PSERC Power Systems Engineering Research Center

PSERC WEBINAR

Data-driven Coordination of Distributed Energy Resources

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The integration of distributed energy resources (DERs), e.g., rooftop photovoltaics installations, electric energy storage devices, and flexible loads, is becoming prevalent. This integration poses numerous operational challenges on the lower-voltage systems to which the DERs are connected, but also creates new opportunities for provision of grid services. In the first part of the talk, we discuss one such operational challenge – ensuring proper voltage regulation in the distribution network to which DERs are connected. To address this problem, we propose a Volt/VAR control architecture that relies on the proper coordination of conventional voltage regulation devices, e.g., tap changing under load (TCUL) transformers and switched capacitors, and DERs with reactive power provision capability. In the second part of the talk, we discuss one such opportunity – utilizing DERs to provide regulation services to the bulk power grid. To leverage this opportunity, we propose a scheme for coordinating the response of the DERs so that the power injected into the distribution network (to which the DERs are connected) follow some regulation signal provided by the bulk power system operator. Throughout the talk we assume limited knowledge of the particular power system models and develop data-driven methods to learn them. We then utilize these models to design appropriate controls for determining the set-points of DERs (and other assets, e.g., TCULs) in an optimal or nearly-optimal fashion.

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Alejandro Domínguez-García is a Professor in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign, where he is affiliated with the Power and Energy Systems area. Also within ECE Illinois, he is a Research Professor in the Coordinated Science Laboratory and in the Information Trust Institute, and has been a Grainger Associate since 2011, and a William L. Everitt Scholar since 2017. Professor Domínguez-García received the degree of "Ingeniero Industrial" from the University of Oviedo in 2001, and the Ph.D. degree in electrical engineering and computer science from MIT in 2007.

Prof. Domínguez-García received the NSF CAREER Award in 2010, and Young Engineer Award from the IEEE Power and Energy Society in 2012. In 2014, he was invited by the National Academy of Engineering to attend the US Frontiers of Engineering Symposium, and 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 Dean's Award for Excellence in Research. He is currently an associate editor of the IEEE Transactions on Control of Network Systems. He also served as an editor of the IEEE Transactions on Power Systems and IEEE Power Engineering Letters from 2011 to 2017.