



CONCERT-Japan

Efficient Energy Storage and Distribution

"Module-Aware Modelling and Assessment of Performance of Interconnected AC/MTDC Power Grids"

MODULATOR

INTERIM REPORT

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High Voltage Direct Current (HVDC) is the present state of the art technology for transferring bulk electric power over long distances. The majority of the existing HVDC installations are point to point interconnections. Connections between three or more points, referred as Multi-Terminal HVDC (MTDC), are expected to emerge in the future power grids in Europe and Japan to support energy policy objectives for integration of renewables like offshore wind energy, for strengthening the power exchanges between neighboring countries and to create a more efficient transnational power market. However, the operational experience on interconnected Alternating Current (AC) and MTDC power grids and the availability of commercial software tools for their analysis are still limited. Methods for assessing impact on grid stability and for optimizing performance of an MTDC grid in connection to an existing AC power grid are still object of research. This limitation in the present scenario can cause increased planning costs and higher risk of interoperability issues or instabilities during the operational phase.

The MODULATOR project is a cooperative project between SINTEF Energy (Norway), Fraunhofer IEE (Germany) and Osaka Prefecture University (Japan) aiming to provide the industry and the research community with software tools and methods for analysis and optimization of future hybrid AC and DC transmission grids. The main objective of this project is to leverage on the experience of the project partners to develop a framework of module-aware modelling of interconnected AC/MTDC grids where each subsystem will be treated as a pluggable building block. This will be the basis for developing state-of-the-art and highly scalable software tools for load flow analysis, small and large signal stability and optimization of interconnected AC/MTDC grids.

In the first half of the project the research partners regularly interacted with monthly teleconferences, bilateral and trilateral physical meetings and research exchanges hosted by all the three research hosting institutions. Based on their own expertise and previous research experiences, development tasks have been distributed and the interfaces and the interactions between the software parts have been specified. A reference grid has been defined and modelled for further validation of the software developed. This included the development or adaptation of models for all the system components. SINTEF Energy developed a tool for small signal stability analysis of hybrid systems that is presently in debugging phase. Osaka Prefecture University progressed in the large signal stability assessment of hybrid transmission systems. Fraunhofer IEE developed an optimization framework for mixed AC/DC-systems that will incorporate the developments of the other two partners and created a model for time domain simulation of the reference system. Integration of these parts and validation of the integrated workflow is planned in the second half of the project.

6 conference and workshop presentations have been given within the project including at the IEEJ Technical Meeting, Kumamoto, Japan, 2019 and at the Cigré International Symposium Aalborg; Denmark in June 4-7, 2019. 1 journal paper is pending.