

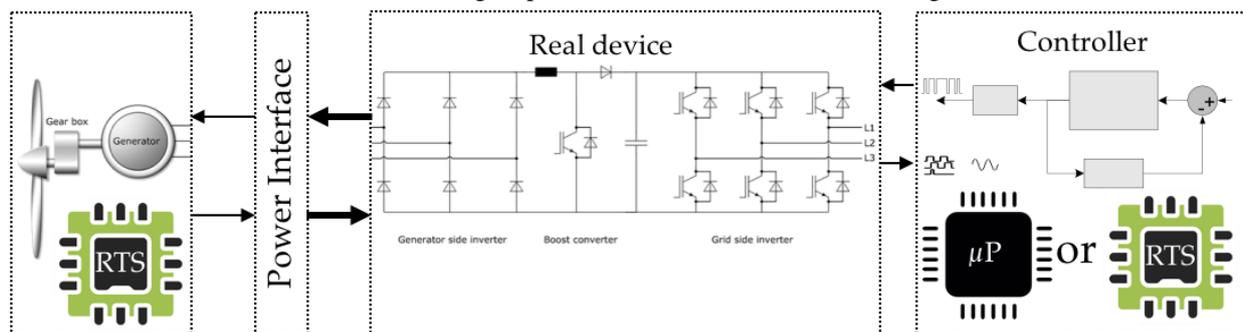
Master project, 2018-2019

— Advanced control of a high bandwidth power amplifier —

Supervisor: Frédéric Colas, Frederic.colas@ensam.eu, L2EP – Arts et Métiers

Context

Power Hardware-in-the-Loop (PHIL) simulation involves interfacing a Real-Time Simulator with a power device such as inverters, motors or transformers and through a power interface as illustrated in the figure below.



In this kind of application, the quality and the bandwidth of the power interface is of paramount importance as stability problems can occur if this interface is too slow for example. Puissance+ is company which designed such interface. Their products are based on linear technology. They have the advantage to generate high quality signals and to have high bandwidths which can reach 25kHz at a rating of 100kVA. However, this technology is intrinsically non-regenerative so that this power interface cannot reinject the absorbed energy in the power supply.

Puissance+ in collaboration with L2EP is designing a new power interface based on switching technology to overcome this drawback. The main objective is to design a power amplifier which can reach the same bandwidth but probably with less quality in signal generation and which is able to inject absorbed energy to the power supply. L2EP has proposed several topologies: they are all based on an association of several switching cells through coupled inductors. A first prototype has been designed however the control part has only been tested in open-loop.

Objective

The main objective of the internship is to design and test a control algorithm for the developed prototype. The prototype is based on cells interleaving [2], one secondary objective of this internship is to study if current balancing is needed.

Work steps

- 1- Bibliographic study on prototype topology and converter control
- 2- Design a control structure adapted to the chosen topology
- 3- Implement it on a control board
- 4- Test the proposed control structure on a prototype

Keywords

Power electronics, Power Hardware In the Loop, control system

Localization

ENSAM Lille

References

[1] A. Viehweider, G. Lauss, and F. Lehfuss, "Interface and Stability Issues for SISO and MIMO Power Hardware in the Loop Simulation of Distribution Networks with Photovoltaic Generation," vol. 2, no. 4, 2012.

[2] A. Schmitt, M. Gommeringer, J. Kolb and M. Braun, "A High Current, High Frequency Modular Multiphase Multilevel Converter for Power Hardware-in-the-Loop Emulation," PCIM Europe 2014; International Exhibition and Conference for Power Electronics, Intelligent Motion, Renewable Energy and Energy Management, Nuremberg, Germany, 2014, pp. 1-8.

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