TRAINING BROCHURE

Actuation and power electronics training

Provisional reservation

Book now

high tech institute

mechatronics academy
brainport

Actuation and power electronics

Price:	€ 2,485 excl. VAT *
Duration:	3 consecutive days
Contact:	training@hightechinstitute.nl, +31 85 401 3600
Score:	8.1 ★★★★☆

Certified by

ecp2

Certification

This course is certified by the European society for precision engineering & nanotechnology (euspen) and the Dutch Society for Precision Engineering (DSPE) and leads to the ECP2-certificate.

Course leader

ir. Jeroen van Duivenbode (ASML & TU/e Fellow)
Dr.Adrian Rankers

Trainers

ir. Jeroen van Duivenbode (ASML & TU/e Fellow)
Dr.ir. Bart Gysen (ProDrive & TU/e)

** Prices are subject to change. Price correction will be applied at the end of the year.*

Keep me posted >

Intro

Life without motion is unimaginable. This statement is also valid in the production industry.

Electro-mechanic actuators, driven by highly efficient and accurate power electronic circuits, are the working horses within the industry. They determine the performance and quality of many industrial processes. In high-end industrial applications the accuracy of the production systems is increasing steadily, enabled by ever more powerful, precise, efficient and cost-effective actuation systems.

Several questions can be asked about dynamic mechanical systems that are related with the actuation;

- How can mechanical systems be kept silent (free of motion) in a vibrating environment when large objects are actuated with high accelerations?
- How is a low energy consumption level accomplished when having a frequently alternating load?
- Why are permanent magnets so important for mechatronic drives?
- Is it possible to make strong actuators without permanent magnets?
- How can an electric car achieve such a high overall efficiency?
- What is the role of power electronics in the application of electromagnetic actuators?

These and many other questions will be elaborated in the course. For that reason the fundamentals of electromagnetic actuators and motors including the necessary power electronics to control them will be covered. Detailed attention is given to the challenging task of choosing the right actuator type for a certain application from an overwhelming diversity. The impact of different principles of electronic power conversion will be unraveled, ranging from linear to switched mode power circuits, each with their own benefits and drawbacks. The need for current or voltage drive is elaborated while attention is given for power amplifier noise. Especially aspects of element selection and/or development for short stroke or long stroke high precision linear actuation will be treated and special multi-DOF actuators will be presented as challenging examples.

PRACTICAL INFO

- *If on-site training is not feasible, we will transition to a live, interactive online (virtual) or hybrid format. If this transition is necessary, we will contact you in advance for your approval.*
- *The training is also available for in-company sessions.*

Objective

After the course, the participant will be able to initiate, specify, guide the development of a special motor or select the proper off-the-shelf actuator (type & version). Participants will acquire a mix of theoretical background, do's and don'ts and practical insight that is useful when designing mechatronic systems with different actuation systems.

Intended for

This course is intended for mechatronic system designers and architects who are involved in the multi-disciplinary development of motion devices and need a better insight into the various aspects of actuation systems in order to make an adequate selection of available off-the-shelf components or initiate, specify and guide the development of a customized actuation system.

Prerequisities:

University level education, with at least two years experience and completion of the courses Mechatronics System Design (METRON1/2) or equivalent.

Program

Day 1

Introduction & Overview

Learning goals. The role of electromechanical drives in mechatronic positioning systems. Some application examples as preview of the course subjects with a little recap of METRON 1,2.

'Working with' Electricity and Magnetism

Maxwell Equations and Lorentz Force. Ohm’s and Hopkinson’s law: Electric and magnetic modeling with “circuits” consisting of sources, resistances/reluctances, permanent magnets and ferromagnetic parts.

Power electronics for actuation

Basic analogue power electronics. Semiconductors, Switching diodes, Power transistors and MOSFETS, Linear and Switching electric power conversion. Energy flow in two directions.

Day 2

Electromagnetic actuators and electromotors

Recap Day1. Basic terms and properties of electromotors and actuators, efficiency, thermal dissipation, performance figures of merit.

