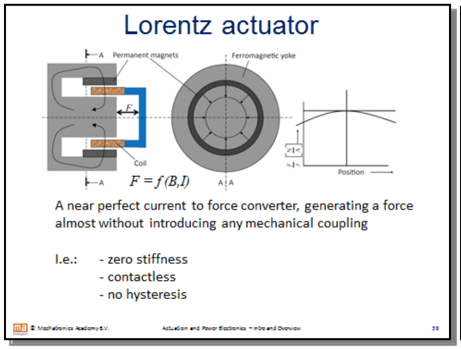
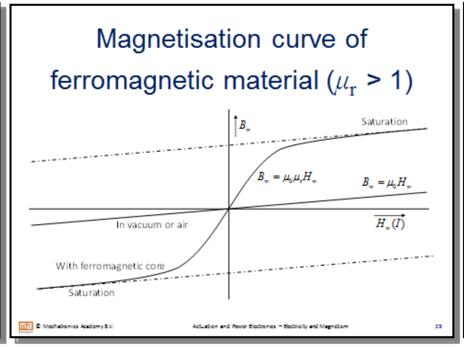
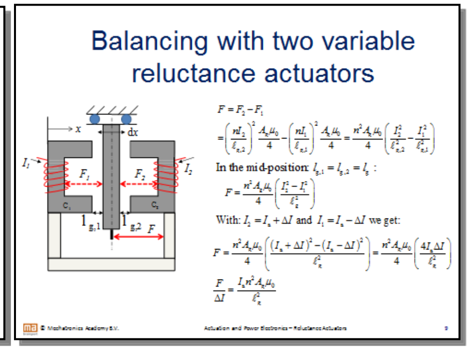
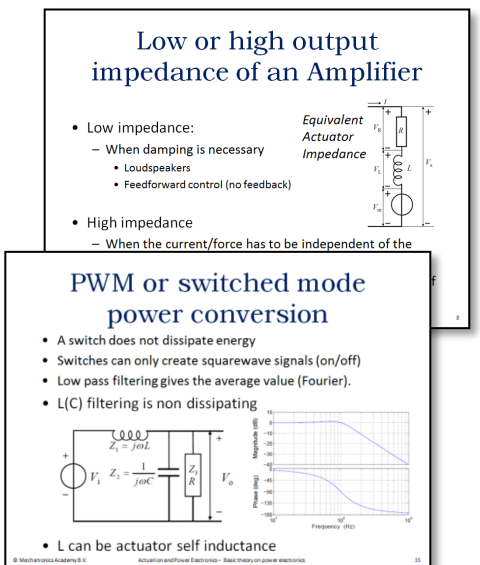
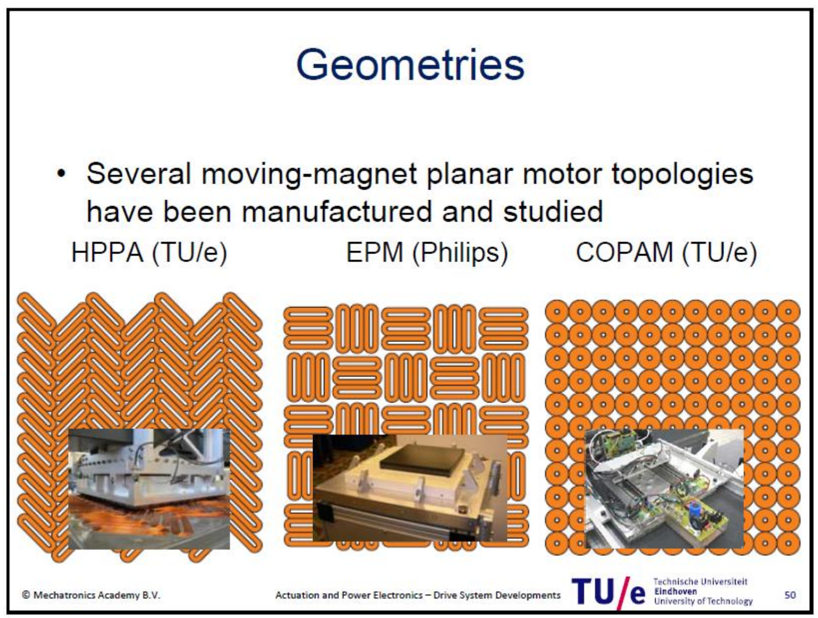
Actuation and Power Electronics

