ENG-612

Power electronics for renewable applications

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Cursus	Sem.	Type
Energy		Opt.

Language of teaching	English
Credits	3
Session	
Exam	Oral presentation
Workload	90h
Hours	**56**
Lecture	28
Exercises	28
Number of positions	**15**

Frequency

Every year

Remark

Dec. 11 to Dec. 15th, 2023. Min. participants for the course to take place: 6

Summary

Introduction to key aspects of power-electronics utilization in renewable energy applications, including the basic operation principles, system-level properties, control, and modeling. Practical experiences are gained via the simulation exercises.

Content

Nowadays, all generation systems based on renewable energy sources, such as photovoltaics, wind turbines or hydropower systems, require some kind of power electronics technology to achieve efficient energy transfer to the utility power grid. This course introduces the basic principles of the power-electronics-based electrical energy conversion and teaches the key system-level aspects.

The course covers the following topics:

Part 1: Principles of the electrical energy conversion
- Operating principles of the power electronic converters
- Pulse Width Modulation (PWM)
- Fundamentals of modeling and control

Part 2: Photovoltaic (PV) energy generation
- PV modeling and characteristics
- Maximum-Power-Point Tracking (MPPT) principles
- Modeling and control of power electronics DC-DC stage performing MPPT
- Extension by the energy storage system

Part 3: Grid connected converters
- Principles of DC-AC power converters
- Grid synchronization and converter control

Part 4: Wind power generation
- Wind turbine modeling and operation principles
- Synchronous generator and ac-ac converter conversion
- Basic principles of field-oriented control

Note

The course exercises will be based on the offline simulations using PLECS software, which can be made available to the course attendants free-of-charge.
Learning outcomes: understanding basic concepts, system level aspects, and role of the power electronics based conversion technologies in the renewable energy applications.

Keywords

power electronics
renewable generation
modeling
control