Mechanical Engineering Master @ EPFL
A. Master degree @EPFL
B. Orientations/specializations
C. Where to find SGM information ?
D. Specific information : specializations, minor, Project et SHS
E. Professors and laboratories
A. Master degree @EPFL

Contact:

Director
Pr. François Gallaire

Deputy
Dr Alain Prenleloup

Secretary
Mme Anne Legrand

Apprentice
M. Colin Leder
A. Master degree @EPFL
The EPFL should be a model university in terms of:

- Its culture of respect, tolerance and integrity
- The rich variety of para-academic activities
A. Master degree @EPFL

The EPFL respect campaign

- Equal opportunity makes us brighter
- Diversity is our strength
- Listen and dare to speak up
- Look out for each other
- Kindness brings serenity
- Together we go further
Zero tolerance!

For all types of harassment (sexual, psychological, mobbing, etc.)

In all situations:

- student - student
- student assistant (SA) - student
- member of the academic staff - student
- member of the administrative and technical staff - student
- ... and vice versa

Possible consequences

- Disciplinary investigation (students) and/or administrative investigation (EPFL staff)
- Sanctions if misconduct is proven
A. Master degree @EPFL

What you can do in those situations?

- If you witness inappropriate behavior, show your disapproval! Inform your class delegate or section.
- If you are a victim, if possible, clarify the situation and tell the person concerned what behavior is making you feel harassed.
- Speak quickly to someone you trust or to our counselors go.epfl.ch/individual-support.
- Find out about the support network: go.epfl.ch/respect.
A. Master degree @EPFL

Statistic: students - teachers

Students

Number of students

08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18

0 100 200 300 400 500 600 700 800

BA MA

Staff

Number of teaching staff

08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18

0 10 20 30 40 50 60

Faculty Lecturers (in&ext)
European Credit Transfer and Accumulation System: 1 ECTS = 30 work hours
(60 ECTS per year x 30 work hours / 45 work weeks = 40 hours by weeks)
## A. Master degree @EPFL

### MSc curriculum (120 ECTS)

<table>
<thead>
<tr>
<th>GROUPE</th>
<th>Electives in Mechanical Engineering</th>
<th>≥44 ECTS</th>
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<tbody>
<tr>
<td></td>
<td>Specialization: ≥ 30 ECTS</td>
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<td>(Excel form on sgm.epfl.ch)</td>
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<table>
<thead>
<tr>
<th>GROUPE</th>
<th>Other electives / Minor</th>
<th>≥30 ECTS</th>
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<thead>
<tr>
<th>BLOC</th>
<th>1 Semester Project in Mechanical Engineering</th>
<th>10 ECTS</th>
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<tbody>
<tr>
<td></td>
<td>SHS Course + Project</td>
<td>6 ECTS</td>
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<table>
<thead>
<tr>
<th>GROUPE</th>
<th>Internship and Master Project in Mechanical Engineering</th>
<th>30 ECTS</th>
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</table>
# B. Orientations/specializations

<table>
<thead>
<tr>
<th>Fluid mechanics</th>
<th>Mechanics of solids and structures</th>
<th>Control and mechatronic</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
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<td><img src="image4" alt="Image" /></td>
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<td><img src="image6" alt="Image" /></td>
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<thead>
<tr>
<th>Energy and thermal science</th>
<th>Design and manufacturing</th>
<th>Biomechanics</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Image" /></td>
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<td><img src="image10" alt="Image" /></td>
<td><img src="image11" alt="Image" /></td>
<td><img src="image12" alt="Image" /></td>
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</tbody>
</table>
### B. Filières et spécialisations

**Mécanique des fluides**
- Drainage of gaseous and liquid fluids
- Non-Newtonian fluid
- Multi-phase flow
- Fluid-structure interaction
- Energy
- Bioengineering application
- Transport

**Mécanique des solides et des structures**
- Transport
- Aerospace
- Power generation
- Sports Technology
- Biomedical applications
- Materials Technology
- Design method

**Contrôle et mécatronique**
- Control: design of control systems to ensure stability and performance
- Mechatronics: electromechanical integration of controlled systems

**Science thermique et énergie**
- Building and industry
- Transport
- Electricity generation
- Renewable Energy
- Etc.

**Conception et production**
- Design process
- Modeling
- Experimental Setup
- Design optimization
- Product Manufacturing

**Biomécanique**
- Applied: design of orthopedic or cardiovascular implants
- Fundamental: correlation between biological response and predictive simulations
B. Orientations/specializations

Control and mechatronic

Pr Alireza Karimi
B. Orientations/specializations

Biomechanics

Pr. Salman Sakar
B. Orientations/specializations

Mechanics of solids and structures

Pr. Guillermo Villanueva
B. Orientations/specializations

Design and manufacturing

Pr. Jürg Schiffmann
B. Orientations/specializations

Energy and thermal science

Pr. Sophia Haussener
B. Orientations/specializations

Fluid mechanics

Pr. Tobias Schneider
C. Where to find SGM information?