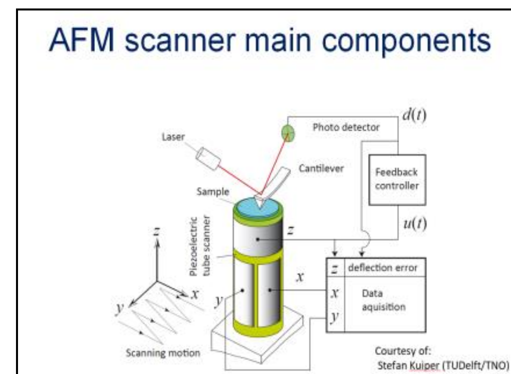


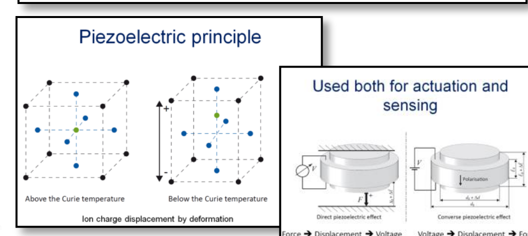












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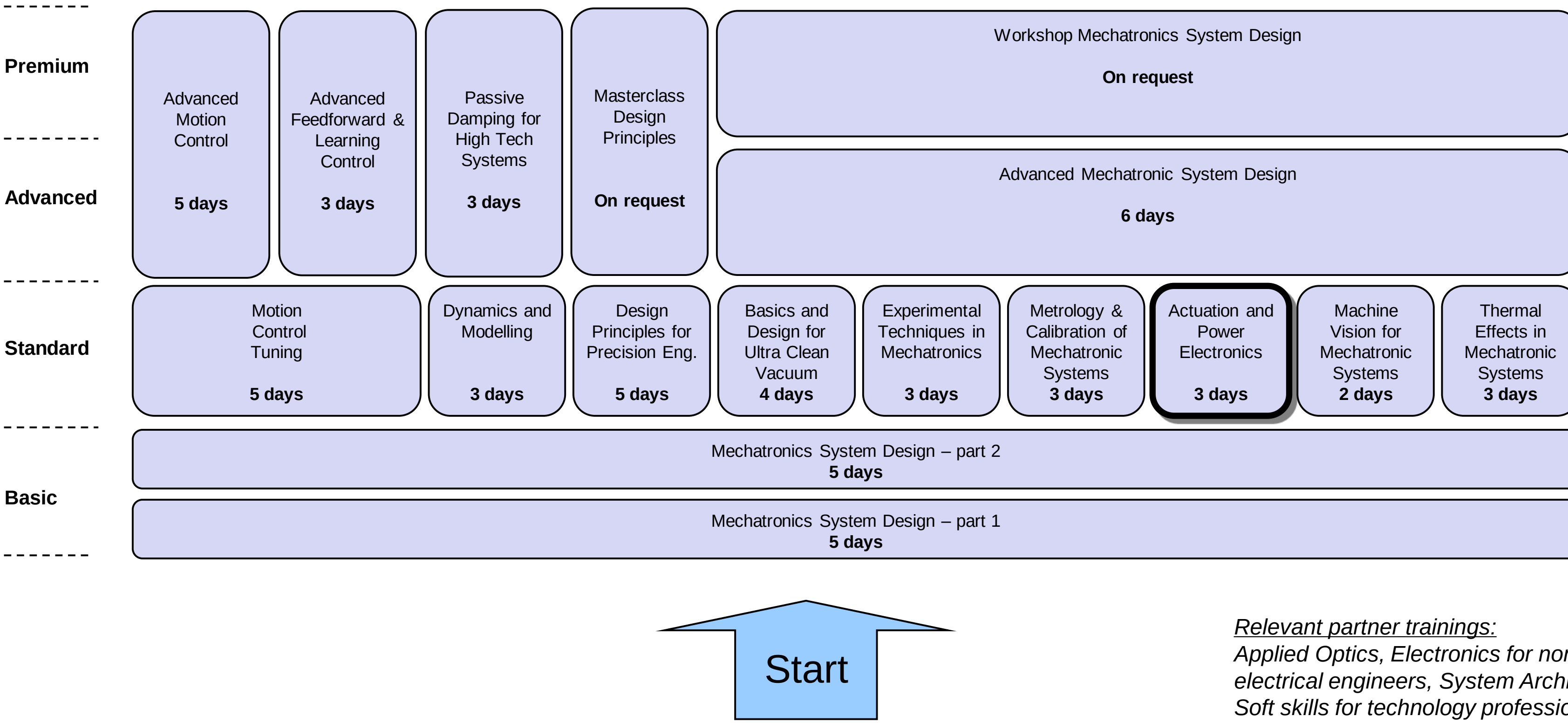
Contents

- Mechatronics Training Curriculum
- Details of Course *Actuation and Power Electronics*

Mechatronics Training Curriculum



<u>Relevant partner trainings:</u>
Applied Optics, Electronics for non-electrical engineers, System Architecture, Soft skills for technology professionals, …

www.mechatronics-academy.nl

Mechatronics Academy

- In the past, many trainings were developed within Philips to train own staff, but the training center CTT stopped.
- **Mechatronics Academy B.V.** has been setup to provide continuity of the existing trainings and develop new trainings in the field of precision mechatronics. It is founded and run by:
  - Prof. Maarten Steinbuch
  - Prof. Jan van Eijk
  - Dr. Adrian Rankers
- We cooperate in the **High Tech Institute** consortium that provides sales, marketing and back office functions.

