Innovation type:
Test framework/method

TRL: 7

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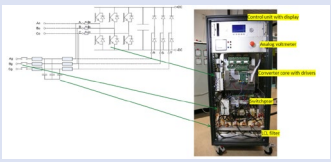
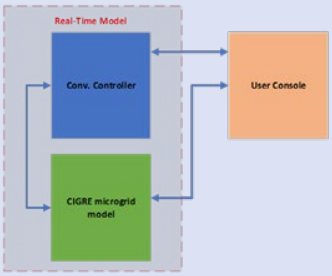
Target group:

Actor/ purpose	x
DSO, TSO	x
Technology provider	x
Member organisation	
Market operator	
Research/ Consultancy	x
Teaching	x





Schematic and physical converters (upper)

Generic structure of the RT-lab environment (lower)

Real-time Power Hardware-in-the-loop microgrid simulation platform

A tool for testing the closed-loop interaction of components in complex power systems. Physical components behavior can be tested in a simulated environment in real-time.

Challenge

Microgrids contain distributed generators (DGs), energy storage systems, controllers and passive loads where the components and controllers have different characteristics. Therefore, the interaction of all these devices and their controllers result in very complex systems where the dynamic performance may be unpredictable.

Solution

Power Hardware-in the loop (P-HIL) is an emerging technique for testing the closed-loop interaction of components in complex power systems. In a P-HIL simulation, a virtual simulated system and actual hardware are coupled together using a real-time simulator plus a power amplifier. This approach offers high flexibility, which can extend the test coverage compared with a prototype or even full-scale testing. Such a facility has been implemented in the Norwegian National Smart Grid Laboratory. A simple implementation that can assess the performance of key hardware, in this case, a power converter, under a realistic but controlled laboratory condition. A report has been prepared to show the benefits of the P-HIL approach, the steps required to perform such an implementation in the National Smart Grid Laboratory, and some simple cases to show the close-loop interaction between actual hardware together with a virtual environment.

Potential

The development gives an opportunity to understand in-depth the potential of doing hardware-in-the loop testing and to test equipment's performance in an internationally recognized test system. This facilitates international collaboration.

Reference in CINELDI

Raymundo E. Torres-Olguin, Tuan T. Nguyen, Santiago Sanchez-Acevedo: "Development of Real-time Power Hardware-in-the-loop microgrid simulation platform", CINELDI Memo, September 2020.