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

Politecnico di Torino
Department of Energy "G.Ferraris"

PEIC Power Electronics Innovation Center

We are looking for a master student to work on

Open Loop Soft-Switching Full-bridge Converter for Solid State Transformer Application

Background

One of the pillars of the Power Electronics Innovation Center (PEIC) is the power converters design and testing for grid application. The development of power systems and the move to smart grid have increased the need for new technologies. In this scope, solid-state transformers have been proposed as a suitable alternative to conventional transformers copper and iron transformers. Solid-state transformers (SST) are among the equipment based on power electronic converters that in addition to better performance than conventional transformers provide a variety of other services. Nowadays the complexity of the electrical

Figure 1. Primary side converter solution.

network has increased due to the increase in new energy generation and storage resources. The electrical energy output of these sources is provided at different voltages (DC and AC) with different frequencies. To tackle these complexities, the use of new topologies, control strategies and device technologies to manage and improve the reliability of the power system is growing. New and simpler types of converters are needed to optimize the performance of these power systems. The power converter that we want to investigate in this thesis is based on a MOSFET soft-switching topology that drives a high frequency (HF) transformer applicable for the primary side of a SST. The control operates in open-loop with a duty cycle of 50%. In the thesis work it will be necessary to analyze the operational functioning in different conditions by analyzing the losses on the devices and the optimization of the soft-switching strategy to optimize the efficiency performances. Furthermore, a comparison with a conventional soft-switching topology with phase-shift converters will be carried out to explore benefits and drawbacks of the proposed converter system solution.
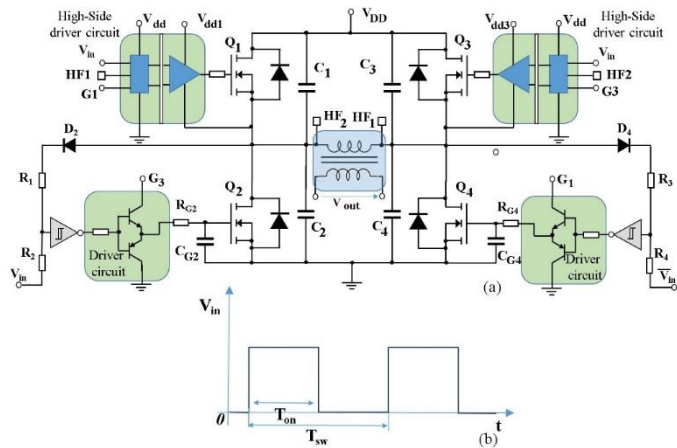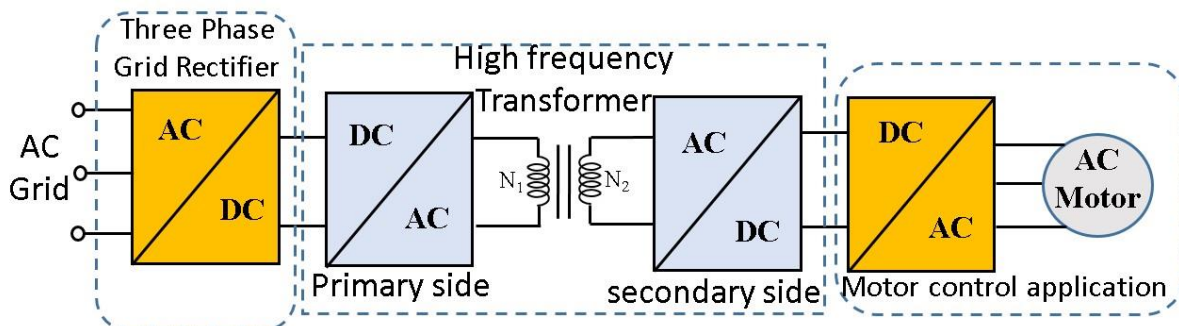

Figure 2. SST block scheme.

Your tasks

- Literature survey of the state-of-the-art of soft-switching full-bridge solution and control strategies for SST applications;
- Design consideration on high-frequency transformer for SST application;
- Analysis of the proposed topology by PLECS and LTSPICE Tools;
- Comparison of the proposed open-loop soft-switching converter and phase-shift power converters.

Necessary skills and related MS courses

- Power Electronic basics in converter topologies and power devices applications;
- Basic knowledge of MATLAB/Simulink and/or PLECS tools;
- 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);
- SST operation and applications;
- Power electronics converter in soft-switching operation and power device applications;
- Power electronics simulation skills using PLECS, and LT SPICE (and/or Orcad SPICE).

Duration of the thesis: 6-9 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, fabio.mandrile@polito.it and fausto.stella@polito.it.