Opening for a Post-doc position
Computer Science and Control Systems Department
at Ecole des Mines de Douai, Douai, France

Title: High frequency experimental modeling of power converters

Keywords : Experimental (Data-driven) modelling, power converters, switched systems

A post-doc position for 12 months, with a possible starting date of January 3th, is available at Mines Douai (French engineering Grande Ecole) within the CE2I project. Applicants should submit a cover letter, a curriculum vitae, and names of two references willing to provide letters of recommendation via e-mail to cecile.labarre@mines-douai.fr and sanda.lefteriu@mines-douai.fr.

Context and motivation

The arrival on the market of wide bandgap semiconductors will cause a major shift in design methods in the field of power electronics. Wide bandgap semiconductors can operate at higher voltages, temperatures and switching frequencies with greater efficiency compared to existing Si devices. The recent development of GaN components adapted to a high frequency working creates opportunities for designing higher power density converters. However, the implementation of GaN components requires the development of new methods for characterizing, modelling and designing these wide bandgap semi-conductors.

In particular, the higher switching frequency for GaN devices requires the development of new design methods to reduce conducted and electromagnetic interferences of power converters. Packaging, PCB routing, EMC filters and shielding must be studied. Moreover, it is necessary to investigate the possible topologies and choose the one best suited for high frequency operation.

CE2I (Convertisseur d'Energie Intégré et Intelligent) is a regional project funded by the Nord Pas de Calais Picardie region in France in the context of CPER 2015-2020. It is led by University of Lille 1 and consists of the following partners: L2EP, LSEE, LAMIH and URIA. In the context of the CE2I project, URIA (Mines Douai) is in charge of developing new high frequency modelling methods of the power converter to optimize the design and to allow better monitoring. Mines Douai relies on scientific expertise in experimental modeling, system identification, model reduction, hybrid control systems applied to energy systems.

Responsibilities

Currently, URIA is developing a modeling technique based on the input-output transfer function of a DC-DC converter in the frequency domain as well as an experimental setup to perform measurements. The post-doc work will consist of
1) Designing the experimental setup and performing measurements of transfer functions of the power converters in the frequency domain to validate the modeling technique in high frequency.
2) Extending the modeling technique to three-phased inverters.
3) Extending the modeling technique by integrating the parasitic elements of the switching components. Currently, the input/output transfer function characterizing a DC-DC converter does not take into account the non-ideality of the switching component.
4) Once the model has been validated experimentally, use system identification to recover the continuous-time model from the measurements.

Profile
The candidate must hold a PhD in electrical engineering or control, with experience in power electronics, modeling and system identification, designing experimental setups.