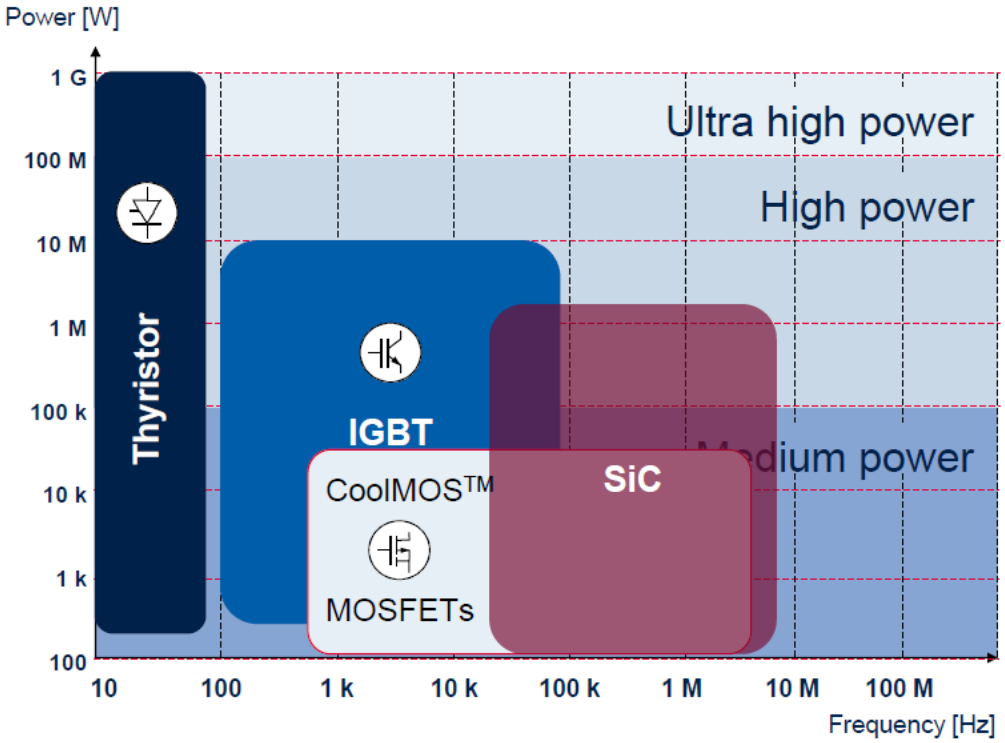
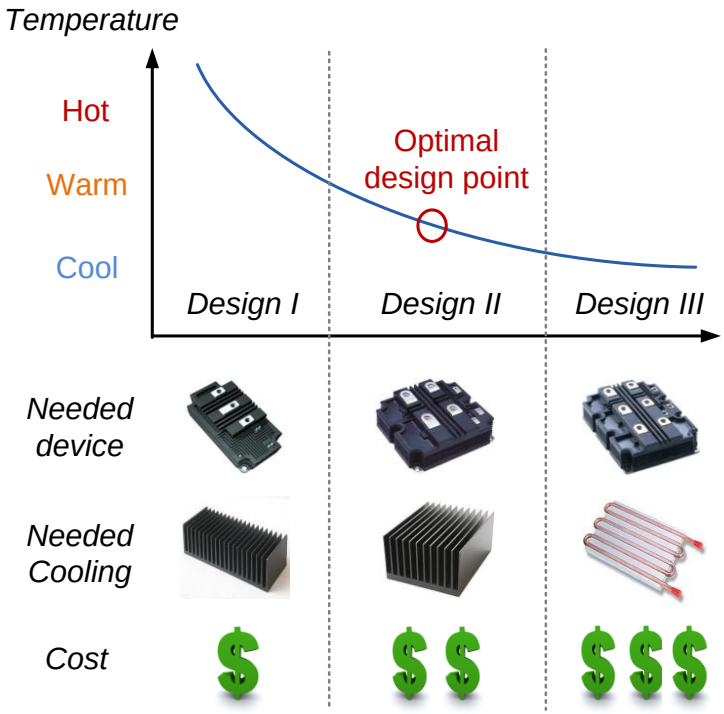
MSc Courses

