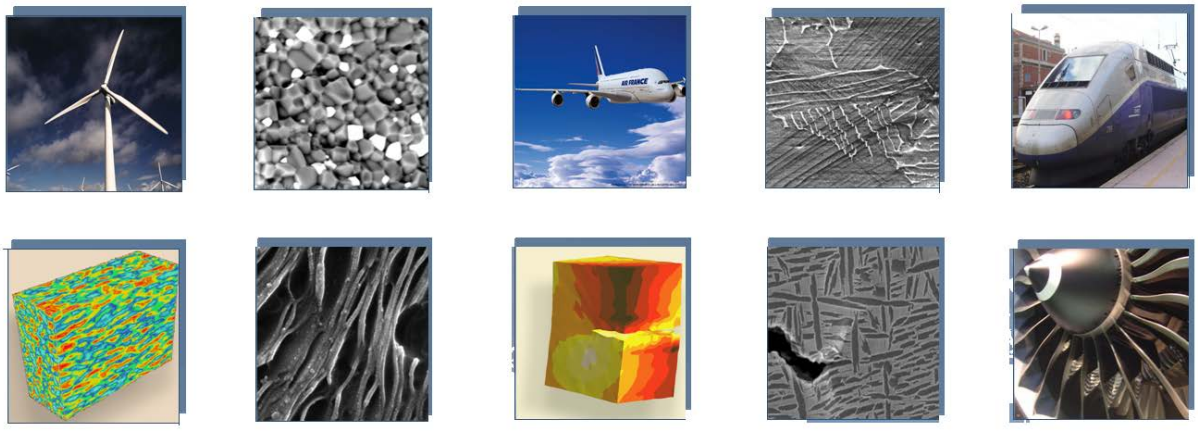
Master's degree : Sciences and Technology

Speciality : Mechanics and system engineering

master's degree program

Master MAGIS-*Paris*



Web site: to find detailed information visit our web site www.magis-paris.eu

contactmaster@magis-paris.eu

Advantages

■ Joint degree between several Universities and Engineering schools.
- UPMC (University Paris 6)
- Arts & Métiers ParisTech
- ENS de Cachan
- Ecole Polytechnique
- Ecole Centrale Paris (ECP)
- MINES ParisTech
- Ecole Supérieure de Physique Chimie Industrielles ParisTech (ESPCI)

■ Labeled ParisTech master
■ Interaction with internationally recognized academic staff.
■ Close contact with industry thanks to a large volume o research undertaken in collaboration with industrial partners.
■ An advanced multidisciplinary mechanics of material approach(using specialized simulation software) that is particularly appreciated in industry.
■ Program taught entirely in English and in French (in parallel sessions).
■ International students are welcome. It is
■ Held in the historical heart of Paris and in research laboratories in Paris area.

Objectives

The objectives of this two years program are to provide students with a deeper understanding of materials science & engineering and solid mechanics fundamentals and to impart a better knowledge of recent developments in the field, for advanced industrial applications and innovative processes.

Most industrial systems (aircrafts, engines, trains, power-plants etc…) involve a wide variety of materials (metals and alloys, polymers and composites, ceramics etc…). Therefore robust and generic approaches are required to model, to simulate and to characterize the mechanical behaviour of materials under complex loading conditions. New designs and technologies often stem from the introduction of advanced materials or innovative processes. The triptych process-material-product has always been optimized year after year, but in a more or less haphazardly way.

Nowadays, efficient and robust scientific methods have emerged and led to the development of tailored materials and processes for a given industrial application. It is very likely that the development of composites material opened the way to the formalization of the relationships between processing, structures, properties and performances of materials. However, that thought process has now been generalized to a wide variety of materials and is at the heart of the “mechanics of materials”.

Because the collection of materials employed in industrial application is very large, the emphasis is put on generic methods, based on fundamental principles and mechanisms, rather than on specific features of materials.

Career Prospects

■ **Careers in industry**: **Aeronautics, transportation, energy, health, manufacturing, plastics, metallurgy**
■ **Positions**: **R&D, project manager, consultant, researcher, head of R&D department**
■ **PhD in one of the many research laboratories associated with the Master**
■ **Careers in academia**

Organization

First-year master (M1)

Various offers for the first-year (M1) exist. The first-year may be taught is French with the major in Mechanics of Materials and Structures at Pierre et Marie Curie University or at Ecole Normale Supérieure de Cachan. To get more information, please visit the websites: www.upmc.fr or www.ens-cachan.fr. The M1 progam with a major in Mechanics, Materials and Processing may be taught in English thanks to a partnership between Université Pierre et Marie Curie, Ecole Normale Supérieure de Cachan and Arts et Métiers ParisTech. French classes for anglophones students. To get more information, please visit the website
www.ensam.eu/fr/formation_initiale/masters_recherche/master_international

Second-year master (M2)

Main periods

- The program begins by an equalization period of the academic standards. This occurs during the first two weeks of September. Our committee will examine your cursus and indicate which courses you may need to attend.
- The core courses begin at mid-September, except for the research project, which should begin one month later, so as to let you time to get familiarized with the various topics in this program.
- In the beginning of November, you will choose a set of options and a research project consistent with it. During six weeks a large part of your time schedule will be devoted to the research project.
- Optional courses will be provided from the beginning of December to mid-February. These courses occur either periodically (each monday morning for instance) or during short periods, so as to give you the opportunity to discover experimental platforms.
- From mid-February to the end of June, you will integrate, for a training period, a research and development team of either our academic partners or our industrial partners.