Actuation and Power Electronics

Course Director(s) / Trainers

Teachers

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

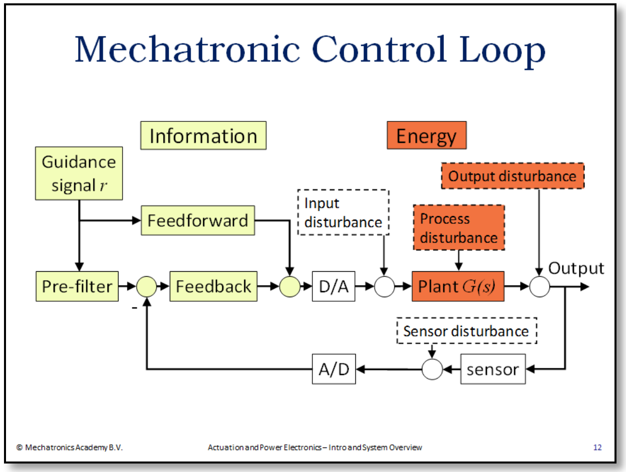
Course Director(s)

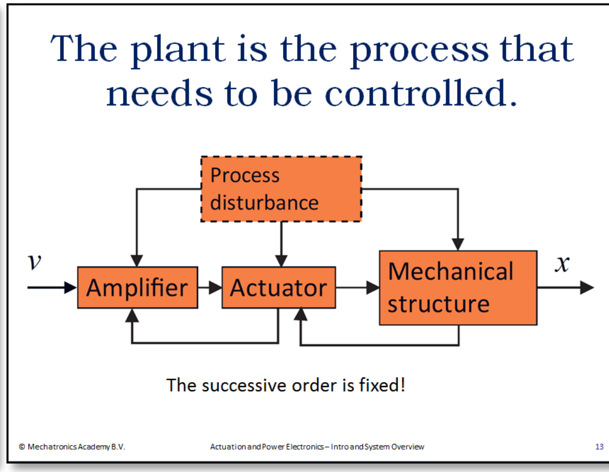
- ir. Jeroen van Duivenbode (ASML & TU/e Fellow)
- Dr.ir Adrian Rankers (Mechatronics Academy)

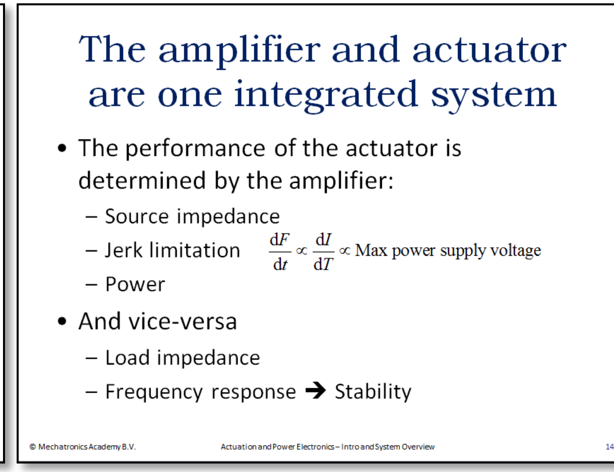
Program

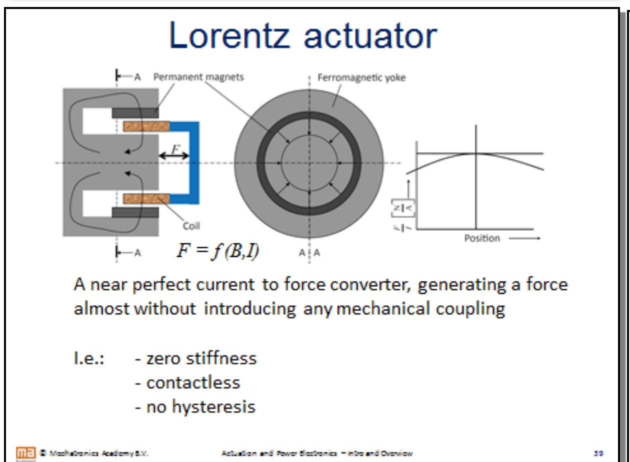
Day	Time	Main Theme	Presenter	Keywords
1	9.00-10.30	1.1 Introduction	Jeroen van Duivenbode	Learning goals. The role of electromechanical drives in mechatronic positioning systems. Some application examples as preview
	11.00-15.00	1.2 "Working with" Electricity and Magnetism	Jeroen van Duivenbode	Maxwell 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.
	15.30-17.00	1.3 Actuators Part 1	Bart Gysen	A little recap of METRON 1,2. Basic terms and properties of electromotors and actuators, efficiency, thermal dissipation, performance figures of merit.
2	9.00-12:30	2.1 Actuators Part 2	Bart Gysen	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. Non-linear reluctance force, linearization by balancing and feedback. Flux control, permanent magnet biasing.
	13:30-17:00	2.2 Power Electronics	Jeroen van Duivenbode	Basics of power electronics. Linear and switching power conversion. Control of switching power amplifiers. Bidirectional energy flow between mechanics and electronics. Semiconductors: Switching diodes, power transistors and Mosfets. Design issues with current amplifiers. Current noise.
3	9:00-10:30	3.1 Piezo actuators	Bart Gysen	Basics of Piezoelectricity, Electromechanical properties, Limitations and drawbacks. Amplifier requirements. Applications
	11:00-12.30	3.2 Actuators Part 3: Application examples	Bart Gysen	Electronic commutation. Amplifier-actuator interaction with different drive electronics demonstrated on real hardware. Two stroke actuation. Magnetic Bearings.
	13:30-15:00	3.3 Lab Tour EPE	Coen Custers	Advanced research on actuators and power electronics
	15:00-16:30	3.4 Planar actuators	Coen Custers	6-DOF Planar actuation and commutation. Animations of magnetic flux and force.
	16.30-17.00	Wrap-up and closure		

