MSc ETH in Micro and Nanosystems
An educational program that can cope with the challenges of a fast changing industrial and academic environment

Jointly offered by D-MAVT and D-ITET
The world of MEMS

Micro and nanosystems are all around us
The world of MEMS
Micro and nanosystems are all around us
The world of MEMS
MEMS & Internet of Things – Humidity sensor

The Internet of Things is a network of physical devices that operate within the existing internet infrastructure.

Environmental monitoring devices can sense air quality, temperature, humidity, noise, light, pressure, etc.

https://cubesensors.com/
The world of MEMS
Micro and nanosystems are all around us
Robotic laser welding enables joining an extended range of materials with high quality and low weld footprint.

Thermoelectric heat flux sensors measure laser power, enabling more reliable operation.

greenTEG gRAY Laser Power Detector Series
The world of MEMS
Micro and nanosystems are all around us
The world of MEMS
MEMS in automotive industry - Gyroscope

Airbag control systems combine multiple sensor devices to predict accidents and significantly increase passenger safety.

Micromachined gyroscopes and accelerometers are key elements in airbag control systems.
The world of MEMS

MEMS in autonomous driving

Autonomous driving requires exact determination of the vehicle’s motion parameters and its environment to allow accident-free driving.

Utilized MEMS sensors include: accelerometer, gyroscope, laser radar, ultrasound positioning, etc.
The Case for a Specialized Master in Micro and Nanosystems

• Be prepared for the ever-changing academic and industrial landscape by an inter-disciplinary education.

• Have access to a broad and interconnected spectrum of research areas.

• Study among other highly qualified students with similar interests and varying backgrounds
Welcome day and apéros with tutors and other MNS students

Talks with PhDs and start ups

Social events for future, current and former MNS students

Contact: Leon Stolpmann
leons@student.ethz.ch

mns@amiv.ethz.ch
https://www.facebook.com/MNSETHZ
Excursions

• 2011 Siemens Mobility, Zürich
• 2011 Sensirion, Stäffa
• 2012 Kistler, Winterthur
• 2013 ABB, Lenzburg
• 2014 Siemens Building Technologies, Zug
• 2015 Sensirion, Stäffa
• 2016 Sonova ( Phonak ), Stäffa
Industry Support for the Master in Micro and Nanosystems

Companies supporting the master program:

ABB  greenTGE  IBM  Kistler  Bosch

Siemens  Novartis  Sensirion

Binnig and Rohrer Nanotechnology Center, the new nanoscience center of IBM and ETH Zürich.
> 200 companies and institutes in CH, A, F, D are working on/with micro and nanosystems
The Case for a Specialized Master in Micro and Nanosystems

• Be prepared for the ever-changing academic and industrial landscape by an inter-disciplinary education.

• Have access to a broad and interconnected spectrum of research areas.

• Study among other highly qualified students with similar interests and varying backgrounds.

• Set yourself apart by a further and specialized education:
  ➢ Transdisciplinary education, team oriented
  ➢ Modern technology for innovations
  ➢ System integration and applications
## Overview of Master categories structure

<table>
<thead>
<tr>
<th>Category</th>
<th>CP</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Core Courses**          | 36 | • Basis of the Master program  
 • Providing core knowledge in the respective area of specialization |
| **Multidisciplinary Courses** | 6  | • Student’s choice of courses at ETH, Uni Zürich and HSG  
 • Can be recommended by tutor |
| „GESS Science in Perspective“ | 2  | • General-education courses in humanities, social and political science from the course catalogue of D-GESS ETH Zürich |
| **Semester Project**      | 8  | • Use of acquired technical knowledge  
 • Provides experience in solving a specific engineering problem |
| **Industrial Internship** | 8  | • Min. 12-week internship in a Swiss or foreign company |
| **Master’s Thesis**       | 30 | • Conclusion of the Master program  
 • Independent and scientific work |

Core Courses

http://www.master-micronano.ethz.ch/curriculum.html

Each tutor has particular areas of interest and offers every student an individualized curriculum within the relevant research area from the list of:

