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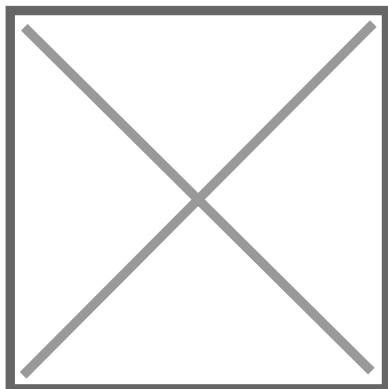
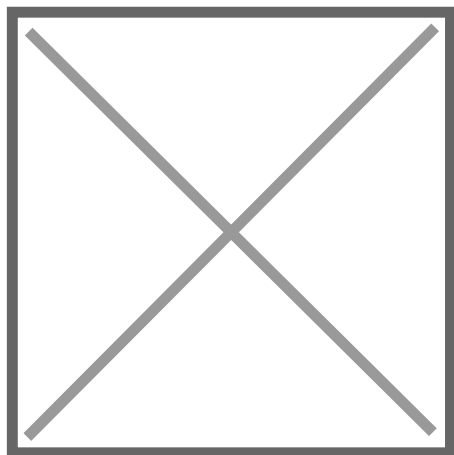
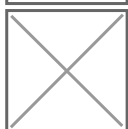
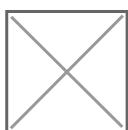
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Add to Compare

M2 Mechatronics, Machine Vision and Artificial Intelligence



Master's degree

Specialisation Electrical Engineering

Enrolment type

Full-time academic programmes Life-long learning

Language(s) of instruction

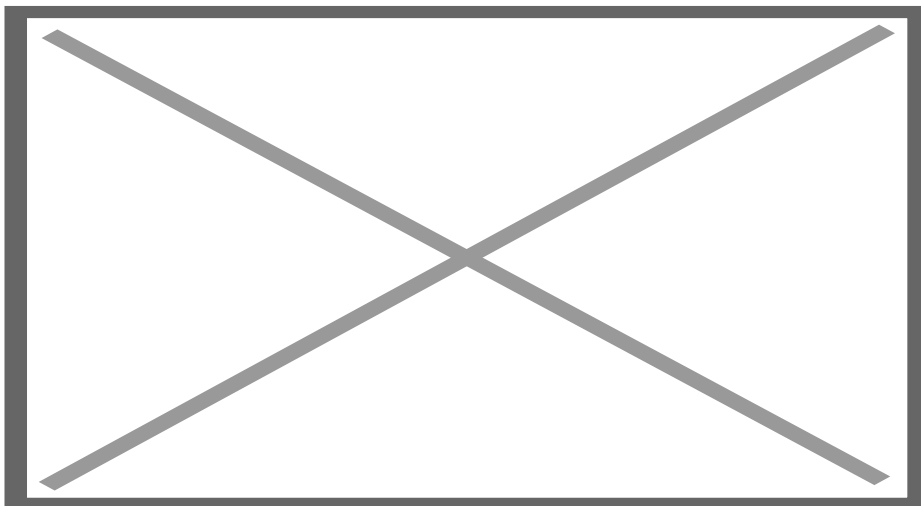
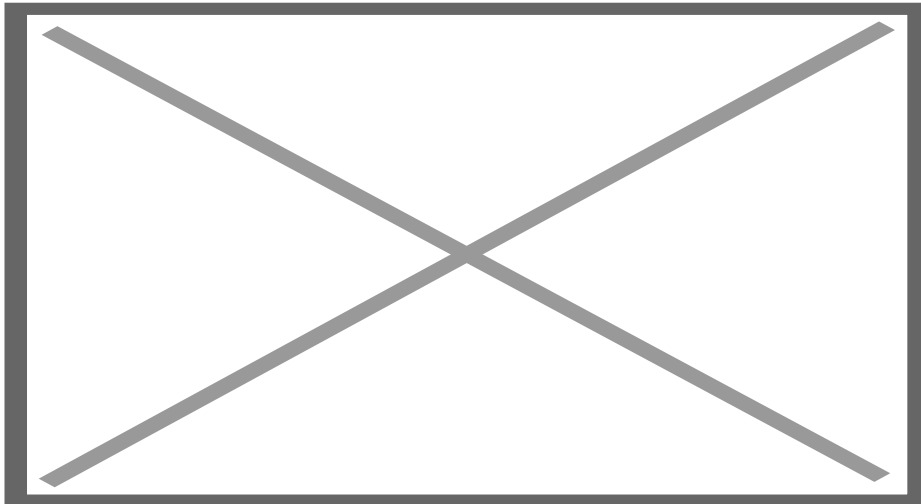
English

