100 kW DC-DC converter design files

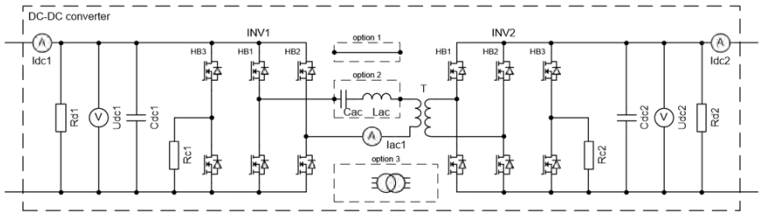
Package " Topology studies"

CONTEXT

The use of Silicon Carbide (SiC) components allows increasing the switching frequency of power converters while keeping an acceptable level of losses. Coupled with Medium Frequency Transformer (MFT), it allows a significant increase of the power density.

In order to assess these technologies, SuperGrid Institute has built a DC-DC converter prototype. This prototype operates with voltage of 1.2 kV, a power of 100 kW and a switching frequency of 20 kHz. It his based on one-phase and three phase Dual Active Bridge (DAB) and Single Active Bridge (SAB) topologies.

SuperGrid Institute proposes a set of results which include theoretical studies and technical choice justifications, design files, and testing report. These results will allow a quick mastering of these technologies for DC-DC converter designs. The different results have been divided in 5 packages and a patent.



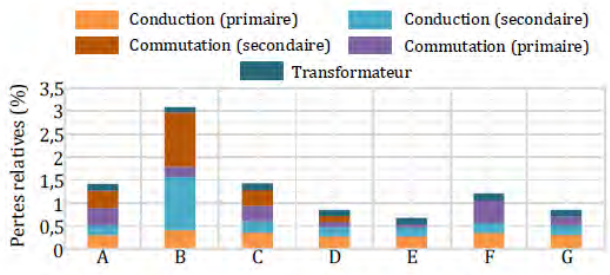


Figure II-33 : répartition des pertes dans les convertisseurs pour la puissance nominale (100 kW)

PACKAGE DESCRIPTION

This package focuses on theoretical studies and topologies comparison for this application. The proposed results include the review of resonant, non-resonant and multi-phase topologies. Different modulation techniques are reviewed according to different requirements. The comparisons includes the performances of the power electronics switches and medium frequency transformers.
The deliverables include studies report, calculation scripts (Matlab) and simulations models)

APPLICATION DOMAIN

- LV and MV bidirectional power converters

ADVANTAGES

Significant topologies number compared

Flexible calculation scripts

TRL SCALE

1 2 3 4 **5** 6 7 8 9

Complete tests realized in laboratory with realistic operating conditions

DELIVERABLES

Reports on the comparison of converter topologies and modulation techniques.
Topology design documents including: system specification, bill of material and design review conclusions
Topology design scripts and simulation models.
Extract of the PhD manuscript of Thomas LAGIER

SCIENTIFIC REFERENCE

T. Lagier et al., "A 100 kW 1.2 kV 20 kHz DC-DC converter prototype based on the Dual Active Bridge topology," 2018 IEEE International Conference on Industrial Technology (ICIT), Lyon, 2018, pp. 559-564, doi: 10.1109/ICIT.2018.8352238.