	VIII (Summer)	IX (Winter)	Optional courses
Kernel Courses Study Plans	Design of power electronics converters (etit-504)	Modelling and Control of power electronics converters (etit-505)	
Renewables & Smart Grid	Renewable Energy Systems (etit-609)	Grid Converters for Renewables (etit-615)	Microprocessor Non-linear control systems Optimization and optimal control
Electric Drives	Microprocessor (etit-610)	Electric Drives (etit-607)	A course on EMC Non-linear control systems Optimization and optimal control
		Seminars	
		PE Laboratory	

Design of power electronics converters (etit-504)

Semiconductors and Drivers, Topologies of PWM power converters and PWM modulation -> optimum hardware design



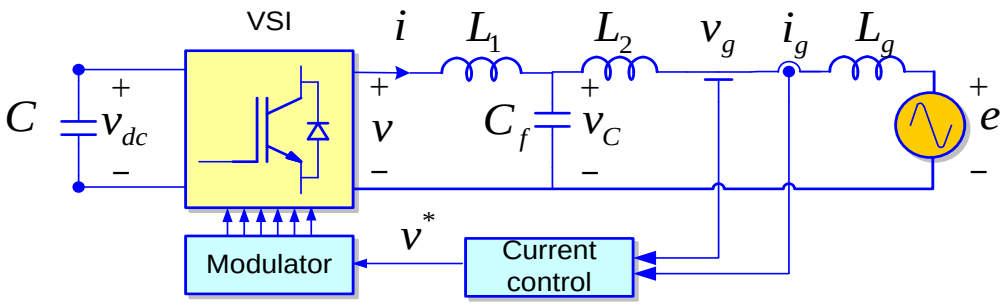


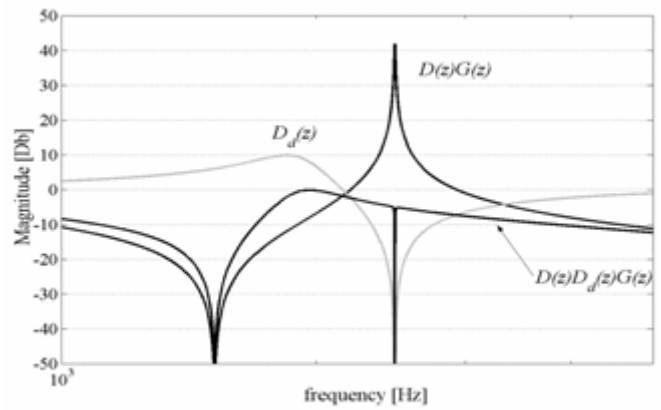
Design of power electronics converters (etit-504)