The field of mechatronics and artificial intelligence is at the forefront of technological innovation, integrating mechanical engineering, electronics, and computer science with cutting-edge AI techniques. It plays a vital role in the future of industry by enabling the development of intelligent solutions in various sectors, including industrial robotics, autonomous systems, advanced manufacturing, and high-tech medical devices.

The Master's programme is structured across two semesters. The first semester focuses on theoretical coursework and extends until February. Students begin with a common core curriculum that builds essential knowledge in both mechatronics and artificial intelligence, providing a strong interdisciplinary foundation. They then progress to specialised modules, allowing them to deepen their expertise in their chosen track - either mechatronics or artificial intelligence. The second semester is dedicated entirely to a six-month internship, starting in February. This internship may take place in a research laboratory or within an industrial company, offering students the opportunity to apply their competencies, gain practical experience, and prepare for future professional or academic careers.

[Télécharger la fiche détaillée](#)

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Information

- [Overview](#)
- [Application requirements](#)
- [Schedule](#)

Présentation

Skills

Graduates of the MMVAAI are well-prepared for a wide range of professional careers. They can work as engineers or research officers in fields such as robotics and mechatronic systems, computer vision and applied AI, embedded systems and electronics, virtual and augmented reality, human-machine interaction, telecommunications, networks, and the Internet of Things (IoT). They are also highly sought after for R&D positions in cutting-edge sectors, including Industry 4.0, smart mobility, healthcare, defence, aeronautics, and energy. For those wishing to continue their studies, the programme also provides a strong pathway toward PhD research in engineering sciences, covering areas such as robotics, AI, computer vision, and advanced electronics. Graduates are eligible to join doctoral schools in computer science, electronics, control systems, and signal processing, opening the door to careers in academia and advanced research.

Objectives

The MMVAI Master's programme offers students a well-rounded education that combines rigorous theoretical foundations with extensive hands-on learning. It is tailored for individuals seeking to build careers in leading research institutions or pioneering technology companies, with a focus on the rapidly advancing fields of mechatronics, machine vision, and artificial intelligence. Through this programme, graduates will gain multidisciplinary expertise, equipping them to address complex challenges at the intersection of mechatronics and AI. They will develop the competencies to design and deploy next-generation mechatronic systems that are not only more intelligent but also more responsive to user needs. This is achieved by integrating artificial intelligence seamlessly across all layers and components of mechatronic systems - from perception and control to decision-making and user interaction. By uniting knowledge from mechanical engineering, electronics, computer vision, and artificial intelligence, the MMVAI programme empowers students to become innovators and leaders capable of shaping the future of intelligent machines and autonomous systems.

Débouchés

Further Study Opportunities

PhD

Calendar

Start of programme (indicative date)

07/09/2026

End of programme (indicative date)

31/08/2027

Admission

Capacity

Available Places

28

Target Audience and Entry Requirements

A minimum of four year university degree in either Computer Science, Electrical, or Mechanical/Mechatronics Engineering. Recognised international qualification would be considered as well.

Période(s) de candidature

Inception Platform

From 01/01/2026 to 31/08/2026

Supporting documents

Compulsory supporting documents

Course selection sheet.

2nd letter of recommendation (compulsory for candidates who have already been enrolled in higher education in France before).

Copy diplomas.

Supporting documents (TOEFL, TOEIC, certificate of a teacher ...) of a level of a foreign language.

Motivation letter.

All transcripts of the years / semesters validated since the high school diploma at the date of application.

