Distributed Optimization within Model Predictive Control of Smart Grids

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Abstract
A hierarchical, iterative distributed optimization algorithm is presented. The motivation is the predictive control of a smart grid, in which the states of charge of a network of residential-scale batteries are coordinated so as to minimize variability in the aggregated power supplied to/from the grid by the residential network. The proposed distributed algorithm calls for communication between a central entity and an optimizing agent associated with each battery, but does not require communication between agents. The distributed algorithm is shown to achieve the performance of a large-scale centralized optimization algorithm, but with greatly reduced communication overhead and computational burden. A numerical case study using data from an Australian electricity distribution network is presented to demonstrate the performance of the distributed optimization algorithm.

Biographical Information
Karl Worthmann received the Ph.D. degree in mathematics from University of Bayreuth in 2012. He is an Assistant Professor for Ordinary Differential Equations at Technische Universität Ilmenau. He was a Visiting Scholar at the Lund Center for Control of Complex Engineering Systems, Lund, Sweden. His current research interests include systems and control theory with a particular focus on nonlinear model predictive control and sampled-data systems. Dr. Worthmann was the recipient of the Ph.D. Award from the City of Bayreuth, Germany, and the German National Academic Foundation Scholarship, Germany. He has been appointed Junior Fellow of the Society of Applied Mathematics and Mechanics in 2013.