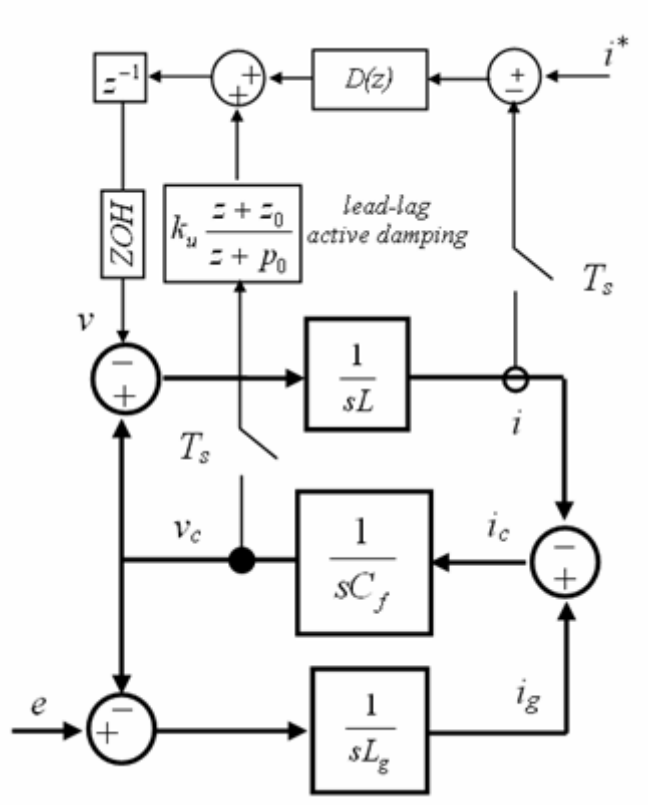
- ✓ Design of a Power Electronics Converter (Semiconductors and Drivers, Soft and hard switching, passive components, Busbar design, EMC problems and remedies, Thermal model)
- ✓ Topologies of PWM power converters (dc/dc, dc/ac, ac/ac): single-cell and multi-cell converters, matrix converters etc
- ✓ PWM modulation (single-phase, three-phase, space-vector, multilevel, interleaving, continuous/discontinuous, optimized)