Curriculum Vitae.

Additional supporting documents

Certificate of English level (compulsory for non-English speakers).

VAP file (obligatory for all persons requesting a valuation of the assets to enter the diploma).

Supporting documents :

- Residence permit stating the country of residence of the first country
- Or receipt of request stating the country of first asylum
- Or document from the UNHCR granting refugee status
- Or receipt of refugee status request delivered in France
- Or residence permit stating the refugee status delivered in France
- Or document stating subsidiary protection in France or abroad
- Or document stating temporary protection in France or abroad.

Programme

AI an Vision Specialization Track

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Reinforcement learning and AI	3	Semestre 1	12	6	8				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Reinforcement learning and AI

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

1. Introduction to Reinforcement Learning (RL)

Definition and motivation

RL framework: agent, environment, states, actions, rewards

Markov Decision Processes (MDP) and Bellman equations

Exploration vs. exploitation

2. Classical RL Methods

Dynamic Programming: policy evaluation, policy iteration, value iteration

Monte Carlo methods

Temporal Difference learning: SARSA, Q-Learning

3. Policy Gradient and Actor–Critic Methods

Value-based vs. policy-based methods

REINFORCE algorithm and stochastic policy gradients

Actor–Critic architecture and advantage estimation (A2C, A3C)

4. Deep Reinforcement Learning (Deep RL)

Function approximation using neural networks

Deep Q-Network (DQN) and its extensions (Double DQN, Dueling DQN, PER)

Deep policy optimization: PPO, TRPO, DDPG

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Virtual and mixed reality	3	Semestre 1	12	6	8				
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Virtual and mixed reality

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

3D data analysis	3	Semestre 1	12	6	8
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Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	practical class	directed study/practical class	directed study/practical class
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3D data analysis

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

1. Introduction to 3D Data

Nature and sources of 3D data: depth sensors, LiDAR, stereo vision, multi-view reconstruction

3D data representations: point clouds, meshes, voxel grids, implicit functions

Coordinate systems and geometric transformations

2. 3D Data Acquisition & Preprocessing

Camera models and calibration

Depth estimation and stereo reconstruction

Point cloud filtering, registration, and alignment (ICP, RANSAC)

Normal estimation and surface reconstruction

3. 3D Feature Extraction & Classical Methods

Geometric descriptors: curvature, normals, shape histograms (FPFH, SHOT)

Keypoint detection in 3D

Object segmentation and classification with traditional approaches

4. Deep Learning for 3D Data

3D convolutional networks (3D CNNs, volumetric approaches)

Point-based architectures: PointNet, PointNet++, DGCNN

Graph-based methods for 3D learning

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Computer vision for non conventional cameras	3	Semestre 1	12	6	8				
■									

Computer vision for non conventional cameras

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Compulsory for MMVAI

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di
International keynote speaker	1	Semestre 1	0	12					c
■									

International keynote speaker

ECTS : 1

Semester: Semestre 1

Detail

Lecture: 0

Directed study: 12

Language(s) of instruction

Anglais

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

FLE	2	Semestre 1	0	14
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Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di
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FLE

ECTS : 2

Semester: Semestre 1

Detail

Lecture: 0

Directed study: 14

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Research project	1	Semestre 1	0	10
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Research project

ECTS : 1

Semester: Semestre 1

Detail

Lecture: 0

Practical study : 10

Tutored project 0

Project : 20

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

- Strong background in mechatronics, robotics, control, and embedded systems.
- Basic understanding of machine learning and AI concepts.
- Proficiency in MATLAB, Python, or C++.
- Experience with modeling, simulation, or hardware prototyping.
- Ability to conduct literature review and scientific writing.

Programme/contents

- Introduction to research methodology: scientific process, hypotheses, validation.
- Literature review techniques: databases, keyword strategies, scientific sources.
- Project definition: problem formulation, objectives, expected outcomes.
- Experimental design: modeling, simulation, prototyping, data collection.
- Integration of mechatronics and AI: sensing, perception, control, learning.
- Data analysis, metrics, and evaluation of results.
- Research ethics, reproducibility, and documentation.
- Weekly supervision meetings and progress monitoring.

