

# Parcours Mobile, autonomous and robotic systems (MARS) 2nd year

Master Traitement du signal et des images



Durée  
1 an



Composante  
Grenoble  
INP, Institut  
d'ingénierie et  
de management  
- UGA



Langue(s)  
d'enseignement  
Anglais

## Présentation

MARS is an advanced academic program on mobile robotic and autonomous systems. This highly competitive program includes advanced courses in artificial intelligence, control theory, drones, embedded systems, diagnostic and reliability, cybersecurity and intelligent mobility. In addition, a 5 to 6-month internship, is conducted in a laboratory or within an industrial research center.

The master degree in Robotics and autonomous systems aims at offering an international master program that allows a better understanding of technical and scientific aspects of connected and autonomous mobile robotic systems and to understand their interactions.

It englobes an advanced academic program on:

- Mobile and aerial robots that can act and evolve autonomously in complex environments
- Perception for detection and tracking of moving objects
- Navigation and Path Planning
- Robotic operating system (ROS)
- Artificial intelligence planning for autonomous robots requiring little or no supervision
- Machine learning
- Advanced methods for optimal control and predictive control
- Methods to monitor and diagnose dynamic systems with a study on the reliability of a systems subject to failure

- Distributed optimization and game theory
- Embedded systems: microcontrollers architectures and sensors for robotics
- Cyber-security: Make risk analysis, detect cyber-attacks and develop strategies. Implement some cyber-security mechanisms, on the communication infrastructure and on the robot systems
- Intelligent mobility and transportation to improve the safety of the vehicle and the comfort of the passengers, as well as the detection and reconfiguration of the controllers in case of emergency.
- Multi-vehicle coordination, in the perspective of understanding the behavior of groups of autonomous and non-autonomous robotic systems.

This program is intended for a public wanting to work in the field of robotics, automotive, aeronautics, and industry. The courses are given by highly qualified intentionally known staff. The training is supported by researchers from associated research laboratories and practitioners from industrial partners.

## Admission

### Conditions d'admission

## Entry requirements

### **Courses are taught in English - B1 level required !**

English language: B1 level. TOEFL: computer-based: 140 / IBT: 60 / paper-based : 457. TOEFL institution code is 6050, Department : Ense3

TOEIC : 550 - IELTS: 4.5

The master's degree in Robotics and Autonomous Systems is a highly competitive academic program (duration: one year, M2 level). Applicants selection is done on the basis of prior academic and/or scientific achievement as documented by academic transcripts, a cover letter, references, and standardized test scores. Students from countries where English language is not the primary language are required to provide TOEFL test scores. To get master degree, admitted students must obtain the certified level B2.

The selection of applicants is based on the following criteria:

- Administrative rules mentioned above.
- Applicants must have previously completed their undergraduate studies and been awarded a Bachelor degree in either Science (BSc) or Engineering (BEng) in a field related to Robotics, such as:

- Mechatronics,
- Automatic control,
- Computer science,
- Electrical engineering,
- Mechanical engineering,
- Applied mathematics.

For students with a foreign degree, their registration is definitely authorized by the Committee for Academic Accreditation at Grenoble university (CVA). Several meetings are organized several times a year (February, March, April, May, June) to select applications from abroad.

## Candidature

**You are strongly encouraged to apply as soon as possible.**

**You can apply here :** Apply online : <https://applicationform.grenoble-inp.fr/FSA/176> / Deadline on May 15th, 2020.

**The students who reside in one of the following countries have also to apply through the "Études en France" procedure :** Algeria, Argentina, Benin, Brazil, Burkina Faso,

Burundi Cameroon, Chile, China, Colombia, Comoros, the Republic of the Congo, South Korea, Ivory Coast, Egypt, United States, Gabon, Guinea, Haïti, India, Indonesia, Iran, Japan, Kuwait, Lebanon, Madagascar, Mali, Morocco, Mauritius, Mauritania, Mexico, Nigeria, Peru, Senegal, Democratic Republic of Congo, Russia, Senegal, Singapore, Taiwan, Tchad, Togo, Tunisia, Turkey and Vietnam.

