pre373 - Control Techniques and Renewable Energy Integration Systems

Module label: Control Techniques and Renewable Energy Integration Systems
Module code: pre373
Credit points: 5.5 KP
Workload: 165 h

Used in course of study:
- Master's Programme European Master in Renewable Energy (EUREC) > Mastermodule

Contact person:

Skills to be acquired in this module:
By the end of this module, students should be able to manage the theoretical and practical aspects related to power electronics, with an emphasis in the analysis of the operation of specific devices used to integrate RE. They should also be able to evaluate the requirements, design and optimise Micro Grids.

At the completion of this module, the student will:
- Become familiar with the AC/DC Drives control systems (multilevel converters, PWM, etc…)
- Get basic knowledge on the technological aspects of power electronic systems connection
- Get knowledge about reactive power compensation
- Be introduced to FACTS Technology

Engineering analysis:
Graduates will be able to formulate and solve engineering problems related to the control of power systems connected to the grid. Also, the will be able to design and optimise Micro Grids.

Investigations:
Graduates will be able to evaluate the requirements to implement Micro Grids.

Transferable skills:
Graduates will be able to work effectively as professionals and as team members to solve technical problems related to the integration of RE in electric grids. Also, graduates will demonstrate their abilities to communicate effectively in multinational teams.

Module contents:
1. Control of AC/DC drives
   - Necessity of power electronics: solar and wind generation, storage, dip and reactive power compensation, DC transport…
   - Modelling and simulation of power electronics systems
   - Conversion DC/DC (Solar): topology, operation and current control
   - Vectorial modelling of three phase systems
   - Control of permanent magnets wind turbines
   - Conversion DC/AC three phase
   - Control of active and reactive power of three phase systems connected to grid
   - Dip and interruptions compensation: DVR
   - Characterization techniques: harmonics, THD, power factor,…
   - Overview of other power systems
2. Active network devices and control
   - Control system for small wind turbines
   - Power inverter design
   - Microgrids
   - Theory and operation principles of FACTS
   - FACTS implementation and technology (Series / Shunt compensation)
   - Applications and simulation of power electronics systems using PSCAD/EMTDC
   - Modelling of thyristor-based static Var compensator
   - Modelling of GTO-Based STATCOM -Modelling of VSC-Based HVD link
   - Modelling and performance of SSOC in wind energy application

Reader's advisory:

Links:
Language of instruction: English
Duration (semesters): 1 Semester
Module frequency: jährlich
Module capacity: unlimited
Modulelevel: MM (Mastermodul)
Modulart: Pflicht
Lern-/Lehrform / Type of program: Lecture, Laboratory, Excursion, Tutorials
Vorkenntnisse / Previous knowledge:

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| Final exam of module | After end of lectures of module | Written exam (40%): 2 hours  
Subject’s work (20%): approx. 8 hours  
(Subject’s work refers to the different assignments that students are asked to finish after a preliminary session during the lessons)  
Presentation (40%): 20 minutes (developed topic) |

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