- recommended core courses and
- elective core courses

<table>
<thead>
<tr>
<th>Recommended Core Courses</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devices and Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog Integrated Circuits</td>
<td>HS</td>
<td>6</td>
</tr>
<tr>
<td>Wearable Systems I</td>
<td>HS</td>
<td>6</td>
</tr>
<tr>
<td>Devices and Systems</td>
<td>HS</td>
<td>5</td>
</tr>
<tr>
<td>Organic and Nanostructured Optics and Electronics</td>
<td>FS</td>
<td>6</td>
</tr>
<tr>
<td>Energy Conversion and Quantum Phenomena</td>
<td></td>
<td></td>
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<tr>
<td>Electronic Transport in Nanostructures</td>
<td>FS</td>
<td>6</td>
</tr>
<tr>
<td>Introduction to Quantum Mechanics for Engineers</td>
<td>FS</td>
<td>4</td>
</tr>
<tr>
<td>Thermodynamics and Energy Conversion in Micro- and Nanoscale Technologies</td>
<td>FS</td>
<td>4</td>
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<tr>
<td>Semiconductor Nanostructures</td>
<td>HS</td>
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<tr>
<td>Material Surfaces and Properties</td>
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<td></td>
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<tr>
<td>Micro- and Nanoparticle Technology</td>
<td>FS</td>
<td>6</td>
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<tr>
<td>Continuum Mechanics for Engineers</td>
<td>HS</td>
<td>4</td>
</tr>
<tr>
<td>Functional Surfaces</td>
<td>HS</td>
<td>2</td>
</tr>
<tr>
<td>Surfaces, Interfaces &amp; their Applications I</td>
<td>HS</td>
<td>3</td>
</tr>
<tr>
<td>Modelling and Simulation</td>
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<td>Computational Statistics</td>
<td>FS</td>
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<tr>
<td>Computational Methods in Micro- and Nano-Structures</td>
<td>FS</td>
<td>5</td>
</tr>
<tr>
<td>High Performance Computing for Science and Engineering (HPCSE)</td>
<td>HS</td>
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<tr>
<td>Multiscale Modeling and Computation</td>
<td>HS</td>
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<tr>
<td>Physical Modelling and Simulation</td>
<td>HS</td>
<td>5</td>
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<tr>
<td>Laboratory Course</td>
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<tr>
<td>Embedded MEMS Lab</td>
<td>FS and HS</td>
<td>5</td>
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</table>
# Master curriculum structure

<table>
<thead>
<tr>
<th>Semester</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>ECTS</th>
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<tr>
<td><strong>Core Courses</strong></td>
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<td></td>
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<td></td>
<td><strong>Master’s Thesis</strong></td>
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<td></td>
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<td><strong>Semester Project</strong></td>
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<tr>
<td><strong>Industrial Internship</strong></td>
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<td></td>
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<td>8</td>
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<tr>
<td><strong>Multidisciplinary Courses</strong></td>
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<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td><strong>Science in Perspective (SiP)</strong></td>
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<td></td>
<td>6</td>
</tr>
<tr>
<td><strong>Master of Science ETH</strong></td>
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<td>90</td>
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</tbody>
</table>
Master Thesis (30 ECTS)

- ~ 6 months full-time work
- Subject with project plan
- Approved by the tutor
- Project at ETH and/or abroad

Before starting thesis work, students must
- have fulfilled all specific admission requirements;
- have achieved 32 credit points in the category core courses;
- have acquired the credit points corresponding to the Semester Project (8 cp)
Application for HS2017 / FS2018

- Application period: 01 March – 31 March 2017
- Apply online: https://www.ethz.ch/en/studies/registration-application/master/application/how-to-apply.html
- No need of recommendation letters for ETH Bachelor students
- No need of English test
- For questions regarding the admission process: ETH Admission Office master@ethz.ch
D-MAVT Student Administration

info@mavt.ethz.ch
ETH-Zentrum, LEE K 208, Leonhardstrasse 21, 8092 Zürich

Opening Hours:
During the semester:
Monday & Thursday: 13:00 – 16:00
Tuesday: 09:00 – 13:00
Wednesday & Friday: 09:00 – 12:00
Tutor system

- The Master program is tutor-driven
- Each student is entitled to a tutor
- Tutor and student define an individualized curriculum
- Tutor coaches students in course planning, research, mobility, industrial training and monitors progress
- Changing the tutor is possible
Prepare your Learning Agreement on the basis of your interests and the tutor’s sample curriculum

