EE-490(c) **Lab in electrical energy systems**

Dujic Drazen

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Practical work	4 weekly
Number of positions	

Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.

Summary

This teaching lab provides the practical experiences related to the operation of power electronics converters and digital control in power electronics, through experimental activities on the Power Electronic Teaching Setups. Work is organised by means of mini projects.

Content

Topics covered in the lab are related to various concepts in power electronics:

- Semiconductor devices and losses in operation
- Pulse Width Modulation methods
- Converter operating principles, e.g. DC-DC, DC-AC,...
- Current control using different regulators (e.g. PID, PR)
- Voltage control
- Control system development
- Power Quality
- Grid monitoring and synchronization
- Photovoltaic energy generation
- Control of various electrical machines (e.g. DC machines, Induction machine)

The work will typically have three parts:

1. Theory, Modelling and Simulations
Following mini project assignement and understanding of theoretical foundation and concepts, modelling and offline simulations using PLECS software will be carried out. In the next step, control concepts will be deployed on the Texas Instruments Digital Signal Processor (DSP) and verified in the Real-Time Hardware-in-the-Loop (RT_HIL) environment, with relevent power hardware part being modeled on the RT-HIL platform. This part of the work is direct preparation for the experimental verification that will follow.
2. Experimental investigations
All the experimental works will be carried out on the Power Electronic Teaching Setups. These are composed from industrial converters with modified control boards that are based on Texas Instruments Digital Signal Processor (DSP). For that reason, this part of the lab will involves software deployment of the concepts developed in the part 1 and systematic testing and commisioning on the real hardware. Experimental results will be collected and compared against offline and real-time simulations.

3. Transversal skill
The student will learn how to plan a mini project, collect and analyse results, write technical report and present results.

Keywords

- power electronics
- digital control
- renewable applications

Learning Prerequisites

Required courses

Basic electrical enegineering knowledge and some programming skills.

Recommended courses

EE-365 Power Electronics
EE-465 Industrial Electronics 1

Important concepts to start the course

- basic knowledge on electronics
- some programming skills

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze
- Characterize
- Perform
- Exploit
- Manipulate
- Verify

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Make an oral presentation.
- Write a scientific or technical report.

Teaching methods

Theoretical concepts relevant forever project assignement will be presented during lectures in the lab. Power Electronic Teaching Setups will be introduced and relevant supporting material will be provided.

Expected student activities

Students will be doing mini project, with goals of converting theoretical concept into working experimental demonstration.

Assessment methods

Mini project report and final presentation of the results.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Moodle Link

- https://go.epfl.ch/EE-490_c

Prerequisite for

This course is useful for the courses:
EE-465 Industrial Electronics 1
EE-565 Industrial Electronics 2