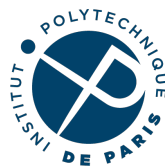
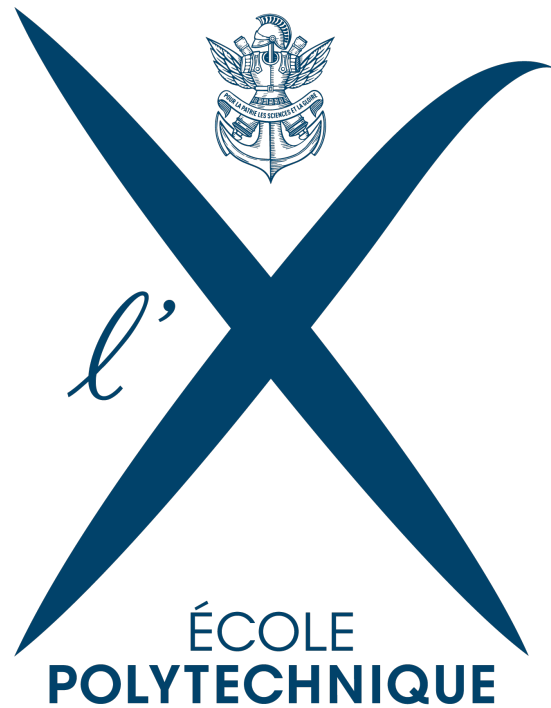




A quick glimpse...

- <http://www.youtube.com/watch?v=-gp6SgubONg>
- http://www.youtube.com/watch?v=_9a38pafR-U
- <http://www.youtube.com/watch?v=bpvkLG66VXs>

Known as l'X



IP PARIS





What are the Grandes Ecoles?

- The *grandes écoles* (literally in [French](#) "higher schools") of [France](#) are higher education establishments outside the main framework of the French [university](#) system. The *grandes écoles* select students for admission based chiefly on national ranking in competitive written and oral exams. In contrast, French public universities have a legal obligation to accept all candidates of the region who hold a [baccalauréat](#).
- Usually candidates for the national exams **have completed two years of dedicated preparatory classes**, although this is not always the case.
- They have produced many if not most of France's high-ranking civil servants, politicians and [executives](#), as well as many scientists, writers and philosophers.
- Some *grandes écoles* concentrate on a subject area, such as [engineering](#), [sciences](#), [social sciences](#), or [business](#).

Facts & figures

⊙ Education

2,750 students

• « Ingénieur Polytechnicien »:	2,000 students	20 % international
• Master of Science:	250 students	50 % international
• PhD:	500 students	35 % international

660 faculty members

- 14 members of the French Academy of Sciences
- 19 % international
- 10 departments (education and research)

⊙ Research

- 1,600 people in the research center
- 600 researchers - 500 PhD
- 22 laboratories
- Total research budget of €95 million
- 1,000 publications per year

⊙ International

- More than 700 international students (27%) from 60 different countries
- 84% of a Class goes abroad (9 months)
- 445 visiting scientists each year (>1 month)
- 179 agreements with foreign universities



A multidisciplinary research centre

Physics and Applied Physics

(Theoretical, Condensed Matter, Solid-State, Particle, Nuclear, Plasma, Materials, Electronics, Lasers, Optics)

Mathematics

Applied Mathematics

Computer Science

Engineering Mechanics

(Solid Mechanics, Fluid Dynamics, Meteorology)

