EE-465

Industrial electronics I

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Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.
Energy Science and Technology	MA1, MA3	Opt.
Energy minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course deals with the control of grid connected power electronic converters for renewable applications, covering: converter topologies, pulse width modulation, modelling, control algorithms and controllers (PID and PR), coordinate frame transformations, grid monitoring and synchronisation (PLL).

Content

Introduction
Power electronic technologies for renewable energy generation, with emphassis on the photovoltaic applications.

Power electronic converters
Requirements, topologies, operating principles, pulse width modulation methods, space vectors, modeling and control.
Grid monitoring and synchronization
Single-phase and three-phase applications, phase locked loops, grid filters, power quality, balanced and unbalanced grid conditions.
Control synthesis
Continuous and discrete time systems, sampling, discretization, cascaded control loops, PID and PR regulators, coordinate frame transformations, tuning, passive and active damping.

Keywords

Modeling, Control, Power Electronic Converters, Power Systems

Learning Prerequisites

Required courses

Control theory, Power Electronics, Power Systems

Recommended courses

EE-365 Power Electronics

Important concepts to start the course

Laplace Transform, Z-Transform, Power electronic converters, control synthesis

Learning Outcomes

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

- Select appropriately power electronic converters for given application

- Derive mathematical models
- Synthesize control structures for different applications
- Prove stability and dynamic performances

Transversal skills

- Use a work methodology appropriate to the task.

Teaching methods

Slides, Blackboard, PLECS examples, Exercises based on the modeling and simulations using PLECS, Reporting

Expected student activities

Attendance of lectures; Completing exercises; Writing reports based on the exercises, Proactivness

Assessment methods

Student are expected to write 4 short reports, during a semester, related to their laboratory exercises. These reports will be graded and contribute to 40% of the final grade.
Oral exam at the end of the course is the open book exam (20 minutes preparation + 20 minutes examination). It contributes with 60% to the final grade.

Resources

Bibliography

Grid Converters for Photovoltaic and Wind Power Systems, Remus Teodorescu, Marco Liserre, Pedro Rodriguez, ISBN: 978-0-470-05751-3, Wiley
Grid-Side Converters Control and Design, Slobodan N. Vukosavic, ISBN 978-3-319-73278-7, Springer

Ressources en bibliothèque

- Grid converters for photovoltaic and wind power systems / Teodorescu
- Grid-Side Converters Control and Design / Vukosavic

Notes/Handbook

Lectures, exercises and solutions are available on the Moodle

Moodle Link

- https://go.epfl.ch/EE-465

Prerequisite for

EE-565 Industrial Electronics II