IGM general webpage: https://sti.epfl.ch/fr/recherche/instituts/igm/

sgm@epfl.ch
C. Where to find SGM information?

Orientation: [https://sti.epfl.ch/fr/recherche/instituts/igm/](https://sti.epfl.ch/fr/recherche/instituts/igm/)

[...] enseignement/master-en-genie-mecanique/filieres-sgm/
C. Where to find SGM information?

Usefull documents: https://sti.epfl.ch/fr/recherche/instituts/igm/

[...] enseignement/documents-utiles-memsc/
17.09.2021

16 ECTS
Semester project + SHS

30+ ECTS
Minor or any courses including those from the list on the 2nd sheet

44+ ECTS
From the list on the 2nd sheet + 2 Bachelor courses (to be approved by Section Director)

Concentration: not mandatory!
Concentration advisor’s signature: needed only if you do a concentration

Becomes green if your plan complies with the rules
Suggested workload 25-35 ECTS / semester
Already proposed by IS-Academia in the Groupe « Options »

To be looked up and placed in the Groupe « Options »
C. Where to find SGM information?

What are the learning prerequisites?

**Advanced control systems**

**ME-524**

**Enseignant(e):** Karim Akersa

**Langue:** fr, en

**Withdrawal:** It is not allowed to withdraw from this subject after the registration deadline.

**Summary:**
This course covers some theoretical and practical aspects of robust and adaptive control. Robust controller design with H-infinity performance, digital controller design with pole placement technique, direct, indirect and switching adaptive control are studied and implemented in a hands-on lab.

**Content:**
- Stability, performance and robustness of closed-loop control systems. Robust controller design by loop shaping. Robust H-infinity controller design in the frequency domain. Multi-stable decoupling controller design.
- Two-degree of freedom RST digital polynomial controller. Pole placement technique and its relation to Internal Model Control (IMC), Model Reference Control (MRC) and Minimum Variance Control (MVC).
- Robust pole placement with G-parametrization. Parameter adaptation algorithms. Direct and indirect adaptive control. Switching adaptive control.

**Keywords:**
- Adaptive control, robust control, digital RST controller.

**Learning Prerequisites**

**Required courses:**
- Control Systems + Lab
- System Identification
- Multivariable systems

**Recommended courses:**
- 1. Control Systems
- 2. System Identification
- 3. Multivariable systems

**Important concepts to start the course:**
- Analyze a linear dynamical system (both time and frequency responses)
- Represent a linear system by a transfer function
- Identify a dynamic system using experimental data
- Design a PID controller
- Design a stable controller for a dynamic system

**Learning Outcomes:**
By the end of the course, the student must be able to:
- Design an advanced controller for a dynamic system, A11
- Assess / Evaluate the stability, performance and robustness of a closed-loop system, A12
- Define specifications/adequate control performance for dynamic systems, A13
- Propose several control solutions, formulate the trade-offs, choose the options, A14

**SEMAINE DE RÉFÉRENCE**

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<tr>
<td>8-10</td>
<td>10-12</td>
<td>15-17</td>
<td>20-21</td>
<td>25</td>
</tr>
</tbody>
</table>

**LEGÈNDE**

- **Cours**
- **Exercice, TP**
- **Projet, autre**
How to choose and register for courses?

1. Create your study plan for the 3 semesters (Excel form)
2. If you do a specialization: submit it for approval to the concentration advisor and then to SGM secretariat
3. A course can count once either in a Minor or in Groupe « options »
4. Register for courses in IS-Academia (mandatory) before October 1st
5. Announce all major modification (ex: minor surrender) of your study plan to our secretariat (update and submit your form)
6. Exam withdraw until the 10th week’s semester, except for semester courses (November 26)
7. 2 Bachelor courses may eventually be accepted with the section’s Director prior agreement
General exam withdrawal deadline for 2020-21 Winter Session: 26 November 2021

It is not possible to withdraw after 1st Oktober from the semester courses listed here:

- ME-401 Projet Génie mécanique I (semester project)
- ME-402 Projet Génie mécanique II (semester project)
- ME-524 Advanced control systems
- ME-403 Applied mechanical design
- ME-412 Experimental methods in engineering mechanics
- ME-410 Mechanical product design and development
- ME-476 Particle-based methods
- ME-499 Simulation and optimisation of industrial applications
- ME-421 System identification
- ME-446 Two-phase flows and heat transfer
Art. 12 - Choix des branches

(5) L’étudiant est responsable de la conformité au règlement du choix des branches

Art. 12 al. 5 (english)

It is the student’s responsibility to have a study plan that complies with the section rules
D. Specific information

