scholar at Stanford University. He has received the NSF CAREER Award, as well as a number of best paper awards.