Learning objectives

- Develop the ability to design, plan, and conduct an independent research project.
- Apply advanced mechatronic and AI techniques to solve a real scientific or industrial problem.
- Strengthen skills in experimental design

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di le c
Machine learning	3	Semestre 1	12	12	12				



Machine learning

ECTS : 3
Semester: Semestre 1
Detail
Lecture: 12
Practical study : 12
Directed study: 12
Language(s) of instruction
Anglais
Remote teaching
non
Programme/contents

1. Introduction to Machine Learning

Overview of machine learning paradigms:
supervised vs. unsupervised

Key concepts: overfitting, generalization,
bias–variance tradeoff

2. Data Preparation & Representation

Data preprocessing: normalization, feature
scaling, encoding categorical variables

Feature engineering and dimensionality reduction
(PCA overview)

Train/validation/test split and cross-validation

3. Linear Models

Linear regression, logistic regression

Regularization: Ridge, Lasso, Elastic Net

Model evaluation metrics (classification &
regression)

4. Kernel Methods

Concept of feature space and kernel trick

Common kernels (linear, polynomial, RBF,
sigmoid)

Kernelized algorithms: Support Vector Machines,
Kernel Ridge Regression

5. Tree-Based Methods

Decision Trees: impurity measures, pruning

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di le c
Advances in Machine Vision	3	Semestre 1	12	12	12				



Advances in Machine Vision

ECTS : 3
Semester: Semestre 1
Detail
Lecture: 12
Practical study : 12
Directed study: 12
Language(s) of instruction
Anglais
Remote teaching
non
Programme/contents

1. Overview of Advanced ML

Recap of supervised learning and neural network fundamentals

Motivation for deep learning: hierarchical feature learning

GPU computing and modern frameworks (TensorFlow, PyTorch)

2. Deep Feedforward Networks

Architecture and training of deep networks

Activation functions, normalization layers, dropout

Optimization: gradient descent variants, learning rate scheduling

3. Convolutional Neural Networks (CNNs)

Convolutional layers, pooling, and feature maps

Classical architectures: LeNet, AlexNet, VGG, ResNet

Applications in vision: classification, detection, segmentation

4. Recurrent and Sequence Models

Recurrent Neural Networks (RNN), LSTM, GRU

Attention mechanisms and sequence-to-sequence models

Applications: speech recognition, time-series

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di le c
Advances in mecatronic systems	3	Semestre 1	12	12	12				

Advances in mecatronic systems

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 12

Directed study: 12

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

- Basic mechatronic engineering knowledge.
- Multi-physics modeling (mechanical, electrical, control).
- Embedded systems knowledge and C/Python programming.
- Control engineering: PID, digital control.
- Proficiency with MATLAB/Simulink and introduction to Simscape/Modelica.

Programme/contents

- Introduction to advanced mechatronic systems: trends and industrial applications.
- Advanced actuators: torque motors, smart actuators, high-performance hydraulics.
- Advanced sensors: vision systems, IMUs, force/torque sensing, sensor fusion.
- multi-physics modeling: electromechanical, hydraulic, and thermal domains.
- High-performance embedded systems: STM32, DSP, FPGA (introduction).
- Software architectures: ROS/ROS2, distributed control, real-time communication.
- Advanced control: optimal control, robust control (intro), dynamic feedforward.
- Digital twins and Model-Based Design: concept, modeling, validation.
- Intelligent mechatronic systems: perception, decision, and action integration.
- Advanced simulation: Simscape, Modelica, real-time solvers.
- Case studies: exoskeletons, advanced robotic systems, mobile platforms.
- Final project: design of an advanced

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di
UE libre Catalogue S1	2.5	Semestre 1							
■									

UE libre Catalogue S1

ECTS : 2.5

Semester: Semestre 1

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Terminale

[Kinematics](#)

[and](#)

[Dynamics](#)

[Modeling of](#)

[Mechatronics](#)

[Systems](#)

