



UNIVERSITÀ DI PADOVA

Dipartimento
di Ingegneria
dell'Informazione

Master's Degree in
Control Systems Engineering

Prof. Angelo Cenedese

DEI - May 29, 2026

Control Systems Engineering in a nutshell

- total formative credit units: 120 – 126 cfu
- building on a solid base of **foundational courses** (24 cfu)
- offering **5 curricula** covering the most active areas of control engineering;
- highly **customizable** (66 – 72 cfu);
- proposing a **rich spectrum** of courses;
- featuring a **final project (internship+thesis)** of up to 30 cfu;
- entirely taught in **English**.

cfu: formative credit unit – 6 cfu: 2 classes per week; 9 cfu: 3 classes per week

Simple Enrolment Requirements:

1. Bachelor Degree with enough credits/courses in:

- **Mathematics and Physics**

Calculus, Linear Algebra, Prob.,

- **Control Engineering**

Signals and Systems, basic Control Courses,...

- **Electrical Engineering and Computer Science**

2. English Knowledge: **Certified B2 level**

In particular, in order to be admitted, applicants must meet the following curricular requirements:

- a Bachelor's degree in class L-8 (Information Engineering) pursuant to Ministerial Decree 270/04, or in class 9 (Information Engineering) pursuant to former Ministerial Decree 509/99,

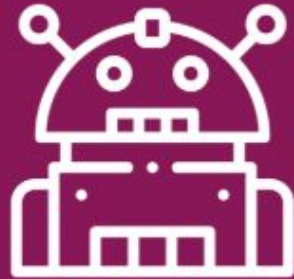
or alternatively:

- at least 9 ECTS credits in the scientific-disciplinary sector IINF-04/A,
- at least 12 ECTS credits in the scientific-disciplinary sectors INFO-01/A, IINF-01/A, IINF-02/A, IINF-03/A, IINF-05/A, IBIO-01/A, IMIS-01/B, IIND-02/A, and IIND-08/A,
- at least 20 ECTS credits in the scientific-disciplinary sectors PHYS-01/A, PHYS-02/A, PHYS-03/A, PHYS-04/A, MATH-02/A, MATH-02/B, MATH-03/A, MATH-03/B, and MATH-05/A.

The personal preparation of students consists of adequate knowledge in the fundamental disciplines (mathematics, physics, statistics) and in the fields of Information Engineering, and is assessed according to the procedures established by the degree programme regulations, in particular through:

- adequate knowledge of the English language, equivalent to at least Upper Intermediate Independent User (B2 level) according to the CEFR framework,
- a minimum graduation grade

THESIS
RESEARCH TRAINING / INTERNSHIP



ARTIFICIAL
INTELLIGENCE

ROBOTIC
SYSTEMS

INDUSTRIAL
AUTOMATION

SYSTEMS &
CONTROL

COMPLEX
SYSTEMS

FOUNDATION of COMMON COURSES:
Systems Theory - Control Lab - Estimation&Filtering

Foundation – Common mandatory activities (24+30 cfu)

Systems Theory	9 cfu	(Year 1, Semester 1)
Estimation and Filtering	6 cfu	(Year 1, Semester 2)
Control Engineering Laboratory	9 cfu	(Year 1, Semester 2)
Final Thesis	21 cfu	
Internship / Research Training	9 cfu	

