Model and control of a full bridge or hybrid sub modules Modular Multilevel Converter (MMC)

Supervisors: François GRUSON, Philippe DELARUE

francois.gruson@ensam-lille.fr, **Arts & Métiers ParisTech;** philippe.delarue@univ-lille1.fr, **Polytech'lille**

Context

Under reflections to use the offshore wind or hydroelectric turbine as renewable energy while providing new ancillary services to the alternative grid, the High Voltage Direct Current (HVDC) grids begin to emerge. The L2EP works on this subject since 6 years in close cooperation with RTE. Three thesis are in progress on this subject. In addition, demonstrators have been developed on this subject and one presented as part of a European project name Twenties (http://www.twenties-project.eu/node/148)

To ensure the transit of such important powers (order of GW), the "Modular Multilevel Converter" (MMC) structure has emerged as a reference. This structure is shown in Figure 1.

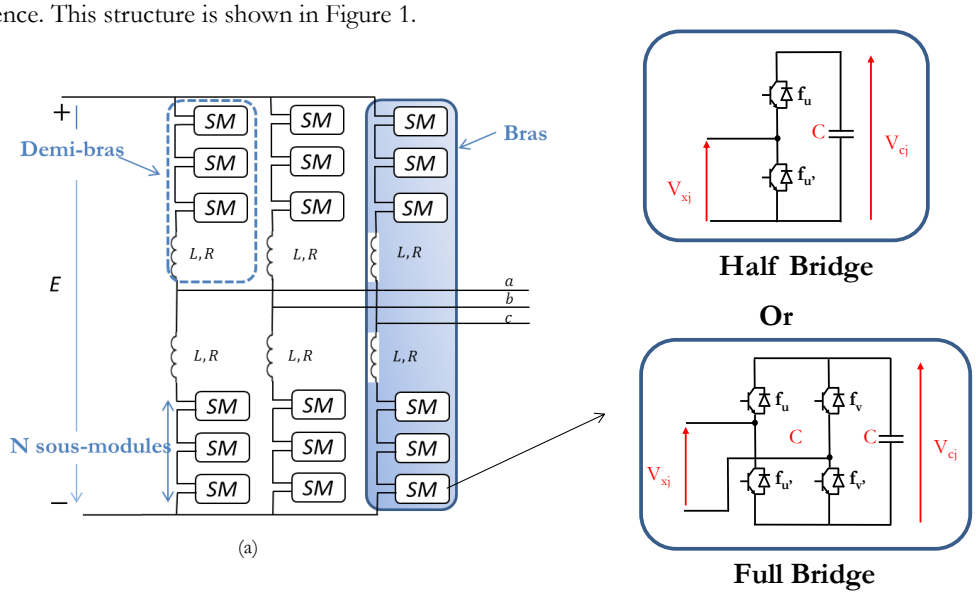

Fig 1 : (a) MMC Scheme (b) Sub-module scheme

The model and control of the MMC with half bridge sub modules (with losses estimation) is now well known and one prototype has been develop.

Objectives

The subject of this master thesis is focused of voltage capacitors balancing techniques of full-bridge or hybrid MMC converters on the study of the full bridge and the estimation.

The objective of this study is to propose models (average or instantaneous) of an arm constituted by full bridge or hybrid sub modules. The objective of this study is to propose a model (average or instantaneous) of the arm composed by full bridge sub modules ones. Its control will be develop in order to estimate the converter losses and its efficiency while minimizing the computation time. The model and their controls simulated (with Matlab Simulink and / or PSIM and / or EMTP-RV) will be used to compare different control strategies.

Work to be done

1. Bibliography on the subject
2. Modeling and control of the average model of the MMC
3. Modeling of one arm and proposes balancing capacitor voltages Techniques
4. Implement in simulation the MMC model, the different control and balancing capacitor voltages techniques
5. Simulations, analysis the silicon losses
6. Report writing