UCF | Electrical and Computer Engineering

Fall 2018 Seminar Series

Flexible Microgrids for Stand-Alone and Grid-Connected Applications

WEDNESDAY, NOVEMBER 14, 2018

11:00AM – R1 101A

(Research Building 1)

Introduction of vast amounts of renewable generation makes it feasible for distribution grids to operate in autonomous regime. Such a system being able to function in a controlled mode both grid connected and autonomous is said to be a microgrid. Power electronics interfaces for both loads and generators (through AC inverters) make a microgrid application even more attractive due to their flexibility. In the present talk, I will cover the main aspects of dynamics and control of inverter-based microgrids, explicitly making a comparison to conventional, machine-based, power grids. I will demonstrate, that such microgrids exhibit a behavior distinctly different from large-scale power systems, unexpectedly losing stability in a very wide range of control settings and I will provide a physical reasoning for that. A special procedure of microgrid dynamic model order reduction will be presented, which elegantly uncovers the main causes of instabilities and reasons for the inadequacy of conventionally used approximations. Based on developed models I will present a method allowing to formulate stability conditions as a set of fully decentralized constraints – each containing only the settings of neighboring inverters. Finally, I will present an approach for developing standards for inverter connections which can guarantee stable operation for arbitrary networks.

Petr Vorobev

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Petr Vorobev received his Ph.D. degree in 2010 from Landau Institute for Theoretical Physics, Moscow. Currently, he is a Postdoctoral Associate at the Mechanical Engineering Department of Massachusetts Institute of Technology (MIT), Cambridge. From 2019 he will be an Assistant Professor at Skolkovo Institute of Science and Technology (Skoltech), Moscow, Russia. His research interests include a broad range of topics related to power system dynamics, stability and control. This covers low-frequency oscillations in power systems, dynamics of power system components, multi-timescale approaches to power system modeling, development of plug-and-play control architectures for microgrids.