- Submission: Within 3 weeks of the start of the semester
- Study Plan: For each semester or for the whole study program
- Updates: Always possible with tutor’s approval
- Final version: Before starting the Master’s Thesis
Tutors in Micro and Nanosystems

- **D-MAVT**
  - Jürg Dual
  - Christofer Hierold
  - Brad Nelson
  - David Norris
  - Hyung Gyu Park
  - Dimos Poulakakos
  - Sotiris Pratsinis

- **D-ITET**
  - Jürg Leuthold
  - Gerhard Tröster
  - Janos Vörös
  - Vanessa Wood

- **D-PHYS**
  - Klaus Ensslin
  - Thomas Ihn

- **D-BSSE**
  - Andreas Hierlemann
Main Research Interests:
Design – Fabrication – System-level testing
- Optoelectronic devices for communications
- Sources and detectors for sensing
- Plasmonic devices

100 Gbit/s plasmonic transmitter.

Wireless antenna using nanotechnological devices

Novel nonlinear light sources

www.ief.ethz.ch
Prof. Brad Nelson
D-MAVT, Institute of Robotics and Intelligent Systems

Main Research Interests:
- Making sub-mm intelligent machines
- Manipulating sub-mm scale objects

www.iris.mavt.ethz.ch
Prof. Christofer Hierold  
D-MAVT, Micro and Nanosystems

Main Research Interests:
- Advanced microsystems:
  e.g. thermoelectric generators, acoustic sensors, and microsystems for medical applications
- Nanotransducers and nanosensors:
  e.g. ultra low power carbon based sensors
Prof. Sotiris Pratsinis
D-MAVT, Particle Technology Laboratory

Fundamentals (Prof. Mavrantzas, Goudeli, Kelesidis)

Catalysis (Dr. Büchel, Koirala, Fujiwara)

Biomaterials (Dr. Sotiriou, Spyrogianni, Blattmann, Starsich)

Devices (Güntner, Schädli)

www.ptl.mavt.ethz.ch
Main Research Interests:
- Stretchable bioelectronic devices
- Biosensors
- Interfacing biology with FluidFM nanopipette
- Building controlled neuron networks
Prof. Hyung Gyu Park
D-MAVT, Nanoscience for Energy Technology and Sustainability

Main Research Interests:
- Carbon nanofluidics for energy & clean tech
- Plasmonics for sensors and energy
- Multiscale manufacturing and 2D materials synthesis

www.nets.ethz.ch
Prof. Gerhard Tröster  
D-ITET, Wearable Computing Laboratory

Main Research Interests:
- Wearable, mobile computing, also on smart textiles
- Personal health and context recognition
- Flexible electronics for textiles and sports

Temperature sensor
Flexible plastic stripe

www.wearable.ethz.ch
Main Research Interests:
- Ultrasonic Particle Manipulation
- Wave Propagation in Microsystems
- Fluid Sensing in Microsystems
Prof. Dimos Poulakakos
D-MAVT, Laboratory of Thermodynamics in Emerging Technologies

Main Research Interests:
- Energy conversion, transport and fluidics
- Biothermofluidics
- Energy and the environment

www.ltnt.mavt.ethz.ch
Prof. Andreas Hierlemann
D-BSSE, Bio Engineering Laboratory

Main Research Interests:
- Neuroelectronic interfacing
- Microfluidics and microtissues

www.bsse.ethz.ch/bel
Prof. David Norris
D-MAVT, Optical Materials Engineering Laboratory

Main Research Interests:
- Synthesis/characterization of quantum dots
- Thermal plasmonics for thermophotovoltaics
- Quantum plasmonics

www.omel.mavt.ethz.ch
Main Research Interests:
- Optical and electronic measurement techniques on nano- and micro-size materials & structures
- Nano- and micron-size materials with new electronic or ionic properties
- Applications: LEDs, solar cells, batteries
Main Research Interests:
- Nanostructures of GaAs family and Graphene
- Superconductor/Semiconductor hybrids
- Transport in mesoscopic structures
Main Research Interests:
- Electron and spin transport in quantum dots and quantum rings
- Scanning probes techniques applied to semiconductor nanostructures

[Images of experimental data]
For more information, contact us or visit:

http://www.mastermicronano.ethz.ch/