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Simulation Technologies Applicable to Microgrids

R. B. Otto[1], F. P. Silva[1], M. B. do Carmo[1], A. B. Piardi[1] and R. A. Ramos[2]
[1] Itaipu Technological Park (PTI), [2] University of Sao Paulo (USP),
Av. Tancredo Neves 6731, Foz do Iguaçu-Paraná, (Brazil). E-mail: rodrigobueno@pti.org.br

Abstract: The new paradigm of the electric sector, given the increased penetration of distributed generation, includes a growing number of microgrids. Therefore, the implementation of microgrids needs to be preceded by studies and simulations to evaluate the possible scenarios under which these systems will operate. This paper presents an overview of state-of-the-art technologies for microgrid simulation and describes an example implemented at the facility to which the first authors are affiliated.

Key words. Microgrid, Simulation Tools, Real-Time Simulation, Distributed Energy Resources, Hardware-in-the-Loop.

1 INTRODUCTION

The deregulation process of electrical power systems added to the necessities demanded by industrialized economies characterized by the diversification of energy matrix as well as the increasing of the efficiency in the process of generation and transport of electric power, provided the subsidies for the advent of distributed generation and microgrids concepts.

In the context previously presented, in this paper, a brief contextualization of microgrids will be presented, followed by a review of the technologies applicable to the simulation and testing of microgrids. To validate the proposal a microgrid model commonly referenced in the technical literature was modeled on a real-time simulation platform.

2 SIMULATIONS TOOLS

- There are several tools for simulation and analysis of microgrid;
- The increase and importance of microgrids have brought a demand for study tools and sophisticated Hardware-in-the-Loop (HIL) testing;
- The great advantage of the Real-Time Simulator (RTS) platforms is to allow the possibility to interface external devices – usually referenced as Devices Under Test (DUT).

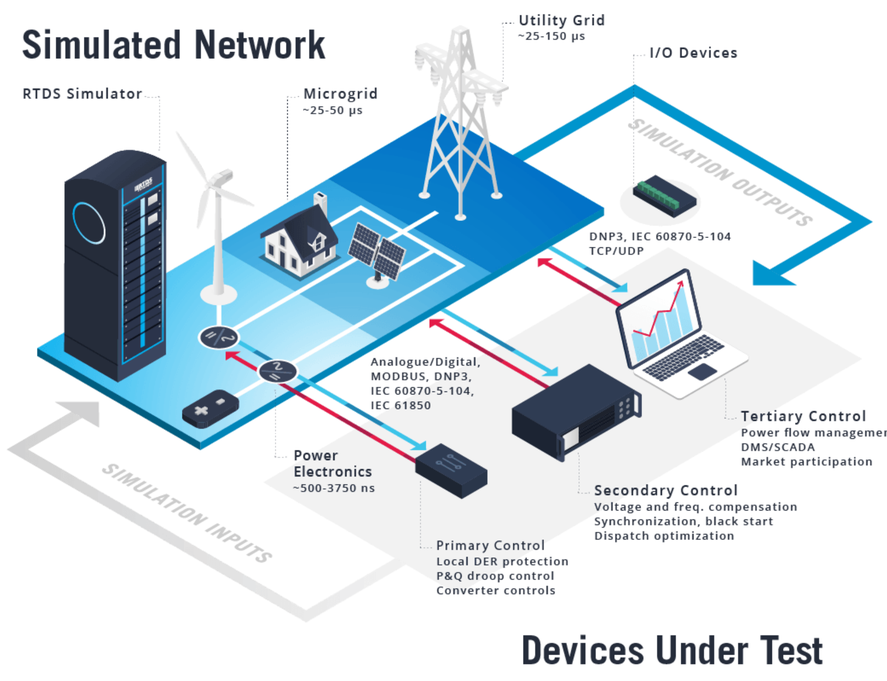

Figure 1. HIL testing of microgrid control systems using RTDS

3 TESTS AND RESULTS

- It was considered that there is an extremely important load connected to bus 11, so this bus was considered the main bar of the system;
- The results of frequency and voltage at bus 11 for the simulated events verified that the microgrid is stable from the viewpoint of simulated events, and the electrical quantities reach adequate values after the perturbations.

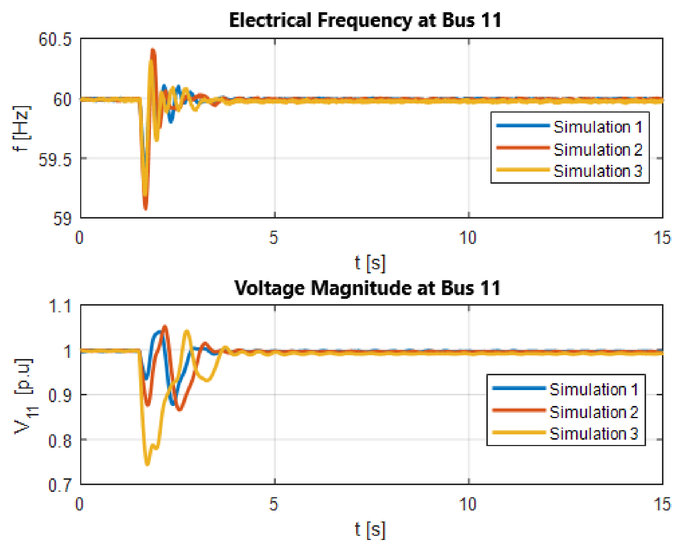

Figure 2. System frequency and voltage at bus 11 for the simulated events

4 CONCLUSION

✓ The complete understanding of the phenomena that permeate the concept of microgrids demands the application of sophisticated analysis tools;

✓ The HIL concept allows equipment to be tested in conditions very close to those found field, with the advantage of analysis flexibility through the possibility of representation of different operational conditions;

✓ The results from the presented case, which correspond to an actual implementation at the facility to which the first authors are affiliated, illustrated the previously mentioned advantages of having a flexible testbed for microgrid simulation.

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