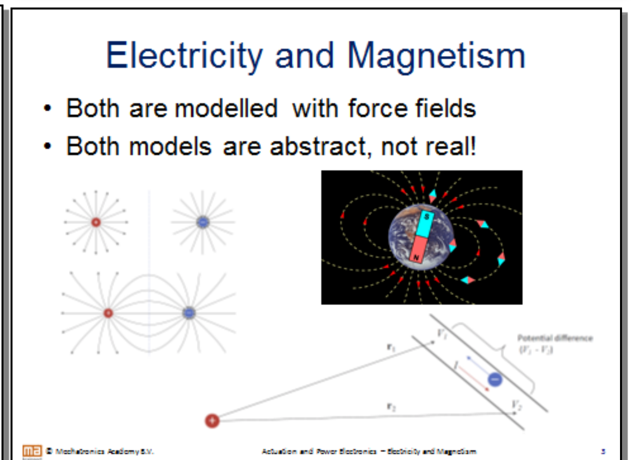
Day 1 (morning)

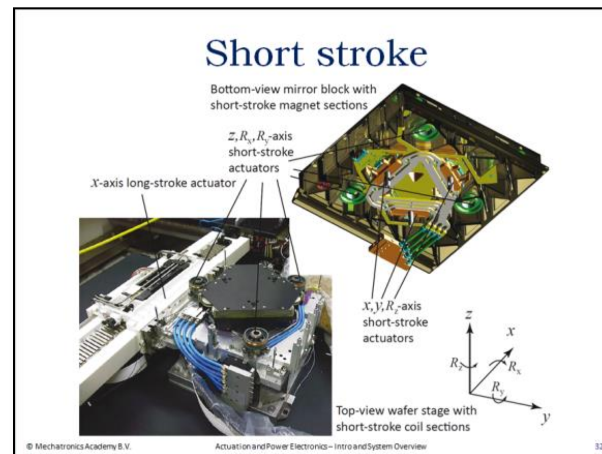




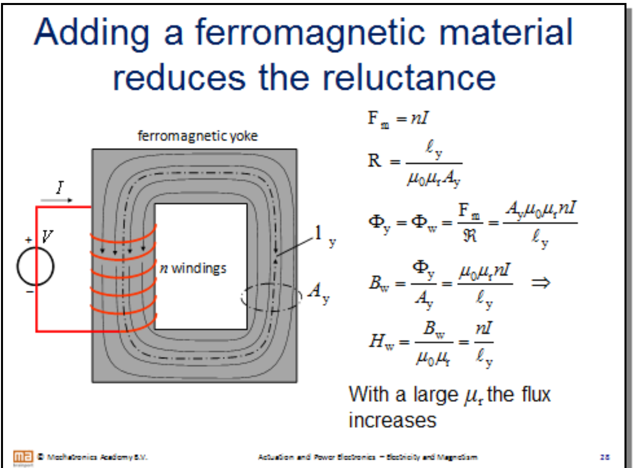


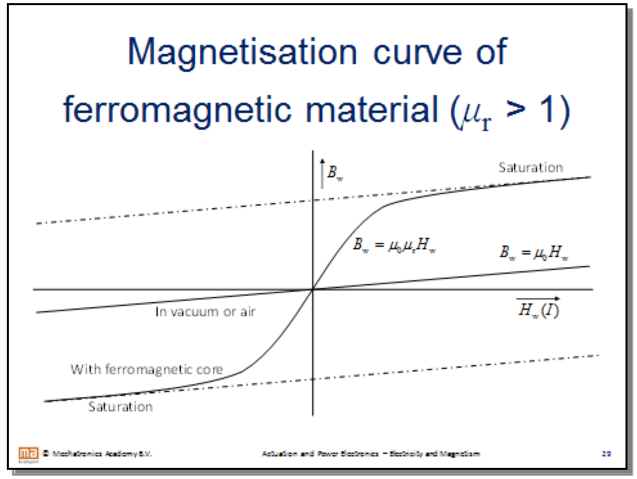


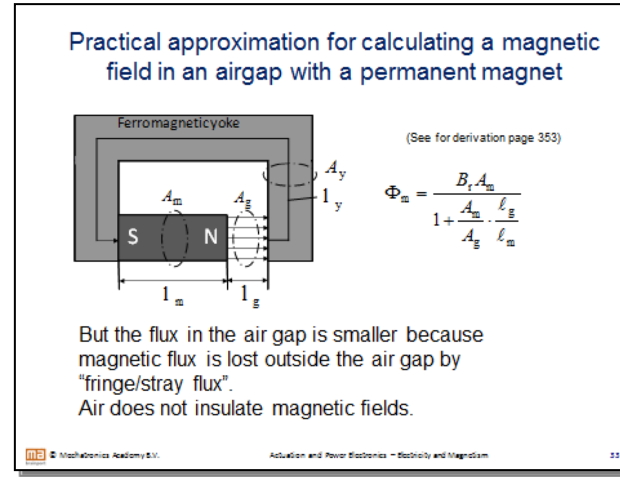


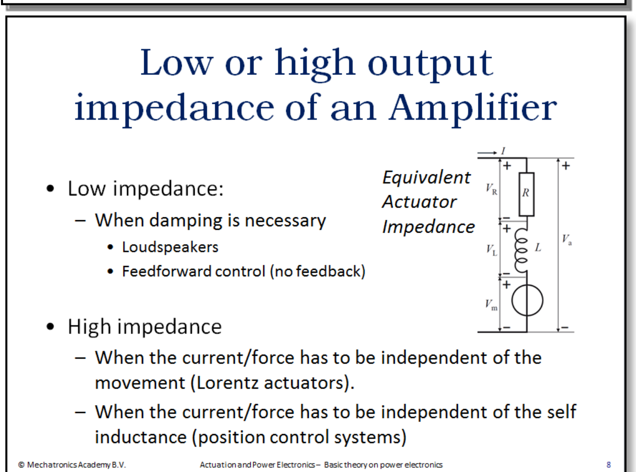


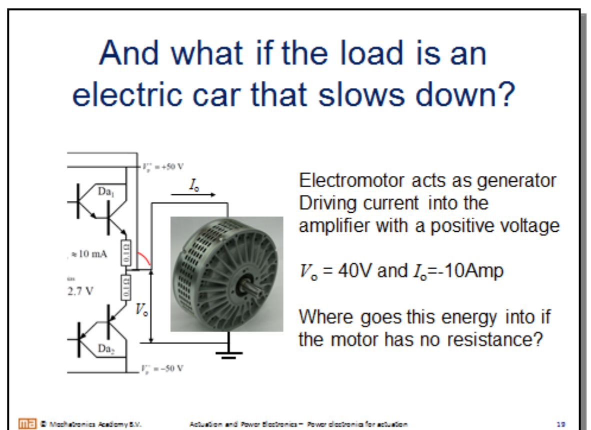
Day 1 (afternoon)

