



Power Systems Engineering Research Center

Architectures and Algorithms for Distributed Generation Control of Inertial-Less AC Microgrids

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Description: This talk discusses the problem of frequency regulation in islanded ac microgrids with no inertia, i.e., those consisting entirely of generators interfaced through power electronics. The control architecture we propose to achieve this is designed to drive the average frequency error to zero while ensuring that the frequency at every bus is equal and that the operating point that results is stable. We also introduce a distributed implementation of the proposed control architecture that relies on a combination of several distributed algorithms. Two of the algorithms, which are well-established consensus-type algorithms, allow the generators and loads to acquire global information needed for making control decisions; the third algorithm, which we propose herein, enables the generators to obtain output values that balance the total demand for load without violating line flow constraints. Collectively, these algorithms eliminate the need for a centralized entity with complete knowledge of the network, its topology, or the capabilities or properties of the generators and loads therein. Moreover, the distributed implementation we propose relies on minimal measurements, requiring only that the power injection at each bus be measured. To verify our proposed control architecture and the algorithms on which its distributed implementation relies, we analytically show that the resulting closed-loop system is stable and establish convergence of our proposed algorithm. We also illustrate the features of the architecture using numerical simulations involving a six-bus networks.

Biography: Alejandro Domínguez-García is an Associate Professor in the Electrical and Computer Engineering Department at the University of Illinois at Urbana-Champaign, where he is affiliated with the Power and Energy Systems area; he also has been a Grainger Associate since August 2011. He is also an Associate Research Professor in the Coordinated Science Laboratory and in the Information Trust Institute, both at the University of Illinois at Urbana-Champaign. Dr. Domínguez-García received the Ph.D. degree in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology, Cambridge, MA, in 2007, and the degree of Electrical Engineer from the University of Oviedo (Spain) in 2001. He received the National Science Foundation CAREER Award in 2010, and the Young Engineer Award from the IEEE Power and Energy Society in 2012. In 2014, he was selected by the University of Illinois at Urbana-Champaign Provost to receive a Distinguished Promotion Award. In 2015, he received the U of I College of Engineering Deans Award for Excellence in Research. He is an editor of the IEEE TRANSACTIONS ON POWER SYSTEMS and the IEEE POWER ENGINEERING LETTERS.