

Bachelor-Thesis

Functional Modelling of Multi-Vendor HVDC Systems

Context:

The European Commission targets the integration of >200 GW offshore wind power into our power system. It is expected that most of this power will be connected using high-voltage direct-current (HVDC) systems.



While HVDC turnkey solutions with tailored design were a common approach in the past, the HVDC industry is now challenged with a demand for much higher volume, faster deployment, and new (extendable) configurations leading to HVDC grids involving several players. One approach to facilitate this design and specification process is the use of Model-Based Systems Engineering (MBSE) to allow functional modelling. Functional modelling has been used successfully in related industries, e.g. software, aircraft, and automotive. First studies have shown that the application of MBSE is also possible for HVDC system development and allows an efficient and systematic system design procedure [1,2]. In this bachelor thesis, an HVDC functional model shall be developed and it shall be investigated in how far modelling of the converters control and protection systems is feasible and useful.

- [1] M. Hoffmann, “Model-Based Systems Engineering for Offshore HVDC Grid Integration Systems,” Ph.D. dissertation, TU Braunschweig, Germany, 2021.
- [2] M. Hoffmann, C. Wei, M. Kurrat, “Requirement Analysis with SysML for Concept Design of Offshore Wind Farm Grid Connection,” in VDE ETG Congress, online, 18-19 March 2021, pp. 808-813.

Student tasks:

- Literature review on functional modelling and HVDC
- Implementation of an HVDC system functional model in Modelio or Enterprise Architect
- Description of a simplified workflow for the integration of multi-vendor aspects
- Addition of control & protection system
- Assessment of this addition with regard to feasibility and usefulness.

Your profile:

- Bachelor student in electrical engineering or WirtIng
- Fundamental knowledge about power system dynamics and control theory
- Interest in management of multi-vendor integration processes
- Desirable but not mandatory: experience with functional modelling (Modelio, Enterprise Architect)

The thesis can be conducted either in English or German.

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