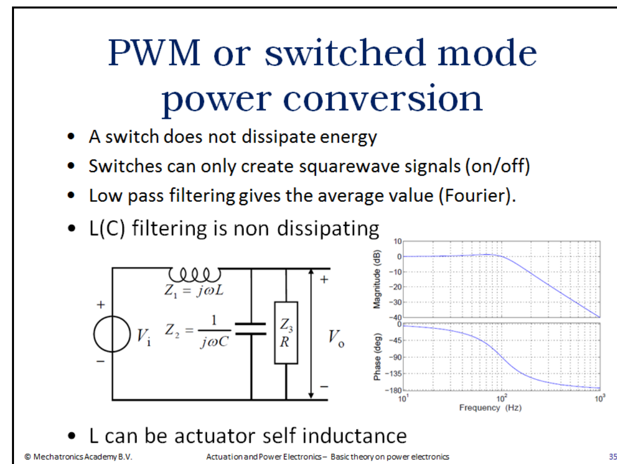












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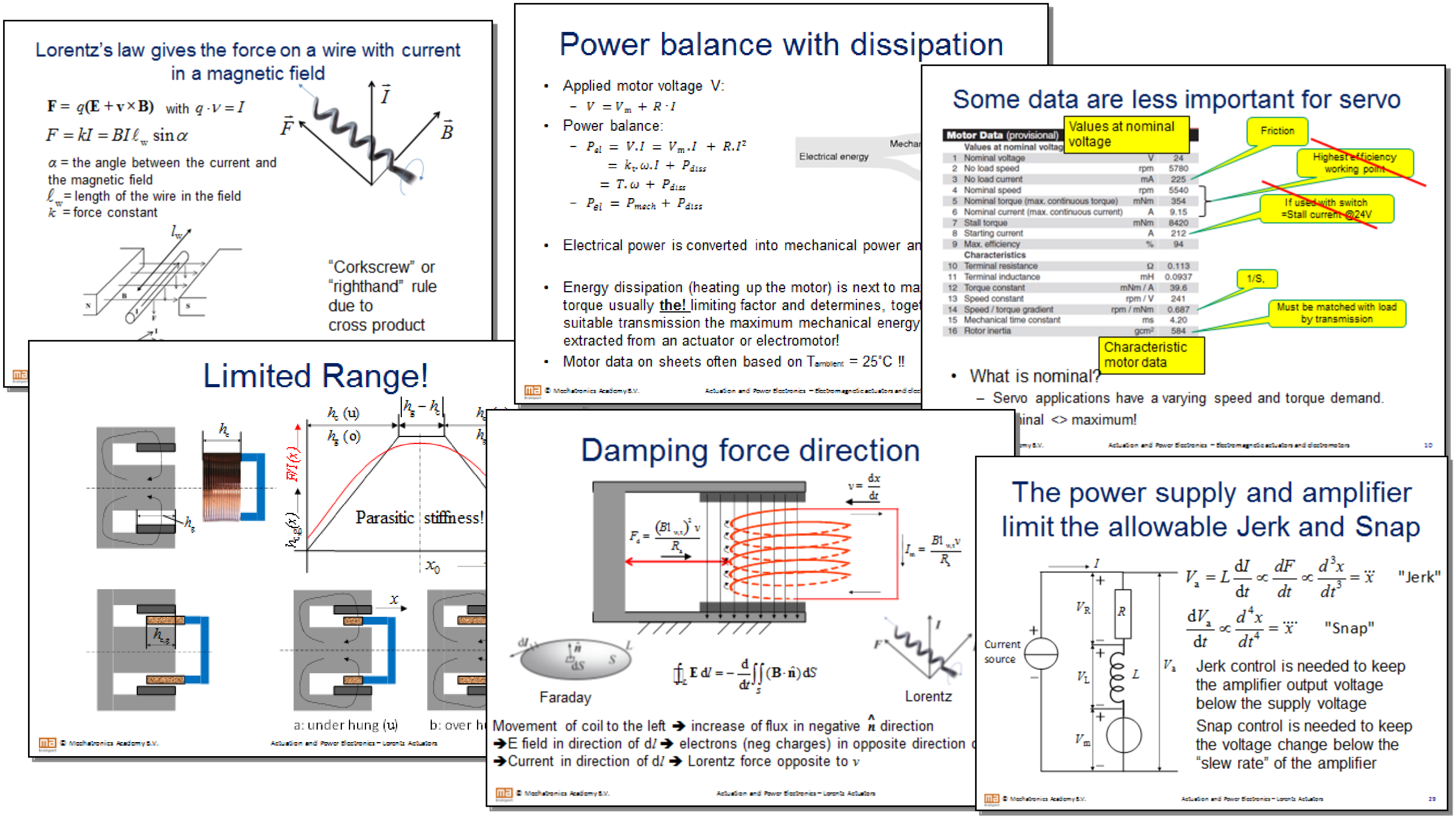
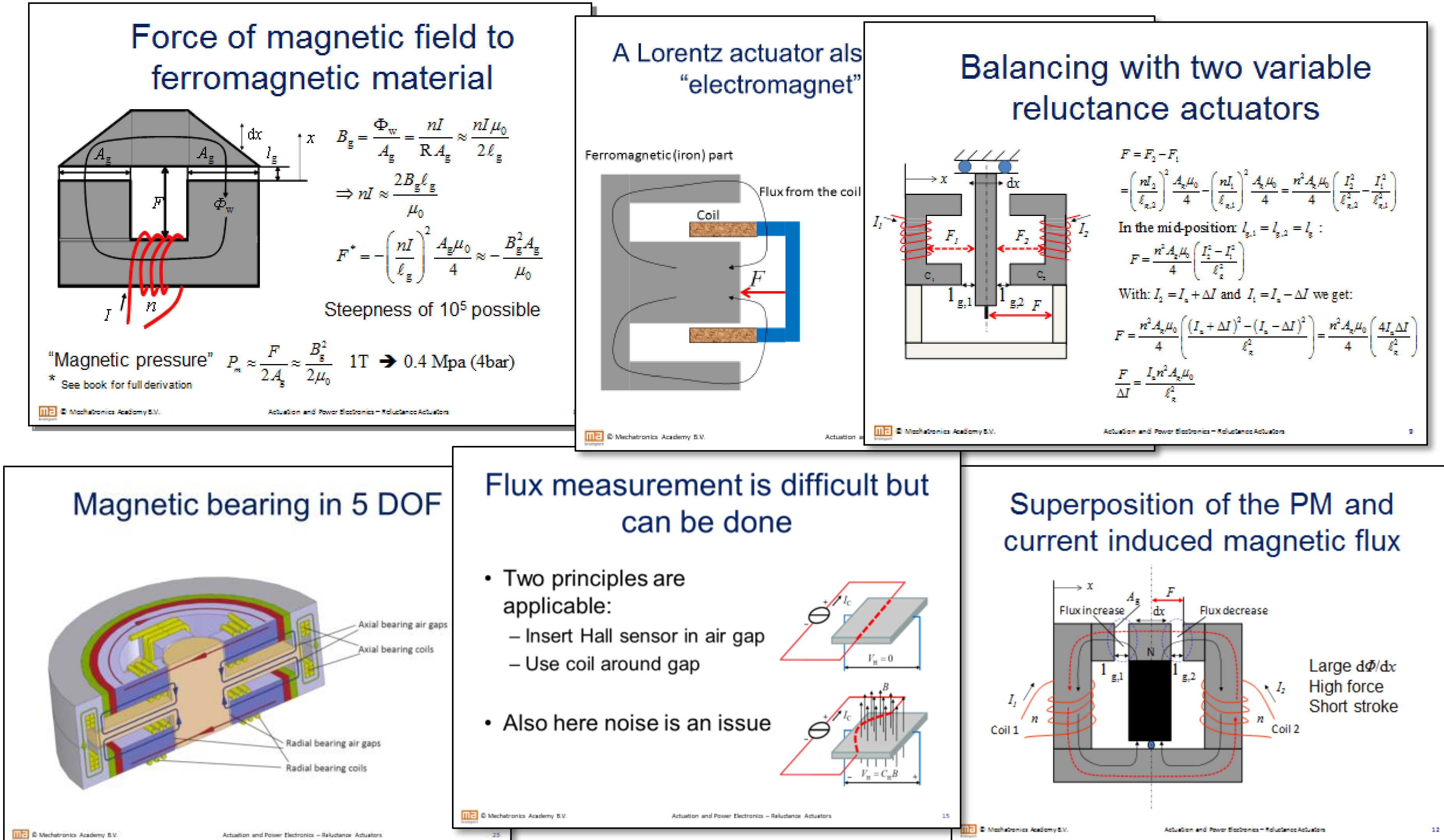