Modelling and Control of power electronics converters (etit-505)

Average model, small-signal linearization, transfer functions, current/voltage/power controllers -> optimum software design





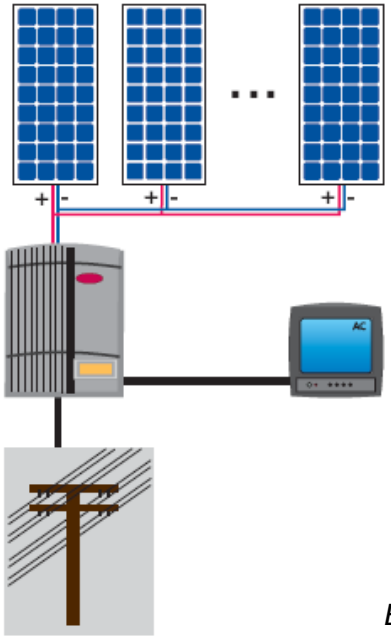


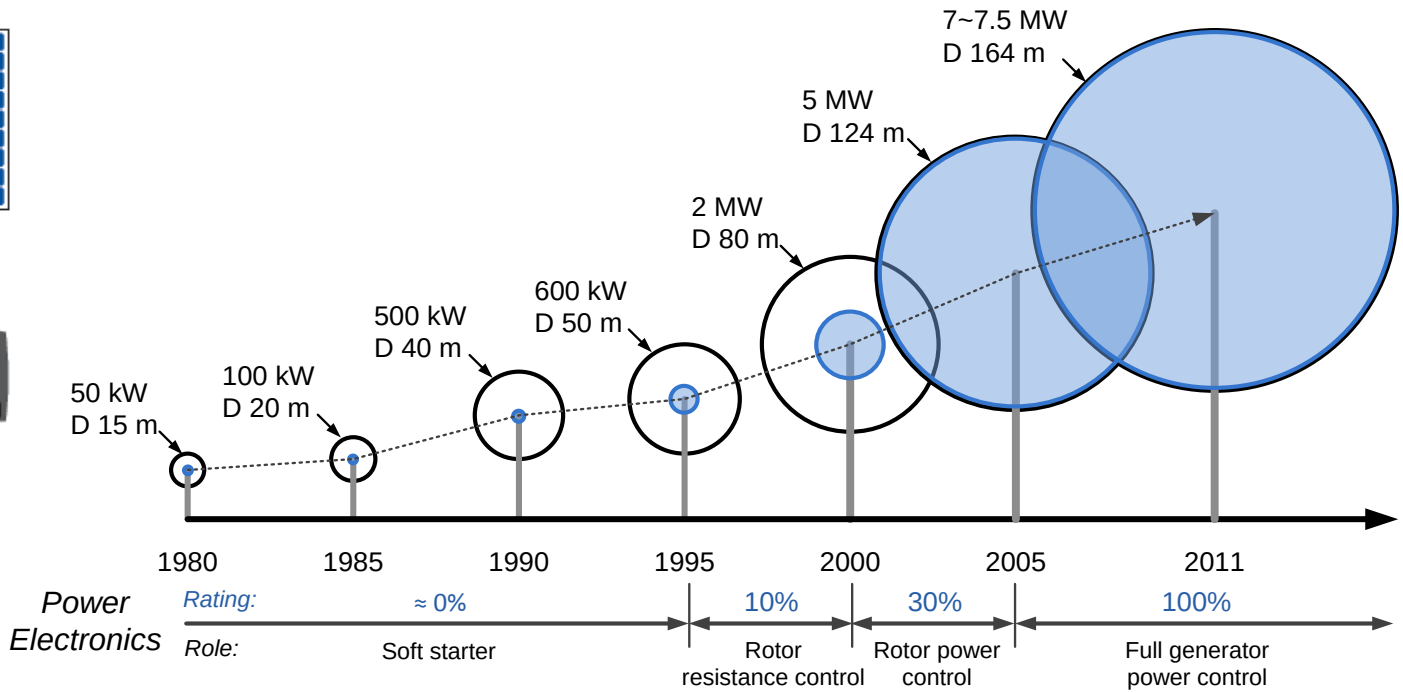
Modelling and Control of power electronics converters (etit-505)

