

University of Stuttgart

Institute of Robust Power
Semiconductor Systems

Dr. Oleksandr Solomakha

Pfaffenwaldring 47, Room: 1.443

oleksandr.solomakha@ilh.uni-stuttgart.de

+49(0)711-685-69022

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**Power
Electronics**

**Master
Thesis**

HIL testing the full-bridge AC/DC converter in PFC stage controlled by external control board in closed loop

Description of work:

Hardware-in-the-Loop (HIL) testing is one of the modern methods to investigate behavior of physical equipment virtually. In this project, the digital twin of power electronics of AC/DC converter in PFC stage is considered in HIL mode. This digital twin is deployed in the dSpace Microlabbox hardware and run in real-time mode. This approach allows us to simulate the operation of power electronics for an external control system. The control system is deployed on the TI control board, and it forms a closed control loop together with a digital twin of power electronics.

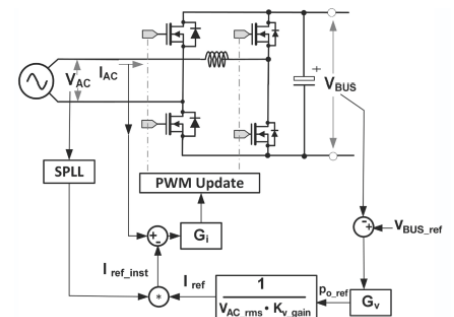
The project aim is to develop closed control loop system running in real-time mode and consisting of power electronics (represented by digital twin on Microlabbox hardware) and control system (represented by TI control board).

Tasks & Goals:

- Familiarization & literature search (10%)
- Calculations, design and components selection of power electronics (10%)
- Design and simulation the control system with the model of power electronics (10%)
- Deployment control system on TI control board (programming directly from Simulink) (10%)
- Deployment the digital twin of power electronics on Microlabbox (10%)
- Assembly setup in the closed-loop system and test (35%)
- Written thesis & presentation (15%)

Benefits for student:

- Familiarization with HIL testing
- Familiarization with dSpace Microlabbox hardware
- Familiarization how to deploy control algorithm from Simulink to TI control board (without C-coding)
- Improving Matlab/Simulink skills



Considered scheme of one-phase full-bridge AC/DC converter
(taken from Texas Instruments website)

Previous Knowledge:

- Power Electronics
- Control System Theory
- Understanding how microcontrollers work
- Matlab/Simulink/Simscape



Control system on TI control board



Power electronics represented by digital twin on Microlabbox hardware

