Dual Active Bridge in Off-Board Chargers

Design, assembling and commissioning of a dual active bridge converter

Graduate

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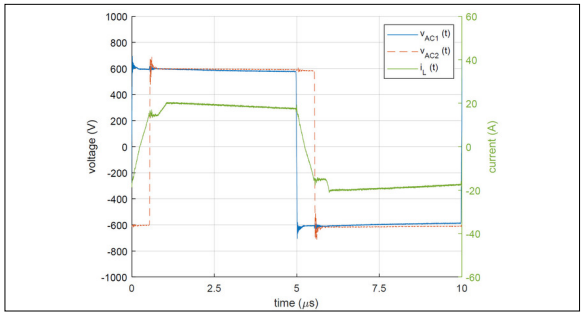
Introduction: The requirements on electric cars are increasing. This also concerns the battery and the charging times. The variance of the battery voltages is increasing due to the different types of motorized vehicles. This places high demands on the chargers. The objective of this thesis is to build a prototype of a dual active brige (DAB) DCDC converter. The DAB has on each DC side an active h-bridge with SiC-MOSFET. The power transfer is accomplished with an inductor on the primary side. A transformer isolates the two active DC sides. The prototype is designed for input voltages from 600V up to 1000V and output voltages from 150V up to 1000V at a power of 10kW.

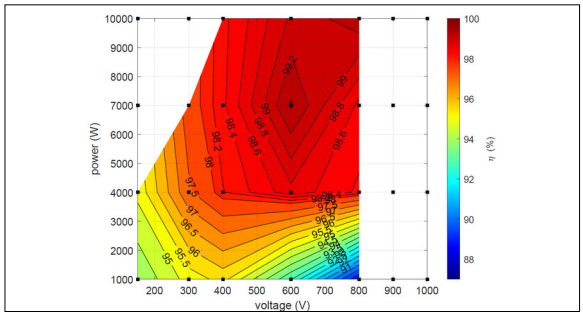
Approach: According to defined specifications a model was built to confirm the concept. In a next step all components of the hardware such as inductor and transformer were defined. A large part of the hardware design, such as schema and layout, could be taken over directly from a previous project. A prototype was developed and assembled. The inductor and transformer were built, verified with measurements and prepared for the operation. The modulation methods were adopted from a doctoral thesis published by the ETH. A firmware was developed on a micro controller with the most important functions to guarantee a stable and safe operation of the converter. The prototype was then put into operation and tested in the laboratory over the full voltage range.

Conclusion: The DAB converter was realized successfully and was tested up to the maximal power of 10kW. The DAB was currently only operated in open loop. The control parameters were set manually according to the operating point. The measurements from the laboratory confirmed the calculations and simulations. Depending on the operating voltages, an efficiency of up to 99.4% has been measured. The results are promising and the great potential of the DAB could be shown. Compared to state of the art topologies, a DAB can cover a wider voltage range at

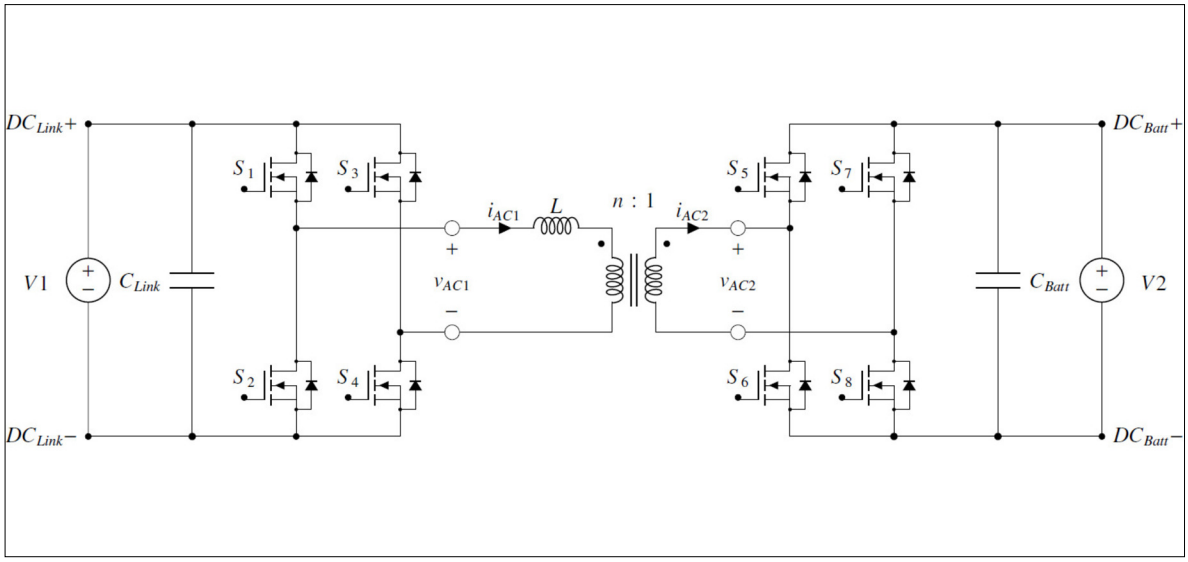
Phase shift moudulation at 10kW
Own presentment



Efficiency chart of the DAB prototype
Own presentment



Circuit diagram of a dual active bridge
Own presentment



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