

**Master Thesis Project, 2022-2023**

**— DC / DC converters for High Voltage Direct Current (HVDC) grid —**

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**Context**

With the possible integration of marine renewable energy like offshore wind turbine or hydro-turbine, the concept of High Voltage Direct Current (HVDC) grids begin to emerge. The L2EP has worked on this subject for a decade in close cooperation with RTE and EDF for instance. 7 PhD thesis has been defended; 3 PhD students, 2 post-doctorates are in progress on this topic. A mock-up of Multi-terminal DC grid has been developed. This demonstrator has been presented as part of a European project name Twenties (<http://www.twenties-project.eu/node/148>). To connect the DC grid to the AC transmission grid, High voltage AC to DC converter are required. A structure has been proposed by SIEMENS in 2007 and has emerged as a reference. This AC/DC converter is called Modular Multilevel Converter (MMC) and it is shown in fig. 1. A small scale MMC has been developed in the L2ep in 2016.

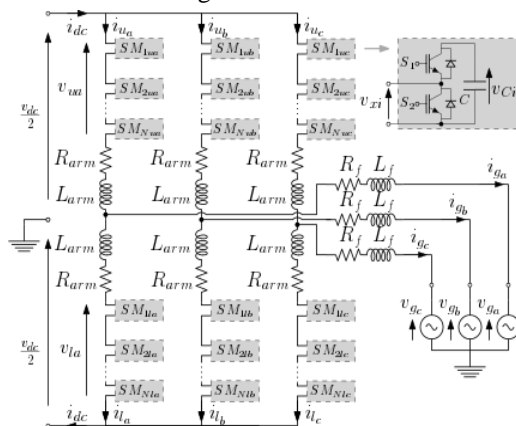


Figure 1: MMC Scheme

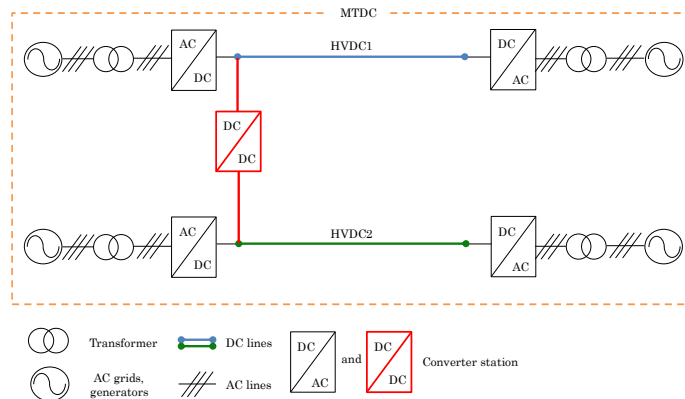


Figure 2: MTDC grid example

The interconnection of multiple HVDC grids cannot be directly considered. In fact, it is not certain that the voltage levels of these grids are the same due to DC grid progressive investment, design, non-industrial standardization between projects and permanent technological evolution for examples. Therefore, it will be necessary to introduce static converters for providing an interface of these different grids as illustrated in fig. 2. This project is part of the DICIT project (Development and Integration of static DC/DC Converters for the Interconnection of high voltage DC Transmissions grid) funded by the ANR (French national research agency).

In parallel to the PhD student topic focused on the integration of the converter into the DC grid, this Master thesis proposes to study a DC/DC conversion structures adapted to the HVDC constraints and extend previous work done [3-4] to improve its design and its efficiency.

**Objectives**

The objective of the study is to perform a literature review of DC/DC converter structure adapted for HVDC, to understand the M2DC structure and its control to extend them with the overvoltage modulation.

**Work steps**

- Bibliography on the subject
- Modeling an interesting static converter with its control
- Implement it in simulation

- Propose an overvoltage modulation of this converter
- Report writing

The works will be developed by using Matlab/Simulink.

## References

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