<https://www.campusfrance.org/en/application-etudes-en-france-procedure>

## Et après

### Poursuite d'études

Graduated students are encouraged to do a PhD in the field of mobile and aerial robots, autonomous vehicles and systems. This master degree allows graduated students to find a job in public and private laboratories as well as in industrial research centers.

### Secteur(s) d'activité(s)

#### Job Opportunities:

At the end of the curriculum, students are able to :

- Design, model, simulate, and propose technical specifications
- Perform, analyze tests, and optimize the performance of robotic system
- Derive and apply global and local numerical models
- Conceive prototypes, new products or new processes. Implement hardware and software architectures
- Propose and conduct an applied research project for robotic, autonomous systems

#### Jobs:

- Control and Automation Specialist
- Robotic Navigation and Perception Specialist,
- AI and Machine Learning Specialist,
- Robotics Engineer, • Academic Career

## Business Sectors:

- Mobile robots
- Aeronautics, aviation, and drones
- Transportation, automotive, autonomous cars
- Defense
- Industry
- Smart houses
- Environmental technology

# Infos pratiques


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## Lieu(x) ville

 Grenoble

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## Campus

 Grenoble - Doyen Gosse

# Programme

## Spécificités du programme

- **Core courses – 20 ECTS (5 ECTS for each course) :**

- Artificial Intelligence: The purpose of this course is to give an overview of the main techniques of artificial intelligence and a thorough understanding of how to apply them to the robotics and autonomous systems.
- Robotics: The course will focus on the kinematics and control of mobile robots, the environment perception, probabilistic localization and mapping, as well as movement planning. The courses and exercises of this course present several types of robots such as wheeled robots, leg robots and drones. Practical work will be performed with drones.
- Advanced control: In this course different control techniques will be taught such as Robust, nonlinear, model predictive controls.
- Research project on a subject related to robotic systems, autonomous vehicles, and drones. Students will be integrated into research teams of partner laboratories.

- **Elective courses – 10 ECTS (2 courses out of 4) :**

- Smart transportation: This course will present a diverse but synergistic body of knowledge in order to understand the functioning of the future smart city and mobility.
- Cyber-security and embedded systems for robotics: This course aims to develop skills necessary for the development and implementation of embedded systems. Students will study the particular constraints of "embedded" robotic-type systems such as implementation constraints and the limits in terms of security, as well as the implementation of deep security approaches combining infrastructure and stand-alone systems. The normative aspects related to robots and drones will be used in these approaches.
- Distributed optimization and estimation: This course will be applied on several robotic communicating robotic mobile systems. It aims at presenting different architectures distributed optimization and identification to obtain experimentally parameters of nonlinear models of robots. Moreover, these techniques allow to control dynamically a group of underlying robots to best fit a common situation.
- Diagnostic, reliability and prognostic: The objective of this course is to present the problem of monitoring, diagnosis, reliability, and predictive maintenance, and its application issues in the field of robotics and autonomous systems.

- **Scientific culture course :**

- Seminars
- Laboratory visits and business
- Management of technical innovation
- Scientific ethics
- French language (FLE)

- **First semester**

Academic program - The first semester (30 ECTS) is restricted to theoretical lectures, practical labs and computer sessions, multidisciplinary projects, and examinations.

- **Second semester**

The second semester (30 ECTS) is a master thesis with an objective to develop students' research skills and capabilities to work independently and creatively in order to propose solutions to research problem. It can be conducted in a research laboratory or an industrial research center, in France or abroad. The duration is between 5 and 6 months. The defense takes place by the beginning of July or the beginning of September. The report must follow standard criteria of a scientific paper. The primarily scientific contents

of the master thesis englobes at least one of the following topics: autonomous systems, robotics (mobile and aerial), transportation and mobility, cyber-physical systems, artificial intelligence, embedded systems, optimization, and control, etc.