Biology

Chemistry

22 laboratories

1,600 people



**Quantitative Economics
& Finance, Management**



Faculty

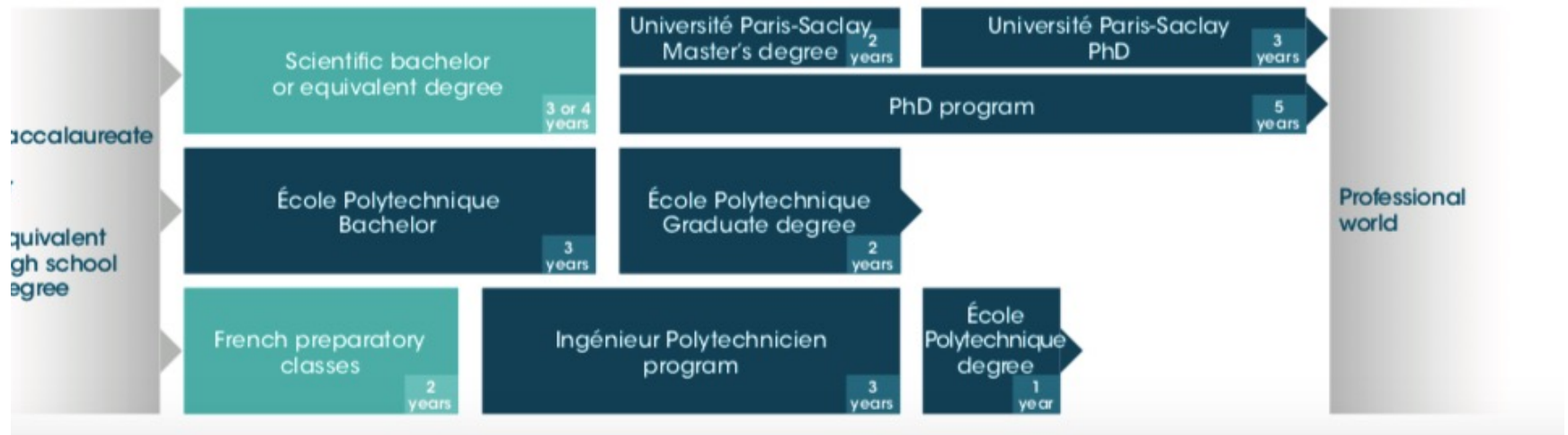
FACULTY - KEY FIGURES

1,100
teachers and professors

39%
international faculty

99% of students
employed 6 months after graduation

X



Ecole Polytechnique Scholars Program

- 3.3 GPA required
- Must be able to read, write and comprehend French at least at a high intermediate level.
- 14-week term (early Sept. to mid December)
- Students take classes ONLY from Year 3 (courses numbered in the 500 range)
- Students take 4 classes in their Programme d'Approfondissement (option) + possible Hum/SS class + required French class

Ingénieur Polytechnicien Program

- **Both general and specialized studies**
École Polytechnique's *Ingénieur Polytechnicien* Program is a unique **4-year program**: 3 years to obtain the Engineering degree and 1 year to obtain École Polytechnique's Diploma.

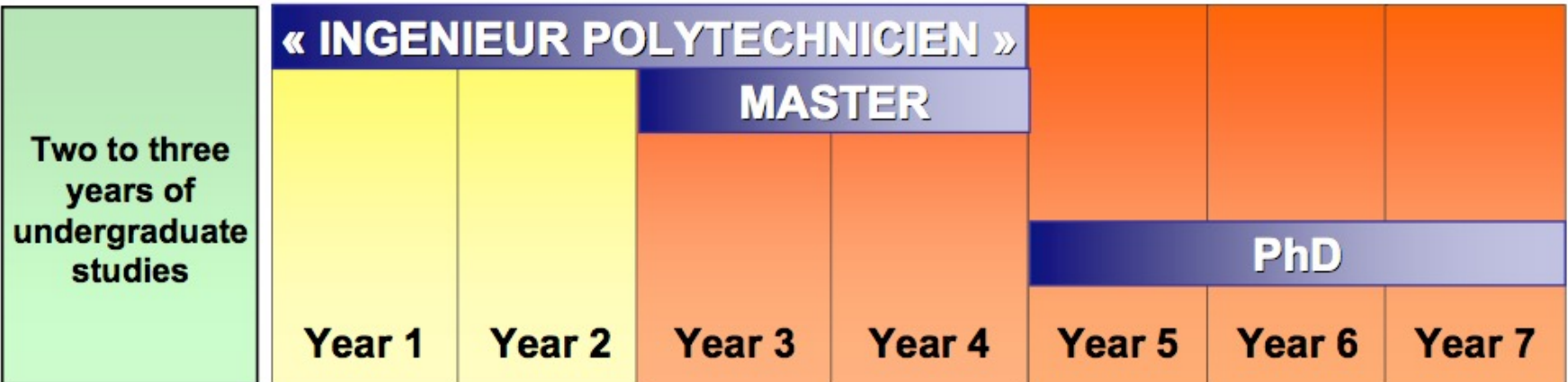
4 Year Program

- This 4-year curriculum provides students with:
 - A multidisciplinary scientific training that gives students a broad scientific base (basic sciences, engineering sciences, social economics).
 - A human, military and sports training that allows students to develop their behavioral and relational skills.
 - Specialized courses with advanced scientific concentrations that rival the top engineering schools worldwide.

