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

We are looking for a master student to work on

Development and evaluation of an induction motor control algorithm for micro-mobility applications

Background

The electrification processes involving transports are leading to the development of various traction solutions using AC motors. Among the applications of electric traction, those of micro-mobility are becoming increasingly widespread and have a large reference market. Generally, light traction is based on low voltage (48V) and low-power systems. The use of AC induction motors in some applications, such as the Renault Twizy, poses a challenge to improving the topology and drive control for the Power Train unit.
Furthermore, applying advanced technologies for power electronic devices, such as those based on Gallium Nitride, allows us to obtain converters for the power train of compact and highly efficient traction systems.

Thesis goal

The thesis activity will be carried out in collaboration with Coburg University in Germany (tutor prof. Marco Denk). It will target the development and implementation of vector control for an asynchronous motor applied to a purely electric low-voltage vehicle traction system in a microcontroller unit. The control system of the developed power train will have the Renault Twizy electric vehicle as a workbench, and the inverters will be using MOSFET and GaN FET devices in the final motor drive solution (see Fig. 1).

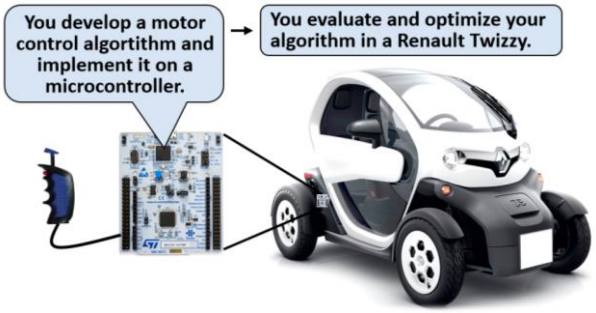

Fig. 1. View of the microcontroller unit for vector control to drive a power train Renault Twizy electric vehicle used as workbench for the experimental validation.

Your tasks

- Analysis and study of vector control for AC induction motor
- Development of a torque and speed controller algorithm for the AC induction motor of the Renault Twizy electric vehicle
- Implementation of the microcontroller software (ST NUCLEO) to arrange for PWM commands to the inverter legs
- Validation of the control system by simulation runs and participation in experimental tests (the candidate will have the opportunity to spend a period at the University of Coburg to develop and trim the control over the real system based on the Renault Twizy electric vehicle under the supervision of Prof. Denk)

Necessary skills

- Basic knowledge of power electronics, electric machines, and drives
- Basic knowledge of digital control

- Basic software skills on microcontroller systems
- Basic knowledge of Matlab/Simulink
- Problem-solving skills

What you will learn

- Advanced knowledge of modelling and control of ac machines
- Advanced data elaboration methods using Matlab/Simulink and/or PLECS
- Microcontroller simulation skills using ST NUCLEO board
- Experimental skills in terms of implementation of control algorithms on a microcontroller
- Use of advanced measurement systems, and organization and execution of experimental tests involving inverter board and AC asynchronous motor in actual traction application for electric micro-mobility

Duration of the thesis: 6 months minimum

Application

We are looking forward to receiving your application. Please include your CV and a short motivation letter about why you fit the position (Italian or English). Send your application to: salvatore.musumeci@polito.it, Fausto Stella fausto.stella@polito.it, Marco Denk marco.denk@hs-coburg.de.