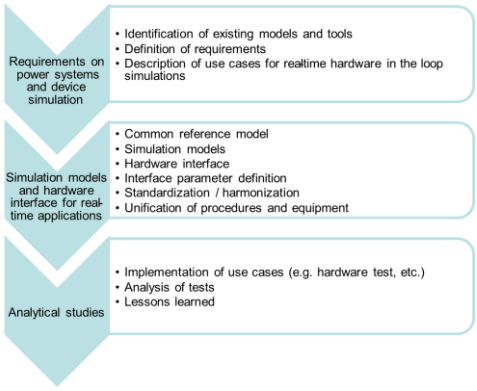
Hardware-in-the-Loop Simulation of Distributed Energy Resources and Power Systems

Tools and methodologies to perform steady-state, dynamic and real-time simulation of distributed energy resources (DER) and power systems

Models

Towards the definition of a Common Reference Model (CRM), i.e. a common standard way of describing models independent of simulation platforms, representative use cases are described in a predesigned format.

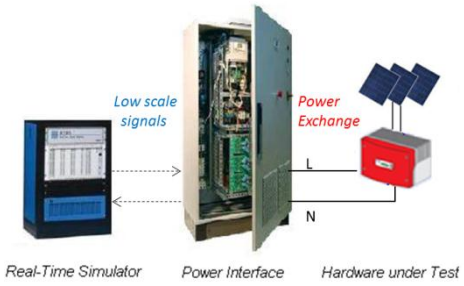


Seven different use cases are selected in order to describe the CRM in the first form, concerning different simulation types that include Real-Time (RT) and Power Hardware-in-the-Loop (PHIL) applications.

Nine validation procedures are presented and two simulation testing methods for real-time, dynamic and steady-state simulations. Although the focus of the validation procedures is on the definition of laboratory steps, modeling is also addressed and obtained results are presented in order to assess the proposed procedures.

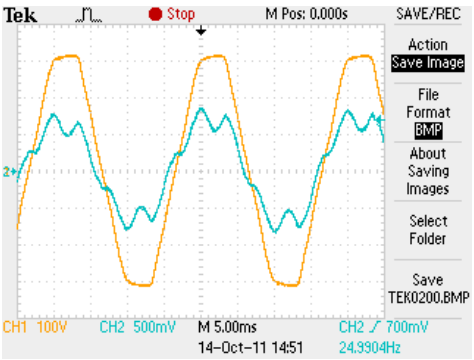
Hardware-Interfaces

Controller Hardware-in-the-Loop (CHIL) and Power Hardware-in-the-Loop (PHIL) simulation are analyzed theoretically and through laboratory experience.



A literature review is performed which provides an overview of both simulation types, highlights the key issues, advantages and challenges and serves as an introduction to the description of the hardware-interfaces section.

The DERri consortium provides facilities that perform HIL experiments focusing on DER. The expertise, experience and progress of the consortium in this approach are demonstrated with the description of HIL applications, focusing on hardware interfaces.



Laboratory procedures, detailed descriptions of HIL topologies (hardware and software), requirements, protection issues and challenges are included.

Therefore, this work presents a broad range of laboratory experiences and aims in assisting the development of other HIL environments.

Get in touch for more information:
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Results:

- *Development of laboratory set-ups for performing real-time Controller-Hardware-in-the-Loop (CHIL) and Power-Hardware-in-the-Loop (PHIL) experiments.*
- *Use cases describing a Common Reference Model concerning different simulation types including real-time PHIL applications.*
- *Validation procedures and simulation testing methods for real-time, dynamic and steady-state simulations.*
- *A broad range of laboratory experience is provided.*

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