

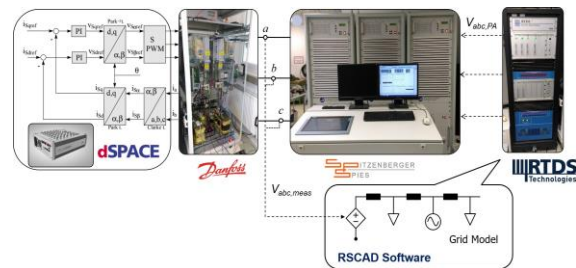
Harmonic Propagation in Smart Transformer fed Distribution Grid with high DG inverters penetration

Master's Thesis

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Abstract— Modern energy systems are characterized by a wide adoption of power electronics interfaced distributed generation (DG) and linear/nonlinear loads. Depending on the penetration level of DG and grid parameters, harmonic resonances can appear in the DGs inverter control bandwidth. This can cause harmonic interactions between grid and aggregated DG inverters, generating distorted inverter output currents. In return, these currents aggravate voltage harmonics in the grid. Solid-state Smart Transformer (ST) can be adopted to improve distribution grid power quality and satisfy the standard EN50160 requirement on voltage quality.



Background— The high demanding for increasing penetration of distributed generation (DG) is challenging the grid stability and power quality. Harmonic propagation generated by impedance interactions between the grid, aggregated DG inverters and nonlinear load can lead to unsatisfactory voltage quality. Solid-state Smart Transformer (ST) with its intelligent control is a valuable solution to tackle this power quality issues. The goal of this work is to investigate, model and control the harmonic propagation in a ST-fed Distribution Grid with high DG inverters penetration. The results are validated with dSPACE P-HIL real-simulation of a CIGRE LV grid.

Objectives:

- Modelling, analysis and control of harmonic propagation in a ST-fed Distribution Grid;
- Implementation of a P-HIL test bench for ST connected to a real-time simulated CIGRE LV grid with dSPACE system;
- Evaluation of the Accuracy and Stability in P-HIL simulation with real-time dSPACE solution.

Type of the Work:

- Theoretical analysis
- Real-Time Simulations\Laboratory

Language of the Thesis:

- English

Connected Project:

dSPACE Collaboration