- ✓ dc/dc converter model
- ✓ Average model, small-signal linearization, transfer functions
- ✓ Design of the controller for dc/dc converters
- ✓ dc/ac converter model: ac dynamics and dc dynamics
- ✓ Current control (PI, resonant controller, deadbeat)
- ✓ dc voltage control (linear, non-linear)
- ✓ ac voltage control
- ✓ active and reactive power controls

Renewable Energy systems (etit-609)

System level analysis of renewable energy systems: problems, connectivity, future trends



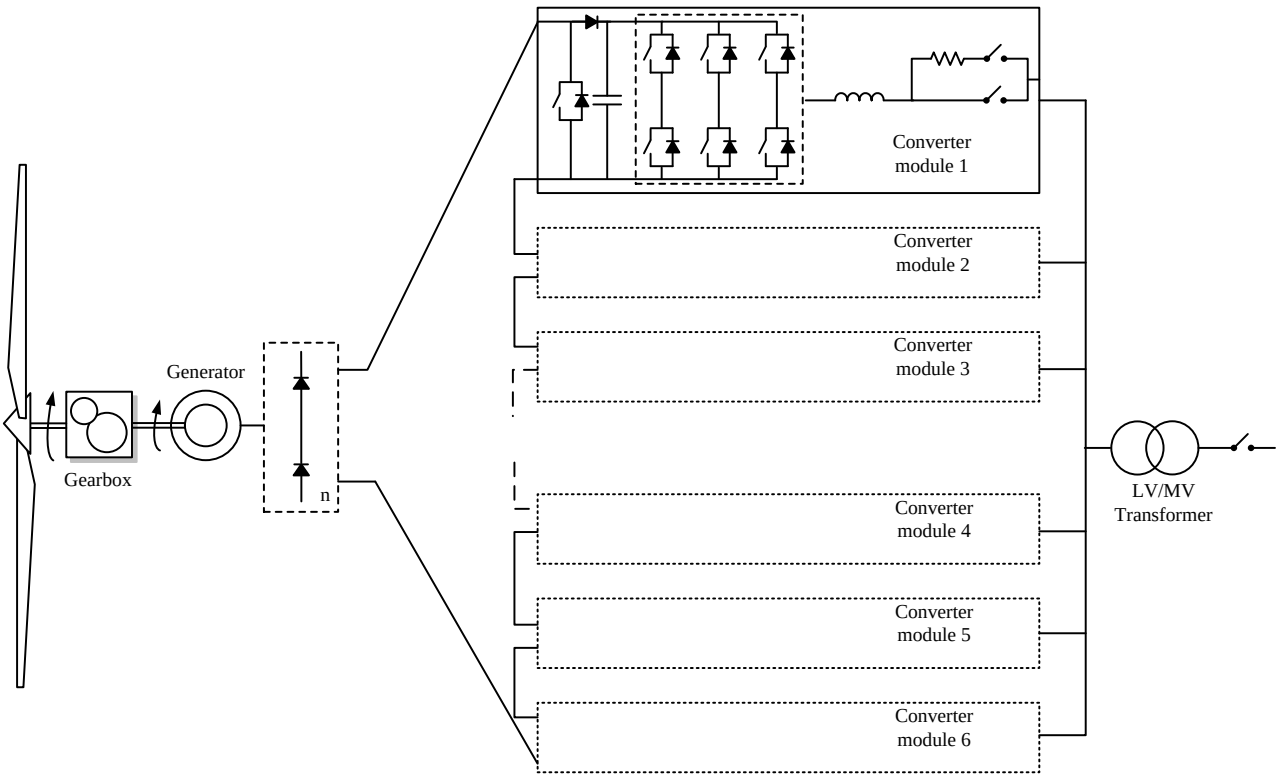


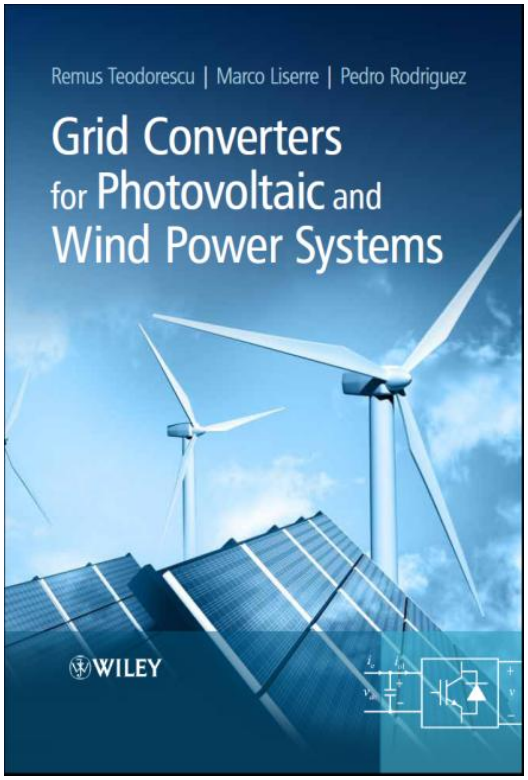
Renewable Energy systems (etit-609)

- ✓ Basic principles of Wind and Photovoltaic
- ✓ MPPT for Wind and Photovoltaic
- ✓ PV-system and PV-park: design procedure
- ✓ WT-system and WT-park: design procedure
- ✓ Grid connection requirements
- ✓ Fault Ride Through
- ✓ Islanding
- ✓ Ancillary services
- ✓ Storage and hybrid systems
- ✓ Microgrids
- ✓ HVDC

Grid converters for renewables (etit-615)

The grid-converter is the interface of all the renewable energy systems to the the electric grid: topologies and control



