Chul-Sang Hwang, Wanbin Son, Heung-Kwan Choi, Chang-Hee Cho
1 Korea Electrotechnology Research Institute (KERI)

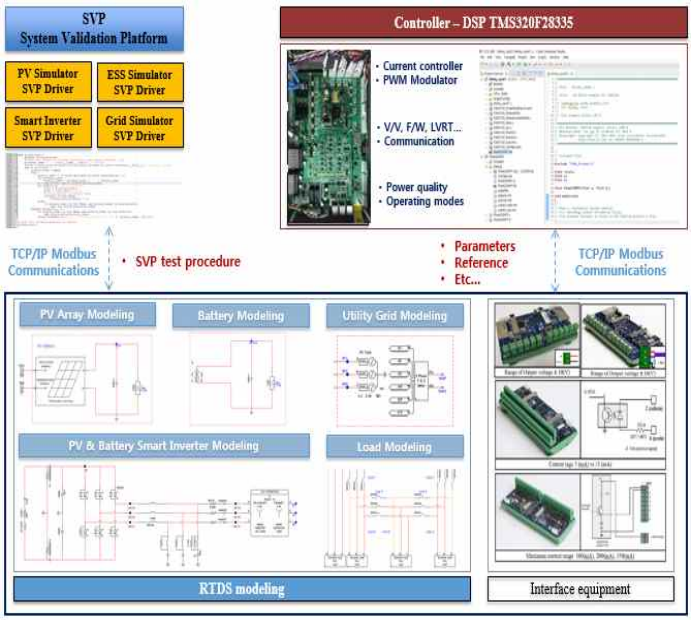
KERI KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE

CONTROLLER HARDWARE-IN-THE-LOOP (CHIL) DESIGN FOR EVALUATING A SMART INVERTER CONTROLLER

IRED 2018
International Conference on Integration of Renewable and Distributed Energy Resources

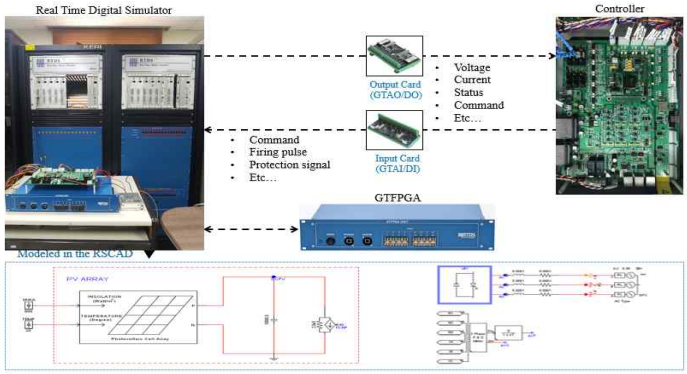
Abstract

The interconnection of Distributed Energy Resources (DER) to the utility grid has raised concerns about communication and interoperability requirements between DER and the system operator. To help the operator meet these requirements, this paper Controller Hardware-in-the-Loop (CHIL) is designed to assist evaluating a smart controller. The CHILS consists of a Real Time Digital Simulator (RTDS), a System Validation Platform (SVP), and a smart inverter controllers. The DER, grid simulator, PV and ESS simulator, as well as the smart inverter, are modeled in RTDS. The SVP is a versatile automated certification platform that allows the test sequences to be scripted through abstraction layers, to test Equipment Under Test (EUT) using the Python programming language. The proposed CHILS method can be effectively utilized to validate and test of smart controller with SVP under the practical environment without a real system.



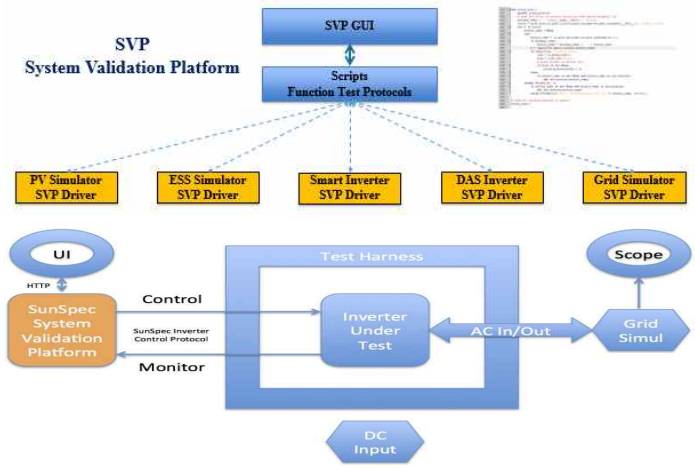
System Configuration

A configuration of CHIL. The RTDS is a fully digital electromagnetic transient power system simulator capable of continuous, sustained real time operation. That is, it can solve the power system equations fast enough to continuously produce output conditions that realistically represent conditions in the real network. The RTDS has been widely accepted as an ideal tool for the design, development and testing of power system protection and control schemes. The CHIL system consists of the PV power generation system model realized by RTDS, real hardware based controller and communication emulator. The PV power generation system model, including PV array, the VSI, a transformer and utility grid is represented by RSCD software and plays a real time simulation. For the simulation, needed interface cards of the RTDS system are a GTIO card for a communication. The DSP receives a synchronization signal from a GTAO card in RTDS. After the control of VSI, DSP will send the PWM signals to a GTDI card in RTDS. The GTAO card and the GTDI card interfaced between the RTDS, magnetic contact switch and the DSP board.



Controller Hardware In-the Loop

The RTDS is a fully digital electromagnetic transient power system simulator capable of continuous, sustained real time operation. That is, it can solve the power system equations fast enough to continuously produce output conditions that realistically represent conditions in the real network. The RTDS has been widely accepted as an ideal tool for the design, development and testing of power system protection and control schemes. The CHIL system consists of the PV power generation system model realized by RTDS, real hardware based controller and communication emulator. The PV power generation system model, including PV array, the VSI, a transformer and utility grid is represented by RSCD software and plays a real time simulation. For the simulation, needed interface cards of the RTDS system are a GTIO card for a communication. The DSP receives a synchronization signal from a GTAO card in RTDS. After the control of VSI, DSP will send the PWM signals to a GTDI card in RTDS. The GTAO card and the GTDI card interfaced between the RTDS, magnetic contact switch and the DSP board.



System Validation Platform

The SunSpec System Validation Platform (SunSpec SVP) provides a framework for automated testing and validating SunSpec compliant devices and applications.

Acknowledgments

This work was supported by the Korea Institute of Energy Technology Evaluation and Planning(KETEP) and the Ministry of Trade, Industry & Energy(MOTIE) of the Republic of Korea (No. 18-02-N0299-14).