3

Annualisé 12

12

12

Kinematics and Dynamics Modeling of Mechatronics Systems

ECTS : 3

Semester: Annualisé

Detail

Lecture: 12

Practical study : 12

Directed study: 12

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

- Mathématiques avancées : algèbre linéaire, matrices, dérivées partielles.
- Mécanique analytique : notions de base en mécanique du solide.
- Automatique et systèmes dynamiques : modélisation, équations d'état.
- Programmation scientifique : MATLAB ou Python.
- Notions de robotique : repères, transformations homogènes

Programme/contents

- Introduction : rappels de mécanique du solide, espaces de configuration.
- Cinématique géométrique : transformations homogènes, rotations.
- Cinématique directe et inverse : chaînes ouvertes, singularités.
- Cinématique différentielle : vitesses, accélérations, jacobien.
- Dynamique Newton–Euler : formulation récursive.
- Dynamique Lagrangienne : équations de Lagrange, matrices d'inertie.
- Prise en compte des effets réels : frottements, flexibilités, efforts externes.
- Dynamique en espace opérationnel : matrices d'inertie opérationnelle.
- Simulation numérique : solveurs MATLAB/Simscape/Python.
- Applications : manipulateurs, robots mobiles, exosquelettes.

Mechatronics Specialization Track

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Electronic Instrumentation	3	Semestre 1	12	6	8			

Electronic Instrumentation

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Independant learning: 0

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Circuit theory, basic analog & digital electronics

Programme/contents

1. **Measurement & Instrumentation:**
Architecture of measurement chains;
performance metrics.
2. **Transduction:** Physical-to-electrical
conversion; overview of ADC/DAC.
3. **Errors & Noise:** Systematic/random errors;
noise sources; uncertainty and noise
reduction.
4. **Differential Measurements:**
Instrumentation amplifiers; CMRR;
common-mode effects.
5. **Sensors:** Main classes of sensors and
conditioning circuits.
6. **Modulation Techniques:** Chopper
stabilization, auto-zero, AM/FM, improving
low-frequency performance.
7. **Coherent Detection:** Lock-in amplifier
principles and applications.
8. **Measurement System Improvement:**
Optimization of accuracy, bandwidth, and
robustness.

Labs & Tutorials (Summary)

- Sensor characterization
- Instrumentation amplifier design and Filters
- Noise and CMRR measurement
- Digital lock-in implementation
- Design of a simple measurement system

Learning objectives

This module introduces students to the

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Robotic Systems Architectures and Programming	3	Semestre 1	12	6	8			

Robotic Systems Architectures and Programming

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

- Basic robotics: kinematics, coordinate frames, transformations.
- Programming in Python and/or C++.
- Understanding of embedded systems fundamentals.
- Knowledge of control systems and real-time constraints.
- Familiarity with Linux and command-line tools is recommended.

Programme/contents

- Introduction to robotic system architectures: layered and modular design.
- Middleware concepts: nodes, topics, services, actions, DDS.
- ROS/ROS2 fundamentals: packages, launch files, parameter server, TF.
- Sensor and actuator integration: IMUs, cameras, LiDAR, motor drivers.
- Communication and networking: real-time constraints, QoS, distributed systems.
- Robotic software pipelines: perception, mapping, planning, control.
- Embedded robotics: microcontrollers, SBCs (Raspberry Pi, Jetson), deployment.
- Simulation environments: Gazebo, RViz, ROS2 simulation workflows.
- Safety, debugging, testing, and performance monitoring.
- Case studies: mobile robots, manipulators, autonomous platforms.
- Project: building a full robotic architecture in ROS/ROS2.

Learning objectives

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
<u>Advanced Control of Smart Systems</u>	3	Semestre 1	12	6	8			



Advanced Control of Smart Systems

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Linear Control.

Programme/contents

Mots clés

optimal control, Lyapunov, Linear control, back-stepping, Robust control

Description du contenu de l'enseignement

Abstract

This course covers nonlinear control design and analysis methods used on Unmanned Aerial Systems. It covers robust stability analysis, optimal control and non-linear control theory used to project state feedback into output feedback. This part forms baseline control algorithms that are augmented with adaptive control in the second part. Lyapunov stability theory is followed by an introduction to the design and analysis of adaptive control systems. Key design points are discussed and illustrated through simulation examples. This course ends with an overview of open problems and future research directions.

