

Master-Thesis / Diplomarbeit:

System-Level Control for DC Microgrid

Context:

The development of DC networks facilitates the desired high integration of renewable energy sources (RES) and energy storage systems (ESS) in the power grids, due to the DC nature of these power units. In this context, the research project Flexible Electrical Networks (FEN) focuses on the development, implementation and analysis of control structures for DC systems. In the framework of the FEN project, the ACS Institute participates in the development of a Power-Hardware-in-the-Loop (PHiL) set-up, where RES and ESS units are connected through dual active bridge (DAB) converters in a DC microgrid. The DC microgrid is connected to the AC system through an AC/DC converter.

Various primary control strategies have been proposed in literature to coordinate the units of a DC microgrid, by providing power sharing functionalities among the converters. These control strategies can be developed in centralised and decentralised approaches. Among these, master/slave control and droop control are the most popular techniques. These control strategies can be modified according to the DC source of the converter.

Your tasks:

The student shall work on the design and hardware implementation of these control strategies in the lab set-up of the FEN project. Specifically, the master/slave control and droop control methods should be investigated. Firstly, the student should investigate possible modifications of these control methods to consider the DC source of the converters, i.e. a PV unit and a battery. The modified methods should be implemented in the Matlab/Simulink model of the DC microgrid to analyse their performance. Then, the student should implement these methods in hardware (compactRIO of National Instrument) through the LabView software, to realise them in the PHiL set-up of the lab and test their applicability and performance in real time.

Your profile:

- Good knowledge of power systems, power converters and their control
- Matlab/Simulink is a prerequisite skill
- Knowledge of LabView is not a prerequisite but preferable skill

The collaboration with the supervisor will be done in English and the thesis should be written in English.

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