Course Specifications
Valid as from the academic year 2018-2019

Advanced Electromechanical Actuators (E640105)

Course size
Credits 6.0
Study time 180 h
Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019
A (semester 1) Dutch
practicum 24.0 h
lecture 12.0 h
seminar 24.0 h

Lecturers in academic year 2018-2019
Stockman, Kurt TW08 lecturer-in-charge
Dereyne, Steve TW08 co-lecturer
Vanwaalleghem, Bart TW08 co-lecturer

Offered in the following programmes in 2018-2019

<table>
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<tr>
<th>Programme</th>
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<tr>
<td>Master of Science in Electrical Engineering Technology (main subject Automation)</td>
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<tr>
<td>Master of Science in Electrical Engineering Technology (main subject Electrical Engineering)</td>
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<tr>
<td>Master of Science in Electromechanical Engineering Technology</td>
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Teaching languages
Dutch

Keywords
Sizing, permanent magnet machines, stepper motors, lineair motors, switched reluctance machine, positioning systems, energy efficiency

Position of the course
Induction machines and dc machines are not the only machines used in industrial applications with speed control requirements. In the course on advanced drive systems some alternative machines are studied: permanent magnet machines (sinusoidal excitation, BLDC), linear motors, stepping motors and switched reluctance machines. For each motor the torque control is analyzed. This allows the student to select the right motor for a given application. In the course on sizing of drive systems, the mechanical properties of a drive system are studied first. This understanding is required to perform the correct sizing of the electric machine and controller. Many aspects need to be considered during this sizing process. The students use manufacturer catalogs to loop up and analyze the required information. Finally also the energy savings of drives and the impact on the total life cycle cost is studied. During the lab sessions the student gets hands on training related to the discussed topics especially the use of servo drives and the tuning of the control loops.
The course is organized around three courses: sizing of drive systems, advanced drive systems and a practicum.

Contents

**Advanced drive systems:**
- Introduction
- Permanent magnet machines with trapezoidal currents
- Permanent magnet machines with sinusoidal currents
- linear motors
- stepping motors
- switched reluctance machines
- position control of servo drives
- servo drive stiffness

(Approved)
**Sizing of drives**
- Introduction
- Inertia calculations
- gears
- friction
- overview of electric motors and their efficiency
- Sizing and selection of motors and drives
- Energy savings
- Life cycle cost of drives

**Practical sessions:**
- DC machines and drives
- Field oriented electrical machines
- Servo-position
- Stepper motors
- Hydraulic position

Initial competences
- Understanding and servicing of simple speed controlled application
- Tuning of simple control loops
- Understanding the operation of induction machines
- Preferably having followed Electromechanical Drives from the bachelor program.

Final competences
1. Sizing of electromechanical drive systems is a structured way.
2. Critical assessment of the sizing outcome.
3. Describing the operation and control of stepping motors, permanent magnet machines, linear motors and reluctance motors
4. Discussing the structure of a positioning system from a control point of view.

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract
This course unit cannot be taken via an exam contract

Teaching methods
- Lecture, practicum, seminar

Extra information on the teaching methods
- Sizing of drives: seminar
- Advanced drive systems: lecture
- Practicum: practicum

Learning materials and price

**Sizing of drive systems** (Dutch)
K. Stockman
cost approximately € 25

**Advanced drive systems** (Dutch)
K. Stockman
cost approximately € 15

**Electromechanical drives 2 - lab** (Dutch)
S. Dereyne, B. Vanwalleghem
Cost approximately € 10

Supporting powerpoint slide shows are electronically available on Minerva.

References
J. Pollefliet, Electronic power control2 : motor control, 2012
ISBN9789038219110

SEW, Het selecteren van aandrijvingen, aandrijftechniek in de praktijk, 1052 2972 (NL)

Course content-related study coaching
Questions related to the lectures can be raised after each lecture or an appointment can be made with the professor. Additional explanation is possible after each lab session.
Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Open book examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Open book examination, oral examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Sizing of drive systems: Open book exam. The student proves to be able to perform the correct sizing of a drive system, given a specific problem definition. The exam results in a written document (2 or 3 excercises) containing all results and calculations.

Advanced drive systems: oral examination with written preparation. During this examination, also the examination related to the practicum (lab) is done.

Electromechanical drives 2: Lab (practicum): During the lab sessions, the students are expected to document the testsetups, measurement results and conclusions. The examination is performed at the same moment of the examination of advanced drive systems.

Calculation of the examination mark

Calculation final score

Final score (/20) = C1xP1 + C2xP2 + C3xP3

Cx are coefficients and Px are scores (/20) with:

P1 : score Sizing of drives
P2 : score Advanced drive systems
P3 : score Lab
C1 = 40%
C2 = 25%
C3 = 35%

3 illegal absences during practical sessions can result in a score AFW (Not Present) for the complete partim.

First and second examination period

Even for a score equal or higher than 10/20, to pass the course at least 7/20 for each partim has to be reached. When this condition is not met, there will be a modification of the calculated number to 9/20.