Education

Undergraduate

Graduate



- > « Ingénieur Polytechnicien » 2,000 students 20% international
- > Master Program 250 students 50% international
- > PhD Program 500 students 35% international



Overview of Ingenieur Program

- 3rd year Curriculum Only
- <https://programmes.polytechnique.edu/en/exchange-programs/international-academic-exchange-program/program-details>

Application Process

Students must turn in all Caltech application forms by **DUE JANUARY 25**
Nominated candidates will turn do the Ecole Polytechnique application
once nominated

Caltech Application Requirements

Application Form

Core Course Checklist

2-3 Recommendation letters

Proposal

- Personal Statement
- Courses needed to graduate
- Program Fit
- Proposed Course List

Ecole Polytechnique Requirements

Application Form

Learning Agreement Form

Curriculum Vitae

An abstract of courses

Language Evaluation

A letter of statement in French

Language Evaluation

Online Application Forms Will Be Posted at

<https://formulaire.polytechnique.fr/candidatures/home/>

You must first be nominated by the Caltech Study Abroad Committee.

DO NOT SUBMIT ANYTHING TO ECOLE POLYTECHNIQUE. EVERYTHING COMES TO FASA.

Useful Websites

- Ecole Polytechnique Application Forms will be posted in January 2022 at:
<https://formulaires.polytechnique.fr/candidatures/home/>

Admissions Process:

<https://programmes.polytechnique.edu/en/exchange-programs/international-academic-exchange-program/how-to-apply>

- Ecole Polytechnique Course Catalog:
<https://synapses.polytechnique.fr/catalogue/2021-2022/parcours/4/X-3A-diplome-d-ingenieur-de-l-ecole-polytechnique-3eme-annee>

- Caltech Program Info & Application Materials:

Go to fasa.caltech.edu and click on study abroad and Ecole Polytechnique



[Advanced search](#)

Programs

Main School :



Program Language : French

PDF [\(short version\)](#)
 PDF [\(long version\)](#)

> Ecole Polytechnique's 'Ingénieur' Program > Graduate studies

MSc in Engineering

Year 3 - Scientific Specialization

Aims : The third year is centered on scientific specialization. During the first two terms students have to choose a set of courses in a specialized domain :

Applied mathematics; Biology; Chemistry at Frontiers; Cognition and Complex Systems Science; Computer Science; Economics; Electrical Engineering; Energies for the Challenges.

This "Scientific Specialization Programm" is completed by instruction in the Humanities and Social Sciences, two Foreign Languages and Sports.

The third term is dedicated to a three-to-five-month research internship allowing students to develop a scientific project in an academic or corporate research environment after

Specialization trainings:

- [Biology](#)
- [Bioinformatics](#)
- [Chemistry at frontiers](#)
- [Economics](#)
- [Electrical Engineering](#)
- [Energies of the XXIst Century](#)
- [Informatics](#)
- [Engineering and Innovation Technologies](#)
- [Mathematics](#)
- [Applied Mathematics](#)
- [Mechanics](#)
- [Physics](#)
- [Cognition and Complex Systems Science](#)
- [Sciences for the Environmental Challenges](#)

3rd semester :

- [Advanced Research Internship](#)

Humanities and Social Sciences:

- [Humanities and Social Sciences \(3rd Year\)](#)

Last Modification : Wednesday 25 July 2012

Advanced search

Programs >> Mechanics

Main School :



Partners Schools :

> EP, Antoine SELLIER

Program Language : French

Requirements :

MEC431

ECTS Credits : 52 (CI) / 60 (M1)

Duration : 2 Terms



PDF [\(short version\)](#)



PDF [\(long version\)](#)

> Ecole Polytechnique's 'Ingénieur' Program > Graduate studies > Year 3 - Scientific Specialization

MSc in Engineering

Mechanics

Aims :

Program Contents :

Period 1 - Fall

Choose 3 main courses

- Biofluid Mechanics and Mass Transport
- Plasticity and Fracture
- Computational fluid dynamics
- Stability of Solids: from Structures to Materials
- Compressible aerodynamics
- Instabilities and turbulence
- Earth dynamics: magnetism, earthquakes, volcanoes, tsunamis
- The Finite Element Method for Solid Mechanics
- Laboratory research project
- Physical bases of the mechanical behaviour of solids
- Soft surfaces

Choose 1 specialization course

- Laboratory research project
- Acoustics and sound environment
- Inverse problems
- Smart materials in Robotics and Microtechnology
- Complex Materials
- Aerodynamics