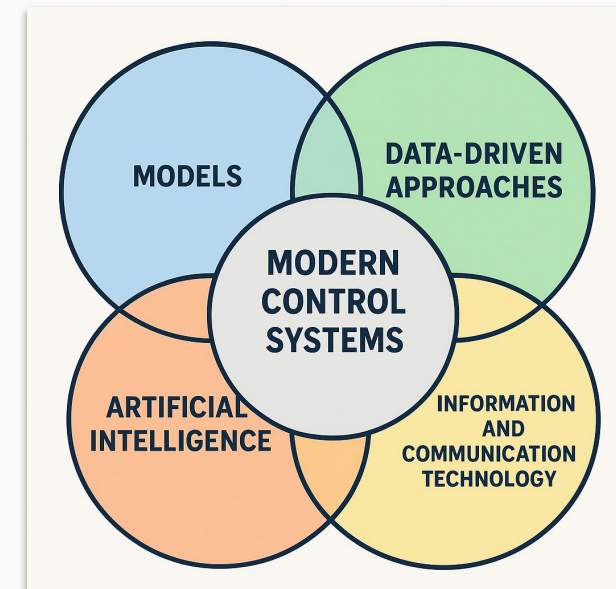


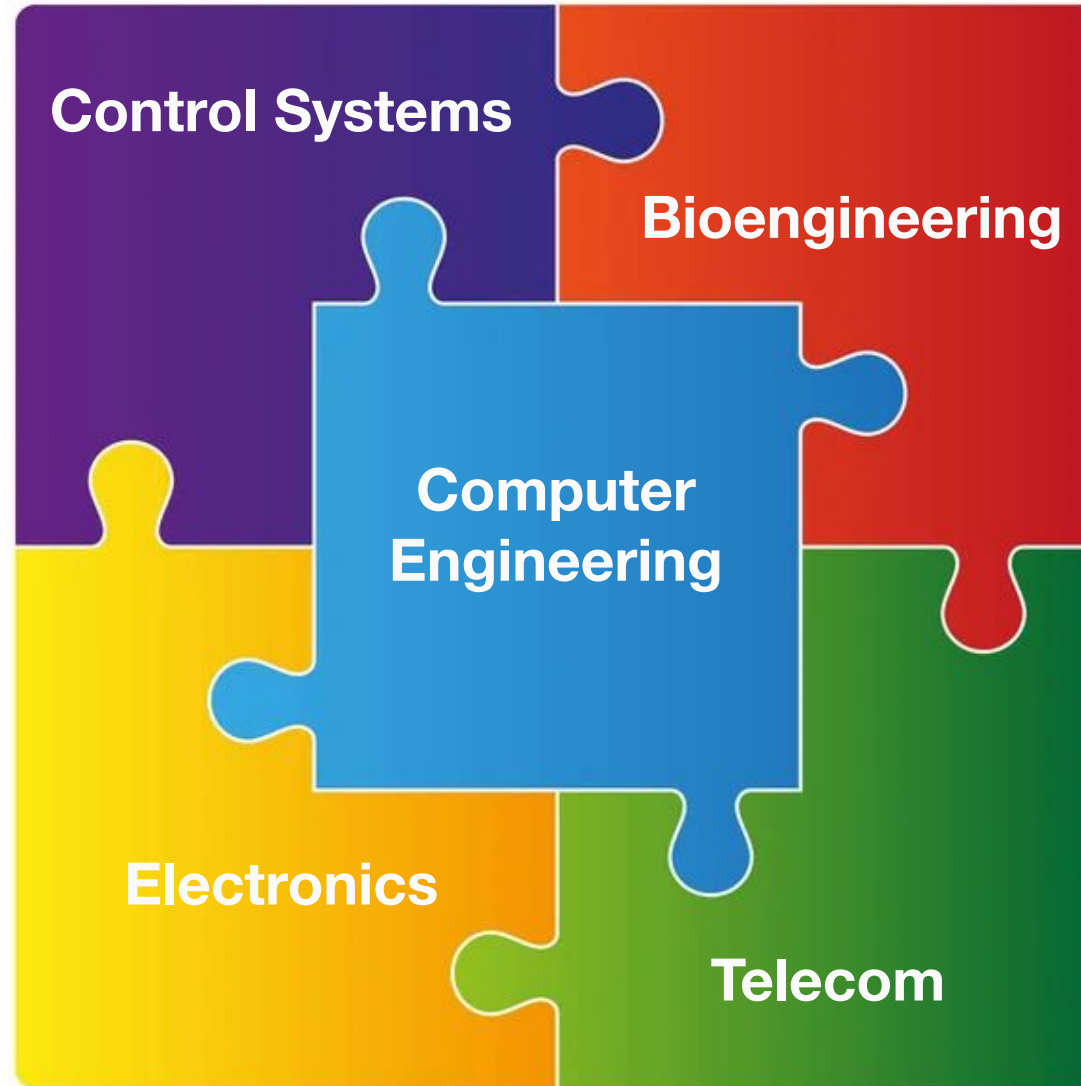
Artificial Intelligence

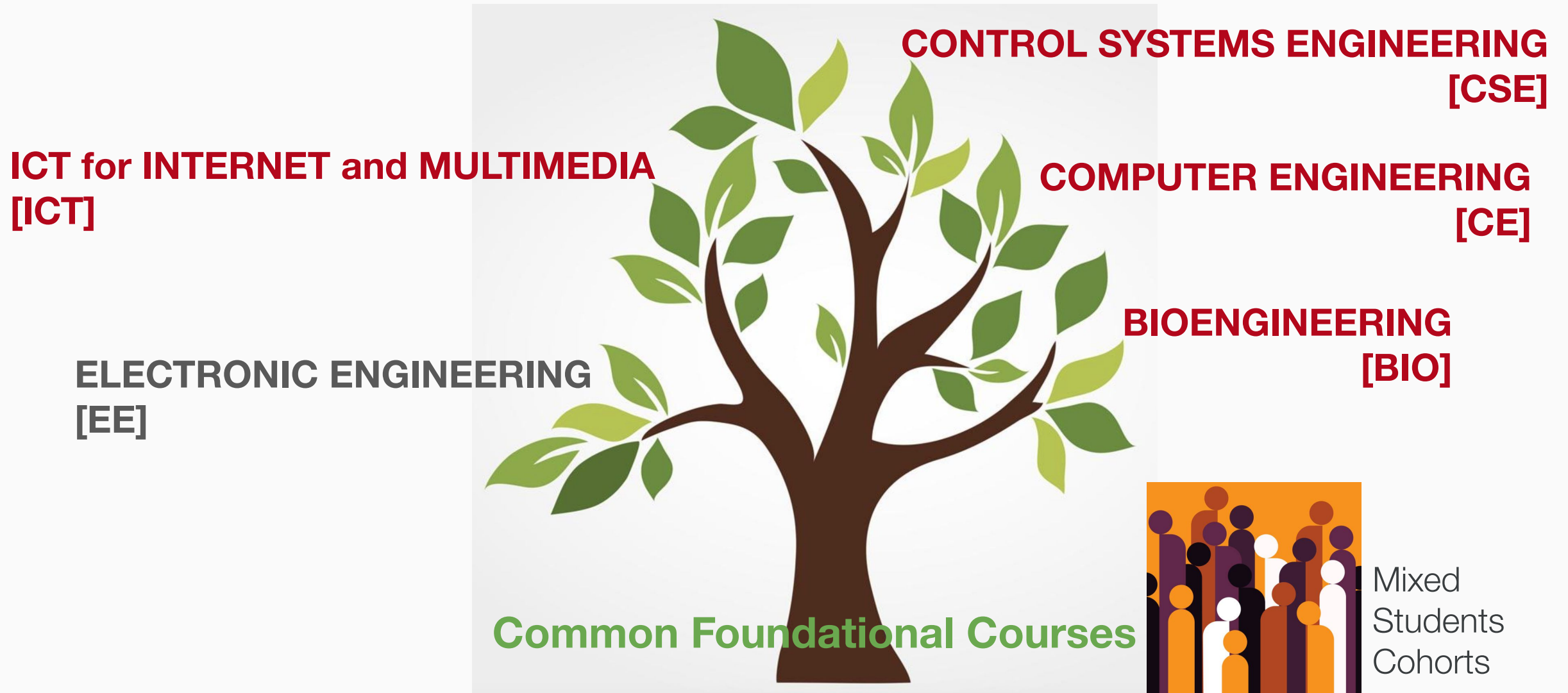
Control Systems Engineering leverages AI to go beyond traditional purely model-based control approaches

- to deal with complex and nonlinear dynamical systems (from the chemical plant to the aerospace application, from the automotive system to the epidemic model)
- to adapt to real-world uncertainties and nuisance, gaining robustness and increasing performance
- to improve decision-making processes while learning constraints and guaranteeing optimality
- to exploit data-rich environments enabling model-free approaches, self-healing systems, and fault-tolerant control

Control meets learning







MANDATORY COMMON FOUNDATIONAL COURSES 30 CFU

MANDATORY COURSES FOR EACH MASTER DEGREE

BIO 48 CFU	CE 27 CFU	CSE 24 CFU	ICT 18 CFU
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ELECTIVE COURSES FOR EACH MASTER DEGREE

BIO –	CE 18 CFU	CSE 21 CFU	ICT 24 CFU
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OTHER/FREE COMMON COURSES

BIO 15 CFU	CE 12 CFU	CSE 15 CFU	ICT 12 CFU
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OTHER ACTIVITIES

English Language/Italian Language

BIO 3 CFU	CE 3 CFU	CSE –	ICT 3 CFU
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Soft Skills

BIO –	CE –	CSE –	ICT 3 CFU
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Internship/Research Training

BIO –	CE 9 CFU	CSE 9 CFU	ICT 9 CFU
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Final Project

BIO 24 CFU	CE 21 CFU	CSE 21 CFU	ICT 21 CFU
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Common Foundational Courses

Course	CFU	Period	Contents
Foundations of AI	9	Y1.S1	Intelligent agents; Search Strategies and Adversarial Search; Constraints Satisfaction; Automated Planning; Probabilistic AI; Probabilistic reasoning and learning in graphical models; Belief networks; Graphical models; Learning as inference; Learning with hidden variables
Machine Learning	9	Y1.S1	Learning Model; Uniform Convergence; Bias-Complexity Tradeoff; Vapnik–Chervonenkis (VC) dimension; Linear Models; Gradient Descent and Stochastic Gradient Descent; Model Selection and Validation; Regularization and Feature Selection; Support Vector Machines; Decision Trees and Random Forests; Boosting; Clustering
Deep Learning	6	Y1.S2	Feedforward Neural Networks (FFNN); Backpropagation; Automatic Differentiation; Overfitting in NNs and regularization techniques; Advanced optimization techniques (ADAM,...); Convolutional Neural Networks (CNN); Recurrent Neural Networks (RNN); Transformers and Self-Attention (LLM)
Reinforcement Learning	6	Y2.S1	Overview of reinforcement learning; k-Armed Bandits; Exploration vs. Exploitation trade-off; Markov Decision Processes (MDPs) and Bellman equations; Dynamic Programming (DP); Monte Carlo Methods, Temporal Difference (TD) Learning; Value Function Approximation; Policy Gradient Methods; Deep Reinforcement Learning

MANDATORY COURSES (54 CFU)

Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2
Foundations of AI	9	Y1.S1
Machine Learning	9	Y1.S1
Deep Learning	6	Y1.S2
Reinforcement Learning	6	Y2.S1

ELECTIVE COURSES – AFFINE (6 CFU)

Course	CFU	Period
Convex Optimization	6	Y1.S1
Computer Vision*	6	Y1.S1
Advanced Topics in Optimization	6	Y1.S2
Learning from Networks	6	Y1.S2
Game Theory	6	Y2.S1
Natural Language Processing	6	Y2.S1
Big Data Computing	6	Y2.S2

ELECTIVE COURSES – CORE (15 CFU)

Course	CFU	Period
Digital Control	6	Y1.S1
Robotics and Control	9	Y1.S2
Adaptive and Model Predictive Control	6	Y2.S1
Industrial and Edge Machine Learning	6	Y2.S1
Mobile and Networked Robotics	9	Y2.S1
Learning Dynamical Systems	9	Y2.S1
Nonlinear Systems and Control	6	Y2.S2
Network Dynamical Systems	6	Y2.S2
Visual-Language-Action Models for Robotics	6	Y2.S2

FREE COURSES (15 CFU)

Course	CFU	Period
<i>Any from above</i>		
Computer Vision*	9	Y1.S2
Digital Circuits for Neural Networks	9	Y2.S1

Mandatory courses distribution and core/affine imbalance

- total formative credit units: **120 cfu**
- final project (internship+thesis): **30 cfu**

Y1-S1	Y1-S2	Y2-S1	Y2-S2	MANDATORY	ELECTIVE
27 CFU	21 CFU	6 CFU	0 CFU	54 CFU	36 CFU

CORE 54-75	AFFINE 15-30	FREE 9-15
54 CFU	21 CFU	15 CFU

Microcredentials



- Opportunity to earn **micro-credentials**, i.e. academic certifications for advanced and targeted competences in specific areas of AI, as an additional and cross-cutting specialization
- Micro-credentials enable students to enhance their academic journey **beyond the 120 CFU** credits required for graduation, strengthening their professional profile with clearly identifiable and internationally relevant skills
- Students achieve micro-credentials by attending courses of **the other Master programs** part of AI@DEI Cross-Program Track

Microcredentials



MICRO-CREDENTIALS		
Course	CFU	Period
Bioingegneria (BIO)		
Biomedical wearable technologies for healthcare and wellbeing	6	Y1.S2
Decision Support System for healthcare	6	Y2.S2
Computer Engineering (CE)		
Agentic Artificial Intelligence for Information Access	6	Y2.S1
Learning from Networks	6	Y2.S2
Control Systems Engineering (CSE)		
Industrial and edge machine-learning	6	Y2.S1
Visual-Language-Action models for robotics	6	Y2.S2
ICT for Internet and Multimedia (ICT)		
Digital Forensics and Biometrics	6	Y2.S1
Machine Learning for Human Data	6	Y2.S1



Robotic Systems

Robots **today** are making a *considerable impact* from industrial manufacturing, to healthcare, to exploration of the deep space and sea...
...**tomorrow** they will be pervasive in our daily life



Shaping expertise in robotics and advanced control.

- concepts of robotics, kinematic and dynamic models
- advanced control schemes for industrial and mobile robots



MANDATORY COURSES (48 CFU)

Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2
Digital Control	6	Y1.S1
Robotics and Control	9	Y1.S2
Mobile and Networked Robotics	9	Y2.S1

ELECTIVE COURSES – AFFINE (15 CFU)

Course	CFU	Period
Convex Optimization	6	Y1.S1
Computer Vision*	6	Y1.S1
Foundations of AI	9	Y1.S1
Advanced Topics in Optimization	6	Y1.S2
Computer Vision*	9	Y1.S2
Deep Learning	6	Y1.S2
Dynamical Systems and Lagrangian Mechanics	9	Y1.S2
Autonomous Robotics	9	Y2.S1

ELECTIVE COURSES – CORE (15 CFU)

Course	CFU	Period
Machine Learning	9	Y1.S1
Reinforcement Learning	6	Y2.S1
Adaptive and Model Predictive Control	6	Y2.S1
Embedded Real Time Control	6	Y2.S1
Industrial and Edge Machine Learning	6	Y2.S1
Industrial Robotics	9	Y2.S1
Modeling and Control of Electric Drives	9	Y2.S1
Learning Dynamical Systems	9	Y2.S1
Nonlinear Systems and Control	6	Y2.S2
Network Dynamical Systems	6	Y2.S2
Robotics Laboratory	6	Y2.S2
Design of Mechanical Drives	6	Y2.S2
Visual-Language-Action Models for Robotics	6	Y2.S2

FREE COURSES (12 CFU)

Course	CFU	Period
<i>Any from above</i>		

Mandatory courses distribution and core/affine imbalance

- total formative credit units: **120 cfu**
- final project (internship+thesis): **30 cfu**

Y1-S1	Y1-S2	Y2-S1	Y2-S2	MANDATORY	ELECTIVE
15 CFU	24 CFU	9 CFU	0 CFU	48 CFU	42 CFU

CORE 54-75	AFFINE 15-30	FREE 9-15
63 CFU	15 CFU	12 CFU



Industrial Automation

Modern Industrial Engineering is a powerful blend of
Automation – Computer Science – Telecommunication

Challenges and stars of the new Industrial Revolution

- Cyber-Physical Systems**: physical quantities are translated into data and information...
- Human is in the loop**: the barrier between man and machine dissolves...
- Resilience and autonomy**: systems gain ability to recover from or adjust easily to misfortune or change...



MANDATORY COURSES (54 CFU)

Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2
Digital Control	6	Y1.S1
Industrial Automation	9	Y1.S2
Modeling and Control of Electric Drives	9	Y2.S1
Embedded Real Time Control	6	Y2.S1

ELECTIVE COURSES – AFFINE (15 CFU)

Course	CFU	Period
Convex Optimization	6	Y1.S1
Computer Vision*	6	Y1.S1
Computer Vision*	9	Y1.S2
Deep Learning	6	Y1.S2
Autonomous Robotics	9	Y2.S1
Sensing and Measurement Systems	9	Y2.S1

ELECTIVE COURSES – CORE (9 CFU)

Course	CFU	Period
Machine Learning	9	Y1.S1
Robotics and Control	9	Y1.S2
Learning Dynamical Systems	9	Y2.S1
Mobile and Networked Robotics	9	Y2.S1
Industrial Robotics	9	Y2.S1

FREE COURSES (12 CFU)

Course	CFU	Period
<i>Any from above</i>		
Reinforcement Learning	6	Y2.S1
Adaptive and Model Predictive Control	6	Y2.S1
Industrial and Edge Machine Learning	6	Y2.S1
Design of Mechanical Drives	6	Y2.S2

Mandatory courses distribution and core/affine imbalance

- total formative credit units: **120 cfu**
- final project (internship+thesis): **30 cfu**

Y1-S1	Y1-S2	Y2-S1	Y2-S2	MANDATORY	ELECTIVE
15 CFU	24 CFU	15 CFU	0 CFU	54 CFU	36 CFU

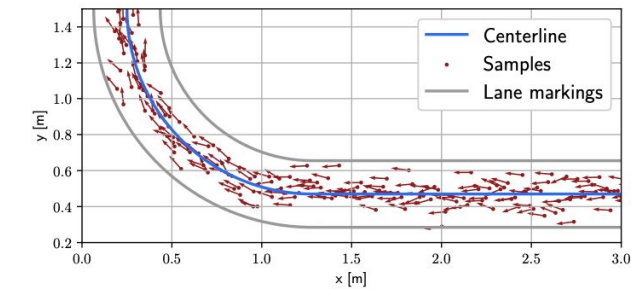
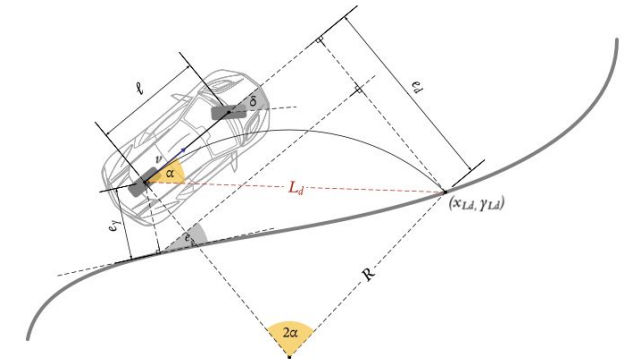
CORE 54-75	AFFINE 15-30	FREE 9-15
63 CFU	15 CFU	12 CFU



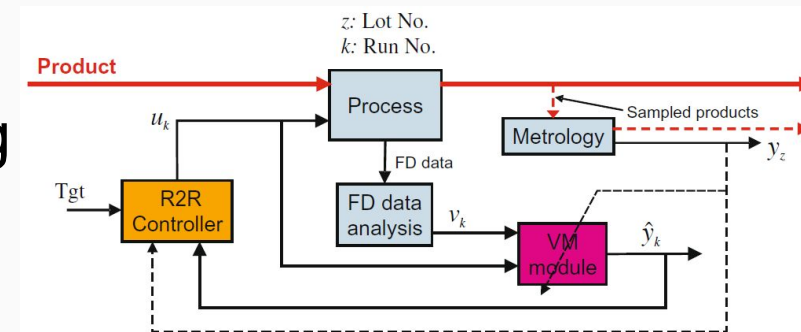
Systems and Control

Engineering Intelligence for Dynamic, Autonomous Systems, where mathematical rigor meets the technological challenges of the future

Mastering **classical** and **advanced control methods** to tackle today's challenges in industry and research



Cutting-edge topics to prepare for innovation, by developing the analytical, computational, and methodological skills.



MANDATORY COURSES (45 CFU)

Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2
Convex Optimization	6	Y1.S1
Learning Dynamical Systems	9	Y2.S1
<i>Control Pack (1 of ...)</i>		
Digital Control	6	Y1.S1
Adaptive and Model Predictive Control	6	Y2.S1
Nonlinear Systems and Control	6	Y2.S2
Network Dynamical Systems	6	Y2.S2

ELECTIVE COURSES – AFFINE (9 CFU)

Course	CFU	Period
Foundations of AI	9	Y1.S1
Computer Vision*	9	Y1.S2
Dynamical Systems and Lagrangian Mechanics	9	Y1.S2

ELECTIVE COURSES – CORE (24 CFU)

Course	CFU	Period
<i>Any from the Control Pack</i>		
Machine Learning	9	Y1.S1
Robotics and Control	9	Y1.S2
Reinforcement Learning	6	Y2.S1
Biomolecular Feedback Systems	6	Y2.S1
Mobile and Networked Robotics	9	Y2.S1

FREE COURSES (12 CFU)

Course	CFU	Period
<i>Any from above</i>		
Computer Vision*	6	Y1.S1
Deep Learning	6	Y1.S2
Learning from Networks	6	Y2.S1
Game Theory	6	Y2.S1
Control of Biological Systems	6	Y2.S1

Mandatory courses distribution and core/affine imbalance

- total formative credit units: **120 cfu**
- final project (internship+thesis): **30 cfu**

Y1-S1	Y1-S2	Y2-S1	Y2-S2	MANDATORY	ELECTIVE
15/21 CFU	15 CFU	9/15 CFU	0/6 CFU	45 CFU	45 CFU

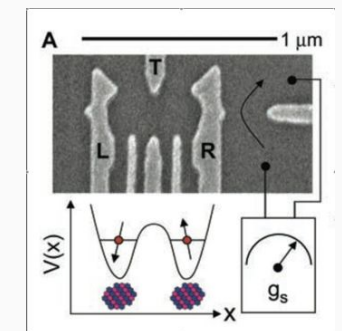
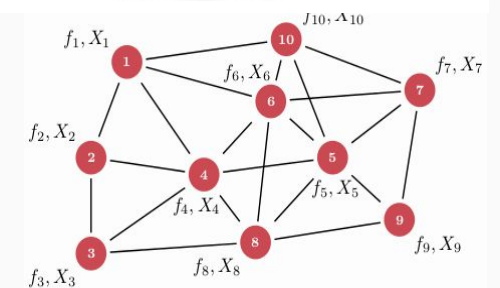
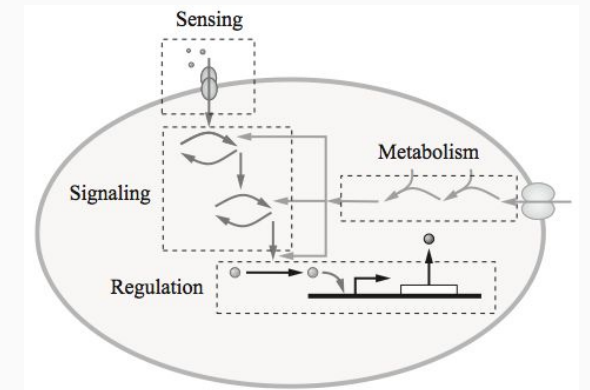
CORE 54-75	AFFINE 15-30	FREE 9-15
63 CFU	15 CFU	12 CFU



Complex Systems

Focus on tools to understand, model, control real-world systems:
Nonlinear, Networked, Biological and Quantum Systems.

Learn how to build models from *data* and *first principles*



Oriented to concepts and methods, naturally leads to theoretical and multidisciplinary research.

MANDATORY COURSES (57 CFU)

Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2
Machine Learning	9	Y1.S1
Dynamical Systems and Lagrangian Mechanics	9	Y1.S2
Learning Dynamical Systems	9	Y2.S1
Control Pack (1 of ...)		
Nonlinear Systems and Control	6	Y2.S2
Network Dynamical Systems	6	Y2.S2

ELECTIVE COURSES – CORE (15 CFU)

Course	CFU	Period
<i>Any from the Control Pack</i>		
Digital Control	6	Y1.S1
Robotics and Control	9	Y1.S2
Quantum Dynamics, Measurements and Control	6	Y1.S2
Adaptive and Model Predictive Control	6	Y2.S1
Biomolecular Feedback Systems	6	Y2.S1
Mobile and Networked Robotics	9	Y2.S1
Reinforcement Learning	6	Y2.S1

ELECTIVE COURSES – AFFINE (6 CFU)

Course	CFU	Period
Convex Optimization	6	Y1.S1
Computer Vision	6	Y1.S1
Deep Learning	6	Y1.S2
Advanced Topics in Optimization	6	Y1.S2
Quantum Information and Computing	6	Y1.S2
Learning from Networks	6	Y2.S1
Game Theory	6	Y2.S1
Control of Biological Systems	6	Y2.S1
Big Data Computing	6	Y2.S2

FREE COURSES (12 CFU)

Course	CFU	Period
<i>Any from above</i>		

Mandatory courses distribution and core/affine imbalance

- total formative credit units: **120 cfu**
- final project (internship+thesis): **30 cfu**

Y1-S1	Y1-S2	Y2-S1	Y2-S2	MANDATORY	ELECTIVE
18 CFU	24 CFU	9 CFU	6 CFU	57 CFU	33 CFU

CORE 54-75	AFFINE 15-30	FREE 9-15
63 CFU	15 CFU	12 CFU

MANDATORY COURSES (24 CFU)		
Course	CFU	Period
Systems Theory	9	Y1.S1
Estimation and Filtering	6	Y1.S2
Control Engineering Laboratory	9	Y1.S2

ELECTIVE COURSES – CORE (30-51 CFU)

ELECTIVE COURSES – AFFINE (15-30 CFU)

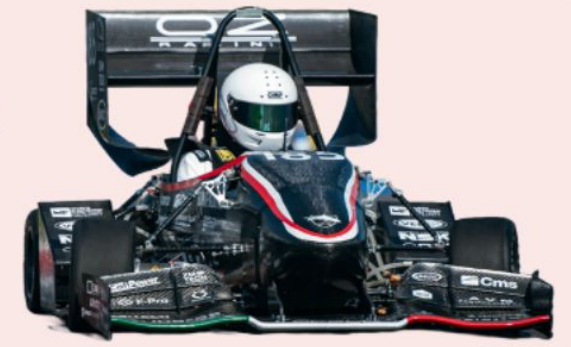
FREE COURSES (9-15 CFU)

Student projects are activities where groups of students, coordinated by professors, work on the design and construction of engineering systems. These projects often participate in competitions at both national and international levels. Some examples...

Alba CubeSat Unipd: the project aims to launch a CubeSat into orbit to study the space debris environment and the satellite micro-vibrations.



Race Up Team: with Formula SAE the conception, design, and production of a Formula-style car is carried out, to compete in a static and dynamic events.



BOSCH Future Mobility Challenge: Autonomous driving on 1:10 scale vehicles to navigate (and compete) in a miniature smart city.



UniZEB: multidisciplinary and permanent Living Lab on Zero Energy Buildings, with cutting-edge technologies from construction to management.



The next slides give a brief oversight of the current research interests of our group.
This may be of interest to you for various reasons:

Topics for possible Master Theses/Stage

Future work opportunities

Why not a PhD in Control?

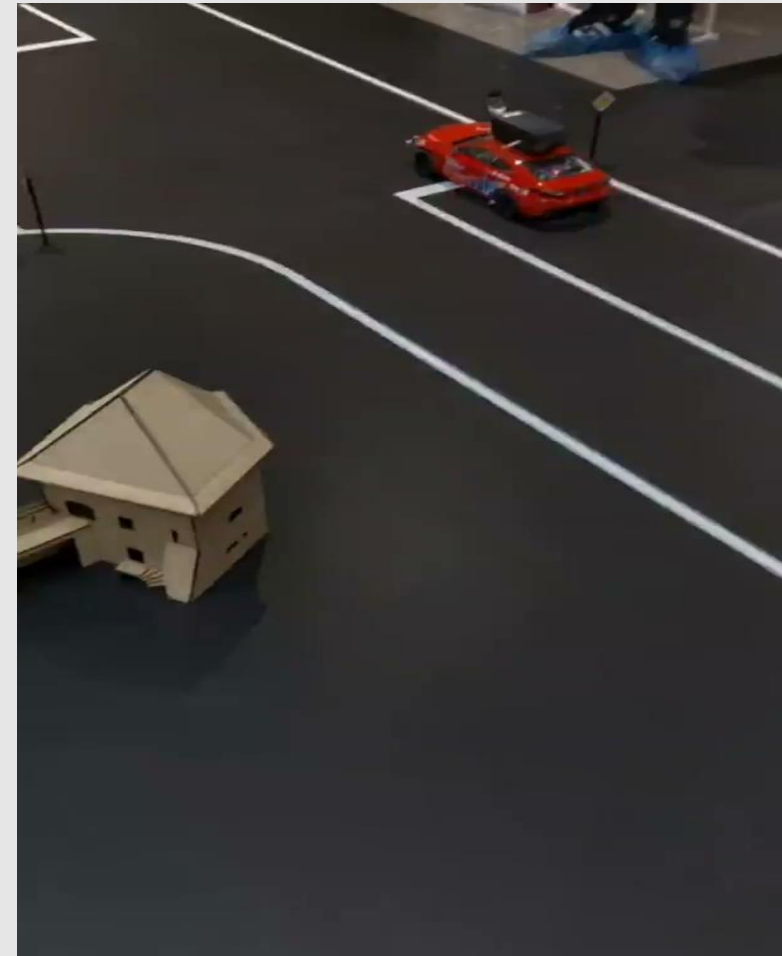
