EE-565

Industrial electronics II

Dujic Drazen

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA2, MA4	Opt.
Energy Science and Technology	MA2, MA4	Opt.
Energy minor	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Practical work	2 weekly
Number of positions	

Summary

The course is dealing with high performance drives and methods to control various electrical machines by means of power electronic converter and advanced control methods.

Content

Introduction: Applications of variable speed drives. Role of power electronics. Types of the electric machines.
DC Machines: Construction and types of DC machines. Modeling and static characteristics. Power electronic converters for 4Q operation. Control system design and tuning.
AC Machines - Asynchronous Machine: Construction and types of AC machines. Models in the original domain, stationary reference frame and rotational reference frame. Static characteristics and operational ranges (e.g. field weakening). Power electronic converters for AC machines. Pulse Width Modulation - PWM. Space Vector PWM - SVPWM. Scalar control (open loop and closed loop). Vector control - Rotor Field Oriented Control (RFOC). Direct RFOC. Indirect RFOC. Direct Torque Control (DTC)
AC Machines - Synchronous Machine: Construction. Permanent Magnets Synchronous Machines - PMSM. Models in the original domain, stationary reference frame and rotational reference frame. Vector control.

Learning Prerequisites

Required courses

EE-365 Power Electronics
EE-465 Industrial electronics I

Important concepts to start the course

Students should be familiar with basics of: power electronics conversion, cascaded control loops, PID type of regulators, pulse width modulation, electric circuit simulations

Learning Outcomes

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

- Design a vector control system
- Conceive a control strategy for an electric machine
- Conceive a control for a converter connected to the grid
- Design a variable speed drive system
- Implement a control strategy for an electric machine
- Realize desired control objectives and performances

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

Supervision

Assistants Yes

Resources

Bibliography

Electrical Machines, Slobodan N. Vukosavic, ISBN 978-1-4614-0400-2, Springer

Ressources en bibliothèque

- Electrical Machines / Vukosavic

Notes/Handbook

Lectures, exercises and solutions are available on the Moodle

Moodle Link

- https://go.epfl.ch/EE-565