Meeting points

During this year, a few meeting points are organized to share your experience and to meet the research and development teams. These open days are organized alternatively by the partners of this program. Visits of their facilities are planned.

Admissions

To apply to the first-year master (M1), please contact us at contactmaster@magis-paris.eu. To apply to the second-year master (M2), please apply online www.magis-paris.eu and fill your application carefully. Our committee will examine your application and decide if you can be admitted to this program. If this is the case, an admission letter will be sent to you as soon as possible. With this letter your will be able to finalize your registration and to apply for grants, accommodation etc…

To apply to M1, a bachelor degree level in physics, mechanics or engineering sciences or equivalent is required to attend the scientific courses. To apply to M2, a M1 degree level in physics, mechanics or engineering sciences or equivalent is required. Students who passed a M1 associated with the MAGIS master program are automatically admitted in M2.

Core courses

In this program we concentrate first on the acquisition of general methods and strategies which can be used for a vast group of materials. The physical mechanisms governing the mechanical performances of metals, alloys and polymers are first analyzed at the scale of the phenomenon (the nanometer or the micron scale). This microscopic view inspires the development of models for the mechanical behaviour of materials at the relevant length scale (i.e. at the scale of the object). In both cases, the emphasis is put on the robustness and the generic nature of the approaches.

In addition, an important objective of this program is to discover modern experimental techniques to characterize the materials properties required to feed the models. And finally, it will be shown how to implement these models in finite element codes so as to simulate the behaviour of components with complex geometries and subjected to complex loading conditions.
The objective of the first part of the program is to provide modern tools (conceptual, experimental and numerical) so as to deal with problems in the field of the mechanics of materials. These tools are firstly explained during lectures and then practiced through problem sets and laboratory sessions. You will have the opportunity to perform various experiments and measurements on research laboratory devices (more than 30 hours of laboratory work per student in this first part of the program). Furthermore, you will have also the opportunity to use complex materials models during finite elements simulations sessions.

This balance between practice of modern experimental and numerical methods and the teaching of new concepts during theoretical courses is the ”trademark” of this program. A careful attention will be paid to this point, in particular through the use of « labs books » that will be used to create continuity between the theoretical courses and the lab sessions. The methodologies and skills developed in this program will be useful in both research & development and industrial production jobs.

Options

The second part of this program consists in elective courses. The electives are grouped thematically so as to be pedagogically consistent. Four sets of elective courses are proposed. The choice of a set of electives conditions the choice of three specific teaching units, while the others remain fully optional. The topics of internships and research projects are also presented thematically and associated with a set of electives.

Damage and fracture of materials and structures

The first set of electives focuses on damage and fracture of materials and structures. It will provide the tools required to answer the following questions: How long a structure can be used before a defect is initiated? How can the initiation and growth of that defect be predicted, either for a fatigue, ductile or brittle failure of the material, for static or dynamic loading conditions? By which mechanisms can the failure occur and how long does it take before the structure fails?
In this set of options you will discover the design methods employed to guarantee the safety and the durability of structures, the experimental techniques developed for this purpose and finally the simulation tools used to simulate the initiation and development of cracks in industrial structures.
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Metal and alloy processing, advanced methods and innovative processes

The second set of electives revolves around metal processing and aims at answering the following questions: How do you process modern engineering materials to control their microstructure and optimize their properties? What novel methods and techniques are available to maximize a materials property balance for a given application?
This specific program covers the fundamental physics which underpins microstructure development during processing of advanced metals and alloys, via deformation, solidification, and powder processing routes. It further provides an overview of advanced processing methods, such as thermal spraying and laser materials processing.

Polymers and composites life-cycle

The third set of electives focuses on the performances of polymers and polymer-based composites. For these materials and specifically for composites the influence of the process is crucial to the final performance of the product. We will hence focus on the questions:
How is the microstructure related to the mechanical properties and to the processing and how can it be optimized for a given final property ? What controls the durability of a polymer part?
This specific program covers the fundamental physics of the mechanical properties of advanced polymers and composites and the relation between the microstructures and the material performances for industrial applications.
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Innovative cutting processes and smart machining

The fourth set of electives aims at discovering the scientific issues in the field of cutting and machining. These issues are studied at various scales. At the macroscopic scale, we will focus on the knowledge of the numerical chain applied in the case of 5-axis machining of free forms. Machining exhibitions of medical prothesis, dies and molds and many other applications will be shown on our facilities located in the LaBoMaP Arts&Métiers ParisTech Cluny lab. At the micro & mesoscopic scales, we will focus on the different phenomena which appear at the tool tip in the case of turning, drilling, milling … techniques.