

Cyber-physical modeling of distributed resources for distribution system operations

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Abstract— Cosimulation platforms are necessary to study the interactions of complex systems integrated in future smart grids. The Virtual Grid Integration Laboratory (VirGIL) is a modular cosimulation platform designed to study interactions between demand-response (DR) strategies, building comfort, communication networks, and power system operation. This paper presents the coupling of power systems, buildings, communications, and control under a master algorithm. There are two objectives: first, to use a modular architecture for VirGIL, based on the functional mockup interface (FMI), where several different modules can be added, exchanged, and tested; and second, to use a commercial power system simulation platform, familiar to power system operators, such as DigSILENT PowerFactory. This will help reduce the barriers to the industry for adopting such platforms, investigate and subsequently deploy DR strategies in their daily operation. VirGIL further introduces the integration of the quantized state system (QSS) methods for simulation in this cosimulation platform. Results on how these systems interact using a real network and consumption data are also presented.

Index Terms— Cosimulation; demand response (DR); DigSILENTPowerFactory; functional mockup interface (FMI); load flow; modelica; OMNeT++

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Citation:

Chatzivasileiadis, S.; Bonvini, M.; Matanza, J.; Yin, R.; Nouidui, T.; Kara, E.C.; Parmar, R.; Lorenzetti, D.; Wetter, M.; Kiliccote, S.; "Cyber-physical modeling of distributed resources for distribution system operations", Proceedings of the IEEE, vol.104, no.4, pp.789-806. April, 2016.