PCB-design and fabrication of a 2L/3L IGBT-based VSI for the use in sensorless MPC of three phase induction motors

Background and preface:

Sensor- und sensorless control of electric machines play nowadays very important roles in the different automation areas, in the industry as well as in the automotive field. Within the scope of the proof of the concept of a modern control strategy some interface- and control-circuits have to be fully designed and fabricated. These electronic circuits have to be simulated and the PCB layout has to be implemented purpose utilizing it in the model predictive control of a three-phase induction motor additionally and according to the desired simulation results some drafts must be validated, enhanced and implemented.

Duties and tasks:

- Literature research on the topic: the use of two levels and three levels IGBT-based Voltage Source inverters (VSI) for sensor and sensorless control of electric motors for high frequency control strategies, the comparison of the different SVVs in both topologies and a comparison between them based on a simulation environment of a passive RL star connected load is an essential part of this task.
- Enhancement of the previous version of the PCB of the two level VSI based on the IGBT-intelligent power Module IKCM20L60GAXKMA1 while taking into account the desired implementations’ improvements.
- Extension of the current design of the PCB for three levels VSI including the needed connectors for the driver- and measurement-circuits for interfacing the STM32F769I based MCU-Board and for receiving the phase current signals of the induction motor under test and the DC-Link voltage and current inclusive the bill of materials for the PCB assembly.
- Remedy the errors in the design while manufacturing the PCB till the finalization of the PCB.
- Constructing a test framework based on three phases RL star connected load to test both the 2L- and 3L-VSI.
- Enhancement of the design inclusive test and validation.

Qualifications and prerequisites:

- Good Knowledge of or rather experience in PCB-Design.
- Good Knowledge of or rather experience in simulation of electric/electronic circuits using Matlab/Simulink/Pspice.
- Good Knowledge of the topic control of electric machines using power electronics.
- Good Knowledge of design of driver-, interface- and measurement-circuits.
- Good Knowledge of microcontroller applications and programing.
- Good Knowledge of design and simulation using MATLAB/SIMULINK.

Start and duration:

October or November 2019 for two months and half.

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