Department of
ENERGY TECHNOLOGY

AALBORG UNIVERSITY
DENMARK

Motor Control Unit

Two inverters were built to control the two traction motors (Fig. 1). One common DC-link decoupling capacitor was employed in order to smooth the current taken from the batteries. For the Insulated Gate Bipolar Transistor (IGBT) modules Danfoss Shower Power liquid cooling technique was used.
The inverter is able to work as an active rectifier to charge the batteries through the motor windings; no external hardware is needed for charging.

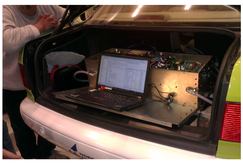


Fig. 1: Inverter inside AAUDI.

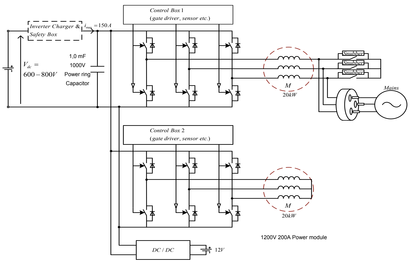


Fig. 1: Schematic of the power inverter.

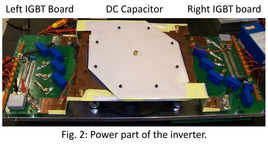


Fig. 2: Power part of the inverter.

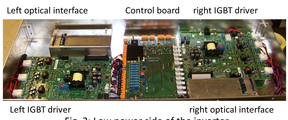


Fig. 3: Low power side of the inverter.

Control Software Description

Vector control algorithm was implemented for the two motors (Fig. 4); interleaved modulation was used in order to reduce the current ripple drown form the DC-link.
The torque reference is received from the Vehicle Control Unit.
The hardware protection, placed at the DC-link current of each inverter protects the motors and the inverters from overcurrent, while the software protection is used for over temperature.

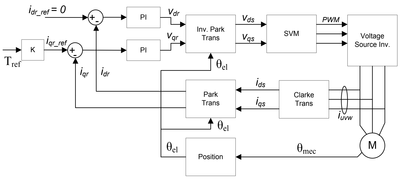


Fig. 4: Block scheme of the control algorithm.

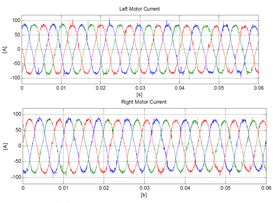


Fig. 5: Measured motor currents while driving.

Results

The first test of the inverter together with one motor was done on a test bench, where a maximum efficiency of 98% for the inverter was measured.
After the motors were installed in the car, the tests were made in a rolling test stand and also on road driving.

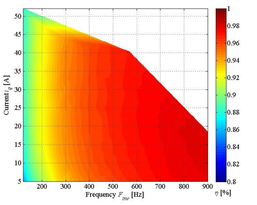
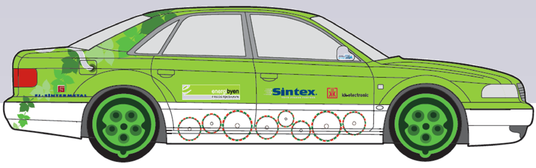


Fig. 6: Measured inverter efficiency.

Outlook

The inverter could be used as an active rectifier thereby charging the batteries from an AC source. However additional plugs and modifications in the software are needed in order to realize this feature.



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