Period 2 - Winter

Choose 3 main courses

- Control : Basic concepts and applications in mechanics
- Optimal design of structures
- Propulsion
- Fluid-structure interactions
- Inelastic Analysis of Structures
- Slender structures
- Micro-scale viscous flows and complex fluids
- Heat transfer and fluid flow
- Physical hydrodynamics for environment
- Structural Dynamics
- Laboratory research project
- Physics of biological polymers and membranes

Choose 1 specialization course

- Laboratory research project
- Projects in structural and fluids mechanics
- Hydrodynamics and Elasticity
- Biomechanics in Health and Disease
- Smart materials : multiscale modelling and applications



Teaching coordinator :



Carlo COSSU

Level : Graduate

Course Language : English

Term : Fall

Number of hours : 36

ECTS Credits : 4

MEC555 Instabilités and turbulence

Scope

Instability, unpredictability and disorder are very often encountered in natural, technological, ecological, economic and social systems with important consequences on forecasting, design and decision making. These concepts have been historically introduced in the study of the laminar-turbulent transition in fluid flows, where they still represent an active field of research. Some questions of interest in this context are: Why 'laminar' solutions, having a maximum degree of symmetry, become unstable and are replaced by less symmetric solutions? What are the reasons of unpredictability in non-linear systems? Is there anything predictable in turbulent flows? The scope of this course is to present our current understanding of the answers to these questions.

Instructor

Carlo Cossu, CNRS-IMFT & Ecole polytechnique
www.enseignement.polytechnique.fr

Contents

Examples of unstable flows and phenomenology of laminar-turbulent transition. Motivations of stability analyses. The simplifying assumptions and their rationale. Stability definitions. The method of normal modes for linear stability analysis. Dispersion relation, stable, neutral and unstable waves.

Instabilities originated by unstable stratification: Rayleigh-Bénard and Rayleigh-Taylor instabilities. Instabilities due to centrifugal forces (Taylor-Couette instability). Geophysical and astrophysical applications.

Modal instabilities in parallel shear flows. Reynolds stress, perturbation energy production and dissipation. Derivation of Orr-Sommerfeld equation. Inviscid case: Rayleigh equation. 2D case: standard theorems (inflection point / Fjørtoft / semi-circle). Inflectional instabilities; mixing layers, jets and wakes. Instabilities driven by viscosity: 2D Tollmien-Schlichting waves. Modal stability of 3D flows: Squire theorem and its interpretation.

Generalised stability theory. Non-normality and transient energy growths. Propagator norm, optimal transient growth, Optimal response to harmonic forcing. The lift-up effect in shear flows, vortices streaks and subcritical transition to turbulence.

Turbulent flows. Physical description of turbulent flows. Ensemble average and Reynolds decomposition. Equations for the mean flow, turbulent Reynolds stress. The problem of closure. Production and dissipation of turbulent kinetic energy. Turbulent free shear layers and self-similar solutions. Origin of large-scale coherent structures. Analysis of production and dissipation. Wall-bounded shear flows: the mystery of energy production process and its relevant scales.

Nonlinear dynamical systems. Phase space. Attractors, basin of attraction, topological view of non-linear stability theory. Chaotic solutions and strange attractors. Unpredictability and the 'butterfly effect'.

Course taught in English

Last Modification : Saturday 30 June 2012

Campus Life

- Students live on campus in single dorm rooms
- There is very affordable on campus dining, as well as a kitchen to cook in
- Lots of clubs, and even more sports. Sports are a huge part of campus culture and are required for regular X students
- There is a week-long fall break, or reading week, in mid-October
- Paris is only 40 minutes away by train!

Campus Life



THE CAMPUS IN NUMBERS

1,500

student housing units,
1 on-campus B&B,
1 cafeteria, 1 café

50

classrooms and
practical workshops,
15 lecture halls

8,000 m²

of indoor sports facilities,
including 2 swimming pools, 2 gymnasiums,
1 fencing room, 1 climbing wall, 1 martial arts dojo

8ha

of outdoor
sports facilities including
1 equestrian center
and 1 artificial lake



Campus – lots of student organizations & sports teams



A campus in an exceptional environment

Just 20 km south of Paris, the École Polytechnique campus covers 160 hectares, on which students create numerous initiatives to organize cultural, artistic, social and sports activities through their student organizations.

Campus life is vibrant and offers a wide range of events, including scientific seminars, shows, exhibitions, etc. Events are open to the public: Science Fair, Heritage Days, conferences, etc.

