

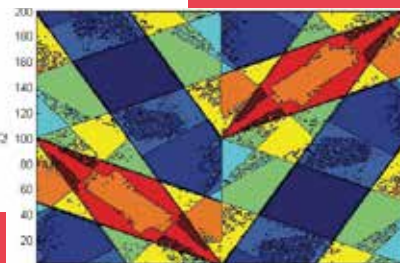


## CONTROL SYSTEMS

### OBJECTIVES

The objective is to provide theoretical and methodological tools in order to analyse the structure and properties of dynamic systems, and to design control and observation solutions.

This MSc programme introduces recent results in modern control theory of linear and nonlinear systems, including structural analysis, modelling, control and observation structures design (robust, optimal, ...), and application of optimization methods in control system design. An important topic of the track is the use of real applications among different fields (energy, grids, transportation, ...) in order to illustrate the different concepts of modelling, control and observation.



### SKILLS

#### Specialism-specific

- > Learn and understand the frame of modern theory for analysis and modelling of dynamic systems
- > Learn how to apply adapted methods of control, estimation and diagnostic (linear, nonlinear, robust, optimal, ...) to dynamic systems
- > Be able to apply these methods to real systems

#### General

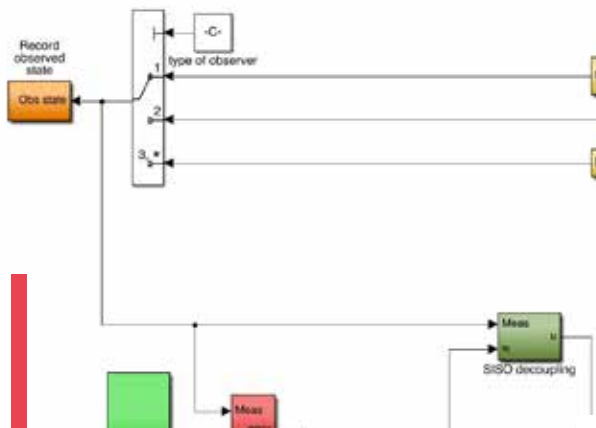
- > Identify models, perform simulation and analyse results
- > Communicate comprehensive results in a meaningful way
- > Undertake bibliographic surveys from international research and professional literature
- > Manage or be part of a project

### JOB PROSPECTS & FURTHER PHD STUDIES

**SECTOR:** Aeronautics, Automotive, Transportation, Energy, Consulting, banking, petroleum, ...

**FIELDS:** Control Engineering, Advanced Processes, Manufacturing, Research and Innovation,

**JOB POSITIONS:** Control Engineer, Process Engineer, Design Engineer, Research and Innovation Engineer (post- PhD).



**Location**  
Nantes, France -2 hours from Paris

**International campus life**

**87** nationalities  
**43%** international students



**Master of Science (MSc)**

## EXAMPLES OF FINAL YEAR INTERNSHIP/MASTER'S THESIS

- > Comparative study of hybrid observers : application in electric vehicles (LS2N, Renault)
- > Stator-Flux-Oriented Control of EH/HEV Motor Drives (Renault)
- > Extended glyceic control model including physical activity and stress (CHU, LS2N)
- > Development of a condition monitoring system prototype for rotating machines with industry 4.0 standards and vibration analysis using machine learning techniques (ACTEMIUM)
- > Uncertainties in model predictive building climate control (KU LEVEN)

## FACULTY, INDUSTRIAL PARTNERS AND RESEARCH LABS

This MSc relies on the Centrale Nantes' faculty, staff and research facilities of the LS2N Institute. Centrale Nantes has several industrial partnerships: Renault, Airbus, RTE, VALEO, GE, Naval Group, GSM, etc.

As part of an industrial research chair with Renault, which aims to improve the performance of electric propulsion in motor vehicles, Centrale Nantes has an electric vehicle test bench specifically for automotive electric propulsion. It comprises of test engines supplied by Renault and a control, power electronics and dynamic load environment to simulate driving situations.

## OTHER PROGRAMME INFORMATION

- > Length of Studies: 2 years
- > Language of instruction: English
- > 3 semesters of courses and 1 semester of Master's thesis

**Tuition & Fees - Scholarships - Application process - Deadlines**

**MORE INFORMATION AND FULL PROGRAMME:**  
[www.ec-nantes.fr/masters](http://www.ec-nantes.fr/masters)

**CONTACT:** [master.admission@ec-nantes.fr](mailto:master.admission@ec-nantes.fr)

## CONTENT AND COURSES

(A Master Degree requires the validation of 120 ECTS credits)

| M1 - AUTUMN SEMESTER   | ECTS |
|--|------|
| Signal Processing  | 5    |
| Classical Linear Control   | 5    |
| Artificial Intelligence  | 6    |
| Modelling of Manipulators  | 4    |
| Mathematical Tools for Signals and Systems   | 4    |
| Embedded Computing   | 4    |
| Modern Languages   | 2    |
| M1 - SPRING SEMESTER   | ECTS |
| Group Project  | 6    |
| Optimization Techniques  | 5    |
| Mobile Robots  | 5    |
| Systems Identification and Signal Filtering  | 4    |
| Dynamic Model Based Control  | 4    |
| Non Linear Control Theory  | 4    |
| Modern Languages   | 2    |
| M2 - AUTUMN SEMESTER   | ECTS |
| Mathematical modelling   | 4    |
| Optimization   | 4    |
| Robust and optimal control   | 4    |
| Observation and diagnostic   | 5    |
| Complex systems  | 4    |
| Analysis and Control Methodologies: Standard, Generalized and Time-Varying Systems | 5    |
| Project  | 2    |
| Modern Languages   | 2    |
| M2 - SPRING SEMESTER   | ECTS |
| Master Thesis or Industrial Internship (paid)*                                     | 30   |

\*In France, for internships exceeding 2 months a minimum legal level of remuneration (approximately €600 per month) is fixed by the government. In some professional branches, this amount may be higher.

NB Course content may be subject to minor changes

École Centrale de Nantes. Direction de la communication. Septembre 2023