Course outline

- Flight modes and Linear control
- Robust control
- Optimal control
- Lyapunov approach
- Back-stepping
- Adaptive control
- Open problems.

Bibliography

W. Durham 'aircraft flight dynamics and control', Wiley 2013 B. Etkin and L.D. Reid. Dynamics of

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Modeling of parallel manipulators	3	Semestre 1	12	6	8			

Modeling of parallel manipulators

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 8

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

- Solid mechanics: kinematics and dynamics of rigid bodies.
- Advanced mathematics: linear algebra, Jacobians, nonlinear equations.
- Robotics fundamentals: coordinate frames, transformations, direct/inverse kinematics.
- Control and dynamic systems: Lagrange and Newton–Euler basics.
- Programming skills in MATLAB and/or Python.

Programme/contents

- Introduction to parallel manipulators: advantages, architecture families, applications.
- Mobility analysis: constraints, degrees of freedom, criteria.
- Direct kinematics: nonlinear systems, existence and uniqueness issues.
- Inverse kinematics: analytical and numerical methods, workspace analysis.
- Differential kinematics: Jacobian matrices, velocity relations, singularity types.
- Kinetostatic modeling: stiffness, compliance, and force transmission.
- Dynamic modeling using Lagrange formulation for closed-loop mechanisms.
- Newton–Euler formulation adapted to parallel structures.
- Handling constraints: loop-closure equations, holonomic constraints.
- Workspace and singularity analysis
- Numerical simulation: ODE solvers, simulation of trajectories, dynamic responses.

Compulsory Internship

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
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Internship	30	Semestre 2							
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Internship

ECTS : 30

Semester: Semestre 2

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

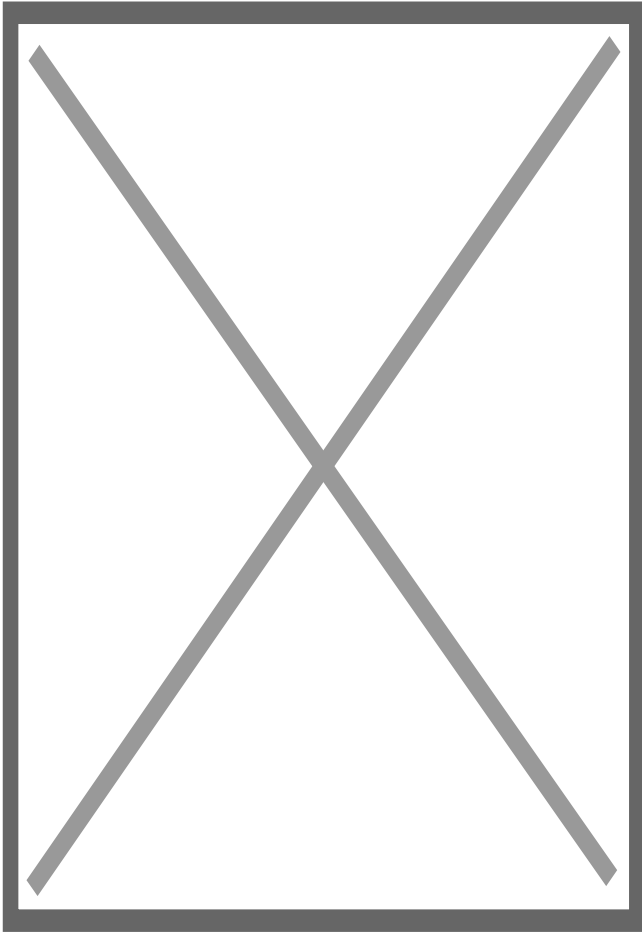
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Teaching Location(s)

EVRY

Training campus

Javascript est requis pour visualiser cette carte.



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[Voir](#)
Student restaurant (CROUS)
Library
Student residence
Sports facilities

Contact

- **Mélodie KAMALANDUA**

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