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 emphasis 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, Proactivity

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.

Supervision
Assistants Yes

Resources
Bibliography

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
http://moodle.epfl.ch/course/view.php?id=14729

Prerequisite for
EE-565 Industrial Electronics II