Day 2 (afternoon)



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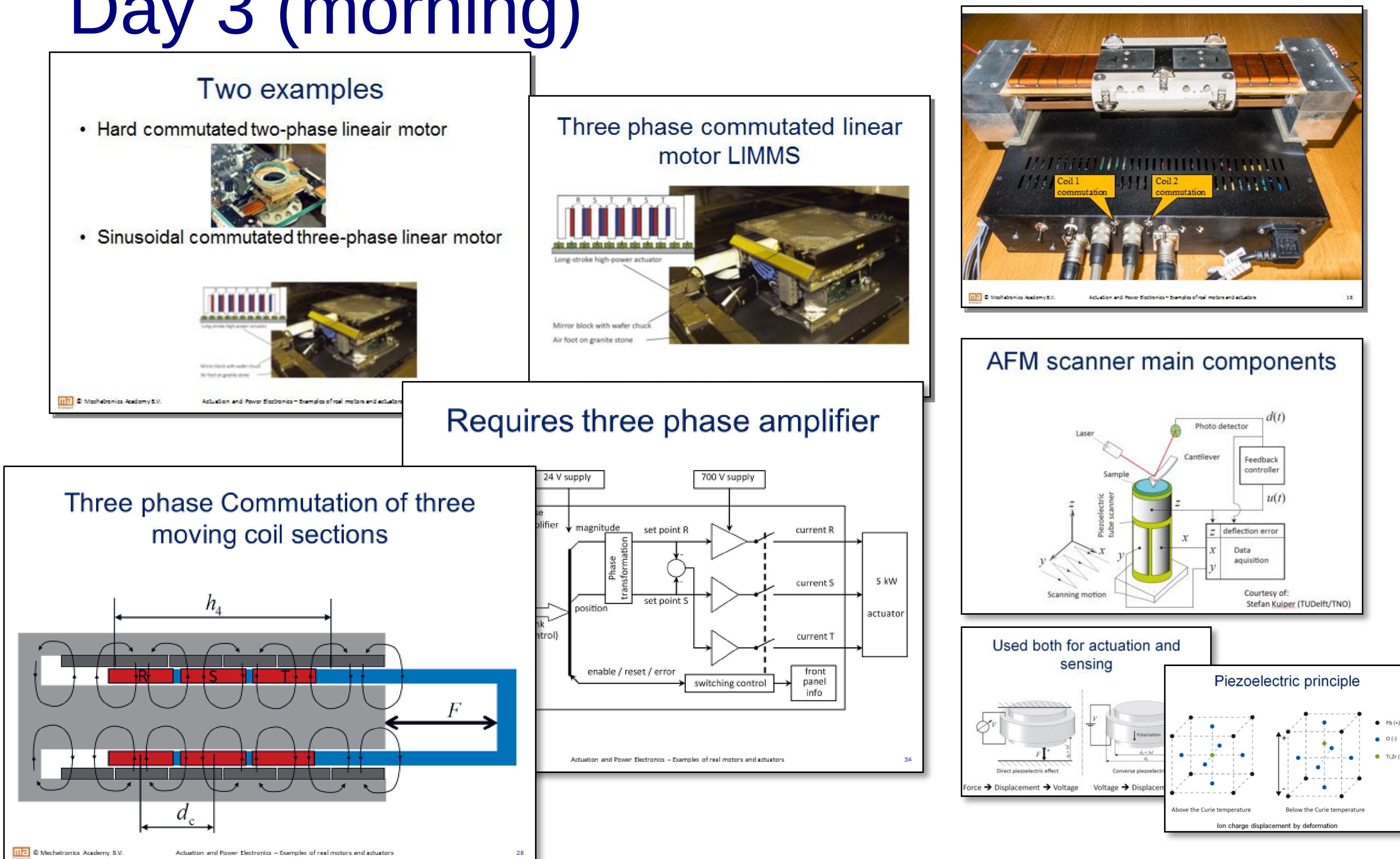
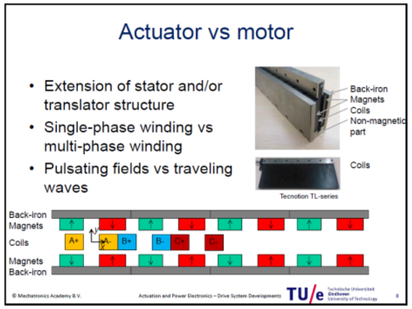
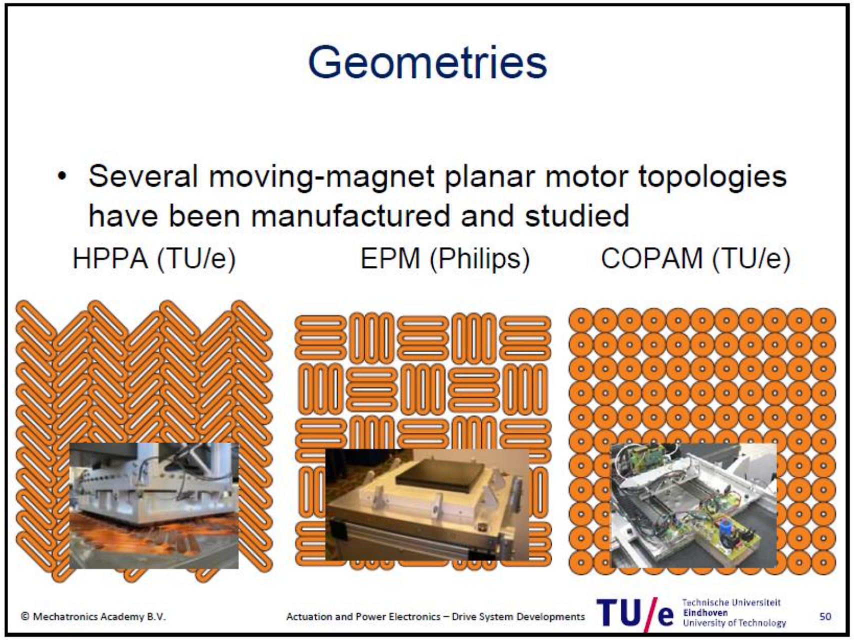
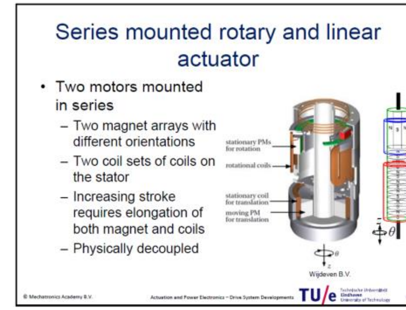
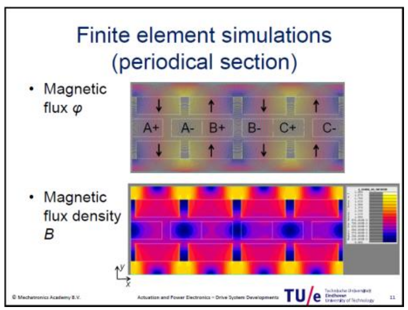