Lorentz actuators and related electronics

Flux linkage vs Lorentz law. Force vs position dependency, current density, dynamic stiffness, damping, current control. Multi DOF actuation. Electrical properties, impact of actuator self-inductance. Amplifier - actuator matching, jerk and snap. Design issues with current amplifiers. Current noise.

Reluctance actuators and related electronics

Non-linear force, magnetic energy, force of magnetic field, linearization by balancing and feedback. Flux control, permanent magnet biasing, Fast Tool actuator, Magnetic Bearings.

Day 3

Examples of real motors and actuators

Recap Day 2. Mechanical and electronic commutation. Standard rotating motors. Practical issues. Amplifier-actuator interaction demonstrated on real hardware. Drive control in the first successful hybrid car (Toyota): A useful side effect of current control.

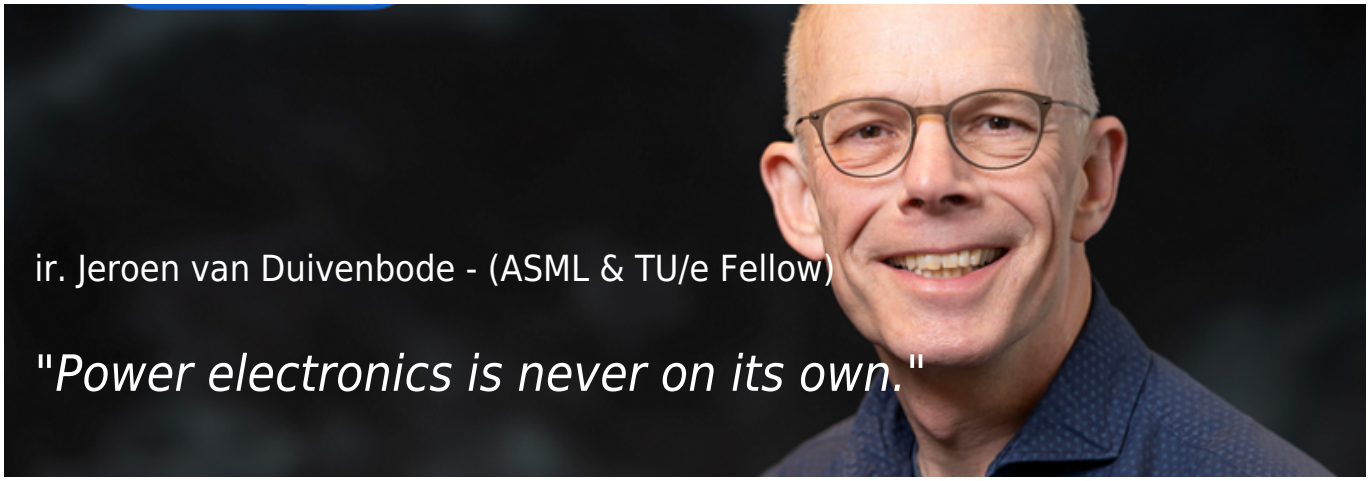
Recent drive system developments

Commutated systems, long stroke actuators, phi-z actuator, planar motor concepts, parasitic phenomena (cogging and end effects), wireless energy transfer.

Wrap-up and closure

Language: Dutch or English (depending on the participants).

Read the interview:



Remarks from participants:

- "Most important knowledge obtained: Different types of actuators, (...) operational principles of amplifiers." > Nikola Vasiljevic , DTU Wind Energy
- "The enthusiasm of the lecturers and their knowhow makes it a success." > Gert Kragten , Gevasol
- "Flux and actuator cases are very good; many slides in little time." > Niels Bosch , ASML
- "Most important items I have learned: Basic electronics, analogy between magnetic and electrical circuits." > Sander Verhoeven , ASML
- "Useful and I learned a lot (but still a lot to learn as well)." > Bjorn Bukkems , TMC