Minors: subscription before the end of the first semester

Recommended Minors

- Energy
- Area and cultural studies
- Management of technology and entrepreneurship
- Computational science and engineering
- Materials science and engineering
- Biomedical technologies
- Spatial technologies

Any other EPFL Minor is accepted
Minors

Registration deadline

- End of the first semester
- Better at the beginning of the semester

Procedure

- Select the minor in IS-Academia
- Contact the Minor advisor
- Fill-in the registration form (copy to SGM)
- Register for courses in IS-Academia
- Withdrawal from a Minor: contact SGM to convert part of the Minor’s ECTS to electives
Specialization is elective

- Domain consolidation
- 30 ECTS with variable fundamental base courses
- EPFL rule under modification: minor vs specialization!!!

30 credits fundamental base courses:

- A Mécanique des fluides: 16
- B Automatique et systèmes: 9
- C Conception et Production: 17
- D Sciences thermiques: 15
- E Mécanique des solides et des structures: 18
- F Biomécanique: 8
Semester projects in Mechanical Engineering

- Projects I: mandatory (10 ECTS)
- Project II: elective (10 ECTS)

Registration procedure

- Find a project (Lab websites, contact an SGM teacher)
- Register for the project in IS-Academia and print the registration form
- Get the form signed by the SGM teacher in charge of the project
- Submit the signed form to SGM
D. Specific information

SHS (social and Human sciences)


The SHS program is over two semesters (Fall-Spring)

REGISTER NOW!
When?

- Before the Master Project (PDM)
- With the Master Project (PDMe)

Duration

- ≥8 weeks, ≤6 months
- 25 weeks if combined with the Master Project

Full presentation the Oktober 28 at 12:00 – 13:00

Hind Klinke
D. Information spécifique

**Industrial internship**

- **Fall**
  - Master cycle 60 credits
  - Internship 8 weeks

- **Spring**
  - Master cycle 60 credits

- **Fall**
  - Minor/speciality 30 credits
  - Internship 6 months

- **Spring**
  - Master project in *Industry* 25 weeks
    - 30 credits
  - PDM in *academia* 17 to 25 weeks
    - 30 credits

- **Fall**
  - Master project in *Industry* 25 weeks
D. Information spécifique

Master Project

2 alternatives

- At EPFL under the (co)supervision of an SGM teacher
- Outside EPFL (University or company, combined or not with the internship) under the (co)supervision of an SGM teacher

Duration

- at EPFL: 17 weeks
- outside EPFL: 25 weeks
You need to pass each exam

The 44 ECTS in Mechanical Engineering can only come from the list in the Excel sheet

You need 30 ECTS for a specialization

If you do a Minor you are not allowed to take any additional ECTS outside Mechanical Engineering

Begin your SHS this Fall

To begin you Master Project you must have passed at least 82 ECTS

Dedicated presentation with Q&A : Monday 27 September by zoom

Be aware that!
E. Professors and laboratories

ECPS
Emergent Complexity in Physical Systems

LFMI
Laboratory of Fluid Mechanics and Instabilities

UNFOLD
Unsteady Flow Diagnostics Laboratory

SCI-STI-MF
MF group Cavitation

IPESE
Industrial process and Energy Systems Engineering

LRESE
Laboratory of Renewable Energy Science and Engineering

SCI-STI-JVH
JVKH Group: Solid Oxide Fuel Cells

SCI-STI-PO
PO Group: Turbomachines
E. Professors and laboratories

LAMMM: Laboratory for Multiscale Mechanics Modeling

FLEXLAB: Flexible Structures Laboratory

EMSI: Engineering Mechanics of Soft Interfaces

NEMS: Advanced Nano-electromechanical Systems Laboratory

LAMD: Laboratory for Applied Mechanical Design

RRL: Reconfigurable Robotics Lab

SCI-STI-DK: DK Group: Closed Loop Lifecycle Management

CREATE-LAB: Computational robot design and fabrication Lab
E. Professors and laboratories

**LA3**
- Automatic Control Laboratory 3

**SCI-STI-GFT**
- GFT-Group Control (microgrids, systems)

**SCI-STI-AK**
- AK-Group Data-driven modelling and control

**MICROBS**
- MicroBioRobotic Systems Laboratory

**LBO**
- Laboratory of Biomechanical Orthopedics
Thanks for your attention

Questions?
EPFL Library

At the Rolex Learning Center
Open 7/7 – 7am to midnight

Services at the desk
8am to 8pm – Monday to Friday

Hundreds of millions of
documents available
on site and online

Register online
go.epfl.ch/siwsscovery-network

Many training sessions
to acquire new skills

Citation, plagiarism, information retrieval, bibliographies, etc.

Study spaces

Quiet and silent areas, Meeting rooms, equipments, etc.