Embedded Systems
WITH INP-ENSEEIHT

Objectives
Embedded Systems are an essential part of almost every aspect of our daily lives from transportation (aeronautics, space, road, rail and sea) to energy and taking into account communication systems. As part of the AeroSpace Valley project, Toulouse has become a key centre in the design of advanced critical embedded systems. Toulouse has one of the highest concentrations of Embedded System industries in Europe with leading aerospace and equipment manufacturers working for the aeronautical, space or car industries, including the Airbus Group and its subsidiaries, CNES, Continental and Thales.

The Embedded Systems Advanced Master Program provides comprehensive training for engineers willing to be a part of the aerospace industry. This Embedded Systems Master Program is a one-year professional course, designed by INP-ENSEEIHT and ISAE-SUPAERO partners with the support of the embedded systems industry to prepare students for challenging aerospace projects.

This program focuses on a multidisciplinary approach and prepares students by passing on in-depth and comprehensive knowledge of the technologies underpinning embedded systems with an emphasis on aerospace. The program focuses on both theoretical and concrete aspects and aims at:

- Developing Embedded-Systems engineering design skills at both system level and function level, built on a solid foundation of complementary subjects: electronics, computer science, energy conversion and management, automatic control, telecommunications and networks;
- Developing a system approach through integrated projects to master specific methods and tools as applied to the following domains: aeronautics, space and the automotive industries. The curriculum is multidisciplinary. It covers hardware (electronics, energy), software (computer science, network links, modeling, analysis and certification) and such issues as Embedded Systems control from an integrated system perspective.

Learning approach
First semester:
An academic session of 546 hours of teaching, provided by the tenured professors at ISAE-SUPAERO and INP-ENSEEIHT and industry experts with their up to the minute knowledge and experience. Teaching activities include lectures, tutorials, lab work and a one-month multidisciplinary project aimed at integrating the academic session into an industrial case study.

Second semester:
Students have to conduct a professional thesis or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from INP-ENSEEIHT or from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

Syllabus
Embedded Systems require a collaborative training approach across a broad spectrum of knowledge involving experts from all fields concerned: electronics, energy, science, networks and control systems.

Hence, the academic part of the Master program consists of a 520 hour long program covering all five disciplinary fields that focuses on architectural aspects through a set of application-oriented lectures and seminars.

Part 1: Embedded Systems - Core - 180 h
Real-time languages - DES Design and Validation - Feedback control - Signal processing - Microprocessor and DSP architecture - Architecture, design and Synthesis of hardware systems - RF Front-end Architecture - Electromagnetic compatibility

Part 2: Energy - 63 h
Actuator and converter control - Electromechanical and static energy converters - Autonomous energetic systems - Embedded electrical networks

Part 3: Networks - 67 h

Part 4: Embedded Systems Design - 160 h
Real time control of an space system - Hybrid Systems - Model-Based System Engineering and Architecture - Real time control of a mechatronic system - System Dependability - Certification - Embedded systems and IT Security - Optimization

Part 5: Embedded Systems Applications - 50 h
Aircraft technics - Introduction to Space Systems - Automobile technics - Workshops

Organization
Heads of program ISAE-SUPAERO
- Prof. Janette CARDOSO
  Janette.cardoso@isae-supaoer.fr

Heads of program ENSEEIHT
- Prof. Jean-Luc SCHARBARG
  jean-luc.scharbarg@enseeiht.fr

Course duration
One year full time: 6 months of courses and 6 months of professional thesis or internship

Course start date
September

Location
ISAE-SUPAERO and INP-ENSEEIHT (Toulouse)

Teaching language
English
# Career opportunities

Embedded Systems offer challenging career opportunities. The course is designed for both young graduates and experienced engineers seeking a postgraduate program to enhance their technical and managerial skills. The skills acquired in this Master’s course can be applied to any industrial sector in which embedded systems are used: aeronautics, space, road, rail and sea, energy industry, communication systems...

Career opportunities in this area are numerous and on the increase in large and small companies alike. This Embedded Systems Master’s course qualifies students for employment as designers, developers, research engineers and project managers in the design and development of innovative embedded systems.

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<tr>
<th>Why did you choose ISAE-SUPAERO and apply for our master?</th>
<th>What were your objectives?</th>
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<tr>
<td><strong>SHIN YESL</strong></td>
<td><strong>GUSTAVO VALLEJO GARCIA</strong></td>
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<tr>
<td>Graduated in 2019</td>
<td>Graduated in 2020</td>
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<tr>
<td>Embedded Systems Engineer</td>
<td>Embedded Systems Developer In the NAVIRIES research team of ISAE-SUPAERO</td>
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<td>UBLU Digital Services</td>
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<td>Wanted to change my carrier path to aeronautics and before starting the new path I’d like to study a bit more on the subject to specialise my knowledge.</td>
<td>The original idea was to reach a higher level of competitiveness within the automotive sector. I wanted to develop certain specific skills in embedded systems that I had identified as determinants for my career. Thereby I decided to enroll in the EMS program at ISAE-SUPAERO, which suited me perfectly!</td>
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<th>According to your experience, what are the strong assets of the Advanced Master?</th>
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<td>You can cover the overall knowledges on the specific theme depending on the major. Most importantly you can meet and experience many classes and people(professors) from the current business field. So it is really practical and unique experience you can get from the MS program.</td>
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<td>The content of the EMS program provides the graduates with powerful tools which perfectly match the real needs of a wide variety of industries, especially in Automotive, Aeronautic, and Aerospace.</td>
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<td>Coursing this program represents a big challenge. It demands hard work and a lot of coffee because of its vast content taught in a short period. And it certainly is worthy if you are looking to boosting your professional career in the industry!</td>
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<th>What are your career plans?</th>
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<td>I recently joined to one embedded engineering company. I will keep trying to participate on aeronautics projects so I can make my dream goal comes true to become an aeronautical engineer.</td>
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<td>Now, I want to gain solid experience in the development of navigation systems. It’s a domain that has completely captivated me!</td>
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**Companies recruiting our students**

Accenture, Airbus Group, Altran, Astek, Atos Origin, CS Communications & Systèmes, NAVAL GROUP, CONTINENTAL, MBDA, Motorola, Realix, Safran, Saget High Tech, Sopra Group, ESA, GE HEALTHCARE TECHNOLOGIES, Philips R&D (Netherland), Thales Alenia Space, SIGFOX...
Admission procedures

ADVANCED MASTERS

Academic requirements
A master’s degree, or an equivalent degree in science or engineering (or in management for advanced masters in management), or bachelor degree completed by 3 years of professional experience.

SELECTION AND ADMISSION

Selection and admission are made by an admission committee:
Possible interviews can be organized if necessary.

Deadlines for application:
Applications open in October 2021 for a start of classes in September 2022. Several admission committees are scheduled from January to July, see schedule on our website.

Application website:

LANGUAGE REQUIREMENTS FOR ALL MASTERS
(including for Masters taught in French)

TOEFL (IBT) 88 points (Inst. code: 9820) or TOEIC 785 points or IELTS 6.5 points

or CAE/FCE 170 points or Linguaskill 170 points

NOTA BENE: Volume of teaching hours and contents of the programs are provided for information only and are subject to change.

LANGUAGE REQUIREMENTS FOR MASTERS IN FRENCH

Language qualification requested
Score B2-Common - European Framework of Reference for Languages

Your contacts

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