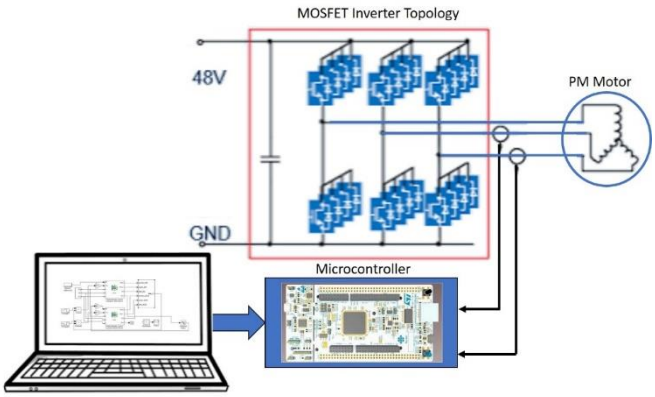
Dipartimento Energia
Power Electronics Innovation Center (PEIC)
Politecnico di Torino

We are looking for a master student to work on

Low-Voltage, High-Current Inverter for Mild-Hybrid Motor Drive: control and testing

published on 23 February 2021

Background



One of the pillars of the Power Electronics Innovation Center (PEIC) is the power converters design and its testing in automotive applications. In recent years, the development of the 48 V mild-hybrid vehicle electrical systems has focused on the cost advantage compared to purely electric or plug-in hybrid vehicles. In mild hybrid configurations, the Belt driven Starter Generator (BSG) arrangement allows a low impact on the engine selection layout respect with to the Integrated Starter Generator (ISG) solution, where the electrical machine is implanted between the engine and the gearbox. BSG needs a high-power density and a low voltage inverter. Usually, in the actual application a multiphase electrical machine solution is considered. The power rating of BSG is overall 15 kW. MOSFET devices are applied in both high-voltage and low-voltage power converter applications. In low-voltage applications, trench-gate MOSFETs are the actual robust choice to obtain high-performances and reliability power converters. In the proposed thesis an inverter (5kW maximum of power rate at 48V and 100A of the output current) implementing the last generation of trench-gate MOSFETs are available to control a permanent magnetic motor for BSG application. In the thesis, the control of the inverter and the testing on the experimental board in the drive application are focused.

Your tasks

- Literature survey of the state-of-the-art Mild-Hybrid motor inverter solution and control strategies;
- Literature investigation on the MOSFETs in parallel connection: current sharing, protection circuit, thermal behavior;
- Simulation of the power devices in inverter application and control strategies using the simulation software PLECS, (and/or LT-SPICE, Orcad SPICE);
- Implementation of the simulated controls on the Microntroller based inverter controller;
- Experimental testing of the inverter and power devices behavior in the drive application.

Necessary skills

- Power Electronic basics in Inverter topologies and power devices applications;
- C programming skills (e.g. Attendance to the course Laboratory of Power Converters and Electrical Drives is sufficient);
- Background of control theory and Basic knowledge of digital control.

What you will learn

- To analyze high level technical literature (mandatory and requested by the companies producing high level technology);
- Power electronics inverter operation and power device applications;
- Power electronics simulation skills using PLECS, and LT SPICE (and/or Orcad SPICE);
- Experimental skills: how to implement a control on a real inverter connected a permanent magnetic control, how to organize an experiment (measuring equipment, testbench…), how to report the results of the experimental activity.

Duration of the thesis: 6 months

Application

We are looking forward to receiving your application. Please include your CV and a short explanation why you fit the position (Italian or English). Send your application to salvatore.musumeci@polito.it and fabio.mandrile@polito.it.