ÉCOLE POLYTECHNIQUE

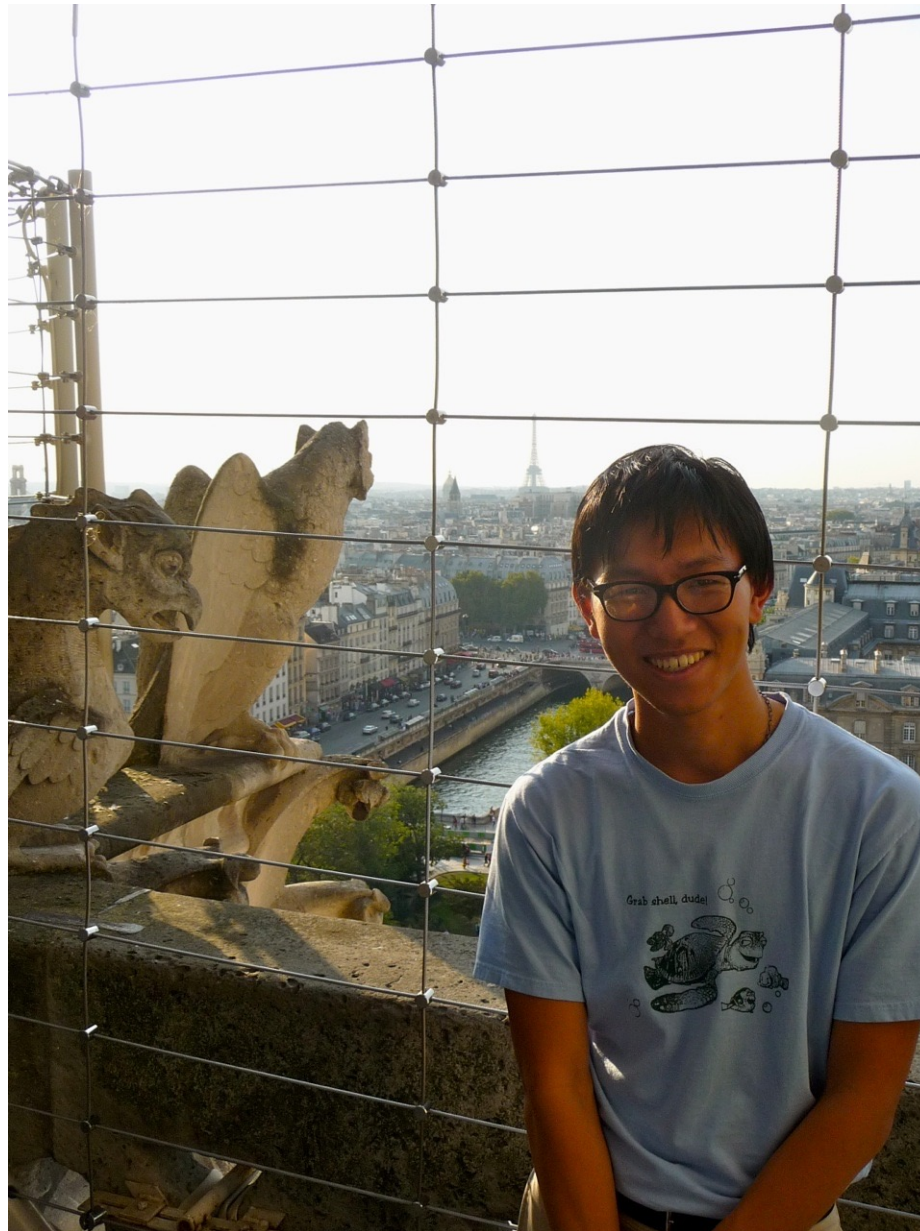
91128 PALAISEAU CEDEX – FRANCE – +33 1 69 33 33 33

www.polytechnique.edu

What's there to do in Paris?

- About a 45 minute train ride from X – you'll be there every weekend!
- Food (<http://www.timeout.com/paris/feature/food/pariss-best-cheap-eats>)
- Paris walking tours: https://www.paris-walks.com/index_m.html
- Art!
 - Le Louvre (Mona Lisa, anyone?)
 - Musee d'Orsay (Hey Monet)
 - Centre Pompidou (inside out building)
 - Musee Carnavalet (Paris history – free!)





Napoleon Uniforms

Founded 1794 & Became Military Academy under
Napoleon in 1804



Horseback Riding!



Le Lac



Campus View

