Hanze

Vak: Power Electronics — credits: 5

Vakcode	ELVB25PE
Naam	Power Electronics
Studiejaar	2025-2026
ECTS credits	5
Taal	Engels
Coördinator	N.A.A. al Geelani
Werkvormen	Projectonderwijs
Toetsen	Power Electronics - Opdracht

Leeruitkomsten

Design
The starting professional considers various solutions in order to arrive at a detailed and well-founded (electro)technical product/service/process based on the program of requirements, using appropriate design methods and taking social interests and engineering standards into account.
Realisation
The starting professional realizes and validates a (prototype of a) product/service/process based on an (electro)technical design and makes appropriate use of materials/techniques/instruments.

Inhoud

In this module, power electronic components, design topologies, the applications and the effects of power electronics on the electricity grid will be studied and a proof of concept will be realized.

Professional Products

- Energy-technical simulations and calculations: The methods and processes by which the behaviour, performance and efficiency of energy-related systems or components are analysed and predicted. This includes the use of mathematical models, numerical methods and software tools. *In this module: calculations on and simulations of power electronics topologies*
- System design – An overview of components and interactions between different components of a system. It includes the design of software and hardware architecture, components, interfaces, and data. *In this module: a power electronics system design*
- Proof of concept – A prototype or small test setup used to demonstrate that an idea, theory or design is feasible in practice. This can be in the form of testing a circuit, for example, or a simulation of a design. In this module: a proof of concept of a power electronics design.

Skills

- Making component and design choices – The process of evaluating and selecting alternatives during the design process, based on criteria such as functionality, cost, sustainability, and aesthetics, to achieve an optimal solution. This can be done, for example, with the help of a pugh matrix or a morphological overview.
- Selection of power components – The process of choosing suitable electrical and electronic components, such as transformers, power electronics (IGBTs, MOSFETs), switches, and capacitors, based on requirements such as power, voltage, amperage, efficiency, thermal management, and reliability within an energy or power system.
- Testing and measuring on an energy technology system – The process of evaluating the performance, efficiency, and safety by using specialized instruments to measure key parameters such as voltage, current, power, frequency, and temperature. This process ensures compliance with design specifications, identifies faults, and optimizes system operation for reliability and efficiency.

Knowledge

- Power electronics components – Semiconductor and passive devices used for converting, controlling, and managing electrical power in circuits. Key components include diodes (for rectification), transistors (such as MOSFETs and IGBTs for switching), thyristors (for high-power control), capacitors (for energy storage and filtering), inductors (for energy transfer and smoothing), and transformers (for voltage conversion and isolation).
- Power electronics topologies – The specific circuit configurations used to convert and control electrical power efficiently. These topologies define how components like switches, diodes, inductors, and capacitors are arranged to achieve functions such as AC-DC (rectifiers), DC-DC (buck, boost, buck-boost converters), DC-AC (inverters), and AC-AC (cycloconverters, matrix converters) conversion.

- Power electronics performance – The efficiency, reliability, and effectiveness of a power electronics system in converting and controlling electrical energy. Key performance indicators include efficiency, switching speed, thermal management, power density, harmonic distortion, and response time, which determine the system’s capability to minimize energy losses, handle power fluctuations, and operate within safe limits

Opgenomen in opleiding(en)

Exchange Energy & Power Electronics (autumn)
Minor Energy & Power Electronics

School(s)

Instituut voor Engineering

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