Focus Specialisation in Mechatronics and Robotics

Prof. Marco Hutter
Robotic Systems Lab
Mechatronics
The Scale of Robotics and Mechatronics

- Nearest Stars: $10^{15}$
- Edge of the solar system: $10^{12}$
- Earth to Mars: $10^9$
- Scale of a car: $10^3$
- Scale of a human hair (μm): $10^{-3}$
- Scale of a cell: $10^{-6}$
- Scale of a molecule (nm): $10^{-9}$
- Scale of a nanometer (nm): $10^{-9}$
Swiss Automata

Pierre Jacquet-Droz (1721-1790), Musée d'Art et d'Histoire, Neuchâtel
Robotics Today
Sense – Think – Act
Software and Hardware

Sense
• Different sensor types (e.g. Cameras, IMU, ...)
• Sensor data interpretation (e.g. Computer vision)

Robotics & Mechatronics

Think
• PCs, microcontrollers, ...
• Planning and decision making

Act
• Different actuators (DC motors, pneumatics, ...)
• Control
# Mechatronics Focus Courses (20ECTS)

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<th>Course title</th>
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<td>Acoustics in Fluid Media: From Robotics to Additive Manufacturing</td>
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<td>Signals and Systems</td>
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<td>Leistungselektronik</td>
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<td>ÖHydraulik und Pneumatik</td>
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<td>Introduction to Machine Learning</td>
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<td>Autonomous Mobile Robots</td>
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<td>Design and Control of Electric Machines</td>
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Lectures from
- D-MAVT
- D-ITET
- D-INFK
- D-HEST
Robotics, Systems and Control | world-leading faculty @ ETH

- Christian Holz: Intelligent Interactive Systems
- Joachim Buhmann: Machine Learning
- Robert Riener: Sensor Motor Systems
- Andreas Krause: Learning and Adaptive Systems
- Marco Hutter: Robotic Systems
- Roger Gassert: Rehabilitation Engineering
- Otmar Hilliges: Advanced Interactive Technologies
- Brad Nelson: Multi-Scale Robotics
- Daniel Ahmed: Acoustic Robotics
- Stefano Mintchev: Environmental Robotics
- Salvador Pane: Multi-Scale Robotics
- Melanie Zeilinger: Intelligent Control Systems
- Roy Smith: Automatic Control
- Roland Siegwart: Autonomous Systems
- Robert Katzschmann: Soft Robotic
- Emilio Frazzoli: Information and Decision Systems
- Stefano Mintchev: Environmental Robotics
- Luc van Gool: Computer Vision
- Margarita Chli: Vision for Robotics Lab
- Chris Onder: Dynamic Systems and Control
- Luc van Gool: Computer Vision
- Stelian Coros: Computational Robotics
- Siyu Tang: Computer Vision and Learning
- Yu Fisher: Computer Vision
- Robert Riener: Sensor Motor Systems
- Simone Schürle: Responsive Biomedical Systems Lab
- Christian Holz: Intelligent Interactive Systems
- Raffaello D’Andrea: Dynamic Systems and Control
- Florian Dörfler: Automatic Control
- John Lygeros: Automatic Control
- Joachim Buhmann: Machine Learning
- Roy Smith: Automatic Control
- Andreas Krause: Learning and Adaptive Systems
- Otmar Hilliges: Advanced Interactive Technologies
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- John Lygeros: Automatic Control
Some of our Research Projects

- Rotory-Wing Drones: Design, control and fully autonomous operation of miniature rotorcrafts
- Agriculture and Construction Robots: Design and navigation of robots for smart farming and construction tasks
- Fixed-Wing Drones: Design and environment-aware navigation of fixed and hybrid drones
- Mobile Robot Manipulation: Object modeling for manipulation, logistics and warehouse management
- Autonomous Cars & Trains: Visual navigation and autonomous operation of trains and cars
- Service Robots: Navigation and transportation in our daily environment

- Machine Learning
- Model-Predictive Control
Switzerland | largest density of start-ups and industry in robotics
Additional Information

• Bachelor thesis can be written in a different focus area
• Choice of the focus has no influence on the choice of Master
• … strong link to Master “Robotic, Systems and Control” …
  but also highly relevant for other areas

Personal recommendation

• Choose your focus based on your interest and fascination for ongoing research at ETH
• Go and check out the homepages, research projects, and offered student theses
D-MAVT Student Administration

Lorena Luzi  Silvia Häfliger  Danijela Lukic  Dr. Maddalena Velonà

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Tuesday, Wednesday, Friday  09:00 – 12:00