PhD Public Defence

Title:	Control and Planning of Expandable Multi-Terminal VSC-HVDC Transmission Systems
Location:	Pontoppidanstræde 111, auditorium
Time:	Wednesday 23 January at 13.00
PhD defendant:	Roni Irnawan
Supervisor:	Associate Professor Filipe Miguel Faria da Silva
Moderator:	Associate Professor Jayakrishnan Radhakrishna Pillai
Opponents:	Associate Professor Tamas Kerekes, Dept. of Energy Technology, Aalborg University (Chairman) Professor in Power Electronics Systems Mike Barnes, University of Manchester, UK Senior Principal Scientist Bertil Berggren, ABB Corporate Research, Sweden

All are welcome. The defence will be in English.

Abstract:

At an area where there are already VSC-HVDC links in operation, it is more likely to develop the MTDC system step-by-step, i.e. started by interconnecting neighboring point-to-point (PtP) links one to another or by connecting a new converter into an existing PtP link. In line with this, COBRAcable (DK-NL interconnection), is planned to be operated as MTDC system in the future by connecting an additional offshore wind farm (OWF) converter to its cable. Therefore, this Ph.D. project aims to provide methodologies to allow a smooth transition from PtP link into MTDC operation or to enable the expansion of an existing MTDC system.

Each of the converters within an MTDC system needs to be ensured to operate within a specific DC voltage operating limits for different power flow conditions. In this dissertation, the impact of adding a new converter into an existing system, while keeping the existing equipment, to the operating limits of the new MTDC system is explained. Moreover, a method to estimate the operating points of the new system is proposed.

The second part of the dissertation deals with coordination of the converters within the MTDC system. A new DC grid control layer is introduced to interface between the centralized MTDC control and localized converter control. The non-islanded converters are operated in the DC voltage control (*UdcCtrl*) mode all the time, while this interface (IFC) unit provides the appropriate DC voltage reference, such that the converter's operating point lies along a specified droop line characteristic. This means that as seen from the MTDC control, each of the non-islanded converters within the MTDC system can be operated in different control modes by merely changing the droop line reference. Hence, this IFC unit simplifies the requirement for forming a multi-vendor MTDC system.

In addition to that, a phase compensator is embedded inside the IFC unit to adjust the time response of the existing *UdcCtrl*. So, the behavior of the existing *UdcCtrl* can be modified externally. Moreover, the IFC unit can work with the auxiliary control functions, such as frequency, power oscillation damping (POD), and emergency power controls. Simulation cases in PSCADTM/EMTDCTMand DIgSILENT PowerFactory software are used to demonstrate the capabilities of the IFC unit.