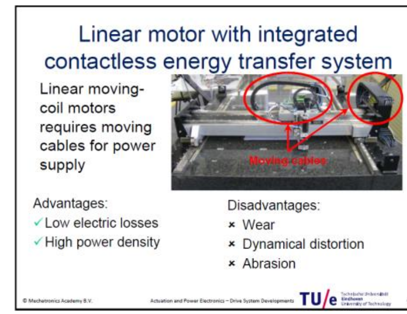
Day 3 (afternoon)

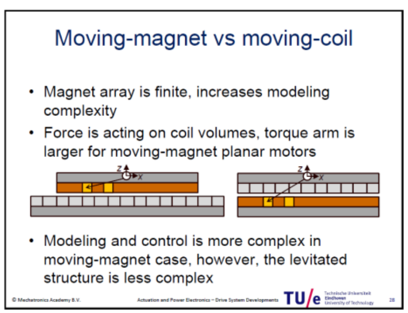


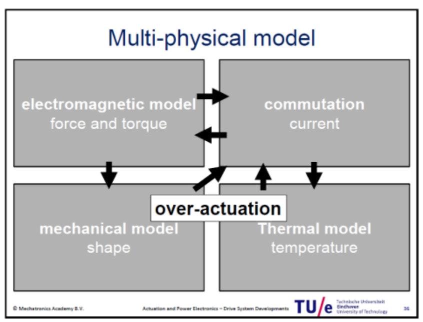


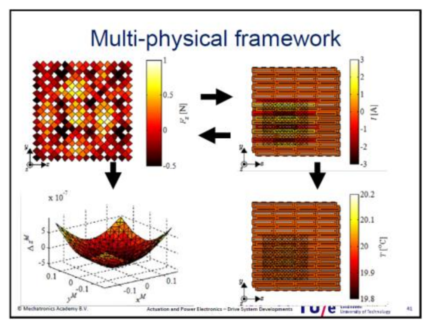


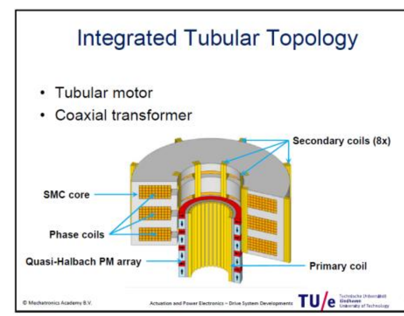












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