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- to empower the future Smart Grid

Smart Power Control in Microgrids with Modern Power Converters

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Challenge and Objectives

Plug-and-play capability is a prominent feature of decentrally controlled microgrids. However, these grids are known to be susceptible to stability issues.

Hence, the main objectives of the research are:

- To develop accurate models for studying low-frequency dynamics.
- To develop control strategies that improve stability margins, while ensuring plug-and-play capability.

Research Tasks

- Establish an accurate, detailed model of a benchmark microgrid.
- To find the dominant factors affecting stability in converter-dominated microgrids.
- To implement the proposed control strategies in experimental setups.

Approach

Enhanced reduced-order models of converters are developed to study fundamental stability properties.

Moreover, power-hardware-in-the-loop (PHIL) experiments are conducted for validating the results, as shown in the figure.

Significant Results

Three conference papers have been published to date. In addition, two journal papers are under review.

The main results include:

- A controller for improving the stability of microgrids based on estimating the system eigenvalues.
- A method for optimally setting harmonic virtual impedances, that takes into account harmonic current sharing between converters while reducing voltage THD.
- A reduced-order model based on realistic converter models is currently in progress.

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Illustration

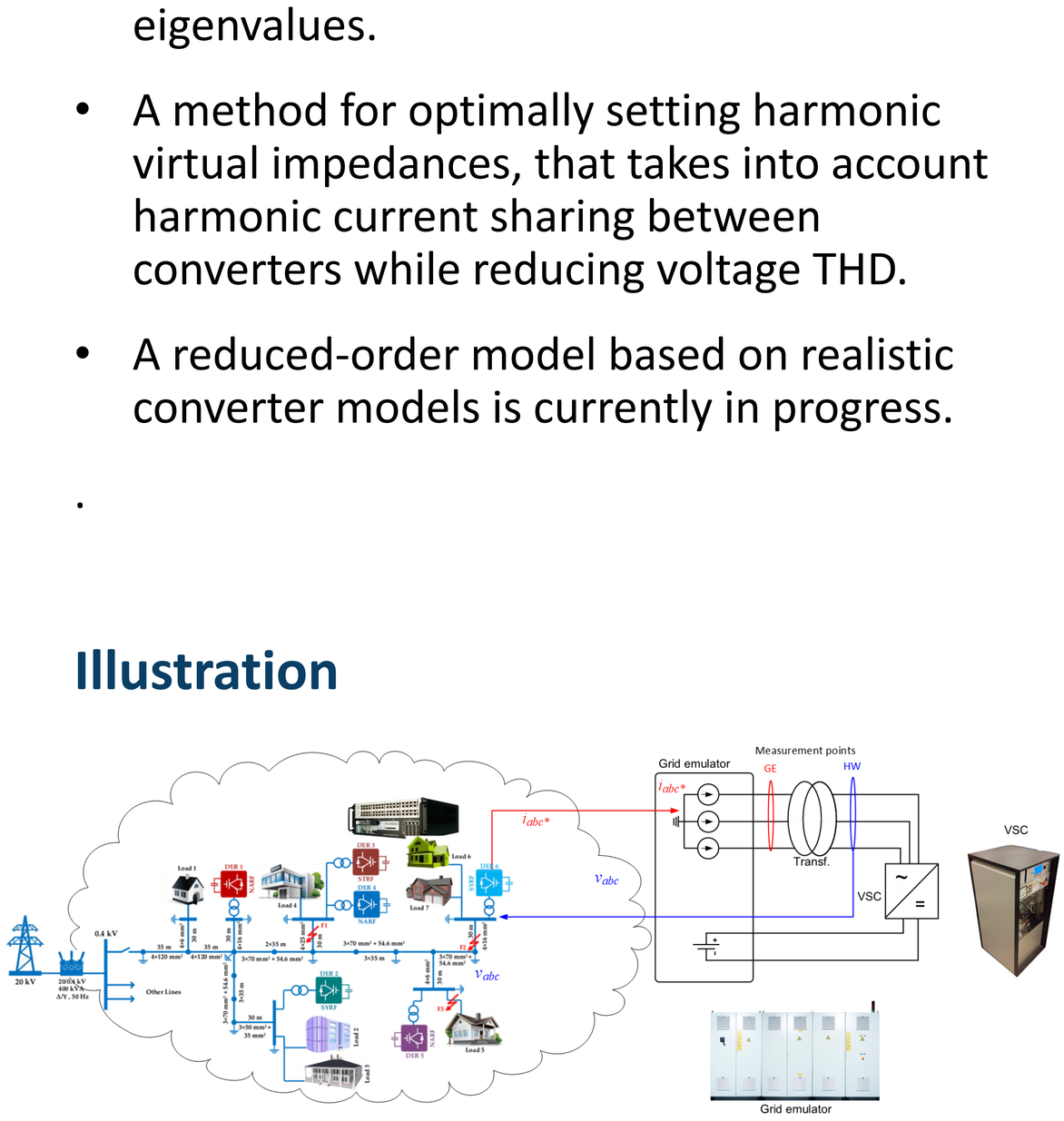

Fig. 1: Power-hardware-in-the-loop setup

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