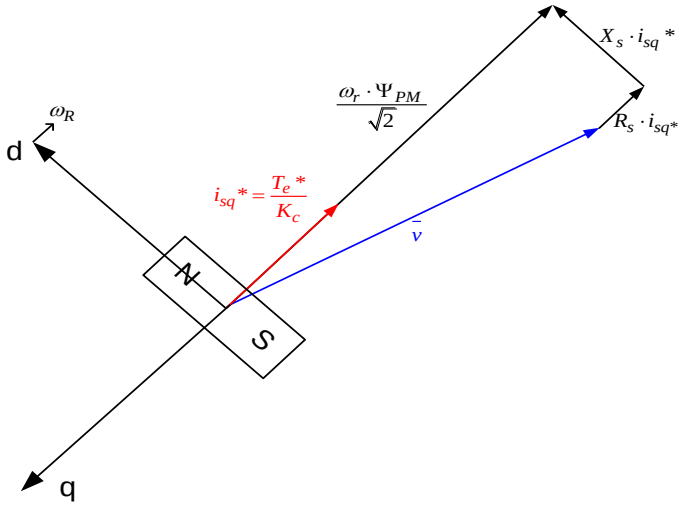


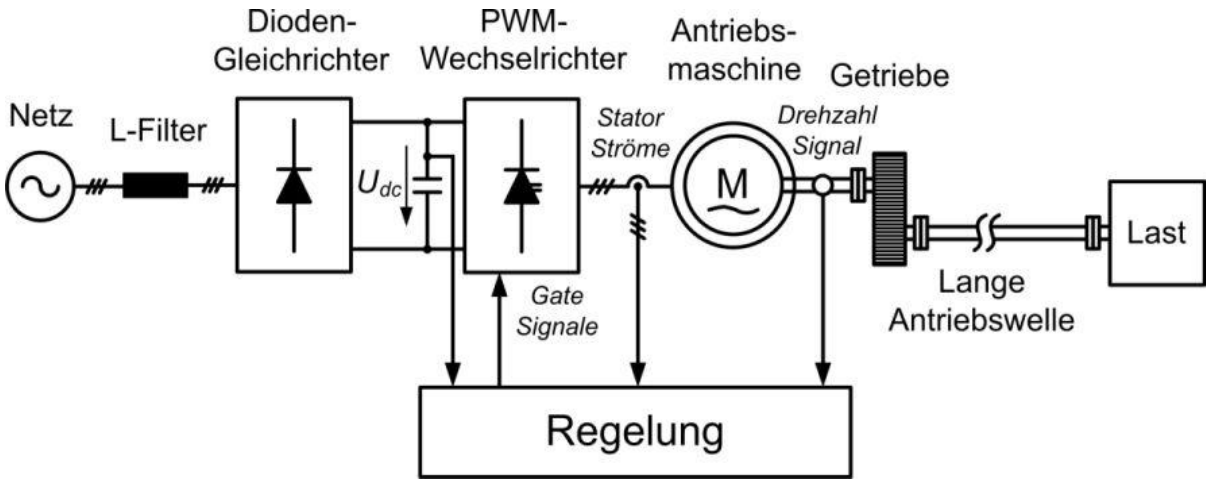
Grid converters for renewables (etit-615)

- ✓ PV converter topologies
- ✓ WT converter topologies
- ✓ Overview of PWM modulation
- ✓ Overview of Current Control techniques
- ✓ Single-phase synchronization with the electrical grid
- ✓ Three-phase synchronization with the electrical grid
- ✓ Harmonic rejection
- ✓ Grid-filter design and resonance issues
- ✓ Parallel connection of power electronics converters

Electric Drives (etit-607)

Space vector and dynamic representation of ac machines: control structures and examples





Electric Drives (etit-607)

- ✓ Space vector representation of electrical machines
- ✓ Dynamic model of the synchronous machine
- ✓ Dynamic model of the asynchronous machine
- ✓ Overview of PWM modulation
- ✓ Overview of Current Control techniques
- ✓ Vector control of the permanent magnet synchronous machine: Current control loop and Speed control loop
- ✓ Vector control of the asynchronous machine: Flux observer
- ✓ Sensor-less operation
- ✓ Design example in industrial drives and in wind energy

Microprocessor Technology for Real-Time Controlling Tasks (etit-610)

Dr.-Ing. Torsten Leifert

SMA Solar Technology AG

The students learn about the functionality, the components and programming of microcontrollers. They will be able to design simple control circuits for applications in control theory or electrical drives. They will be able to design the controller, implement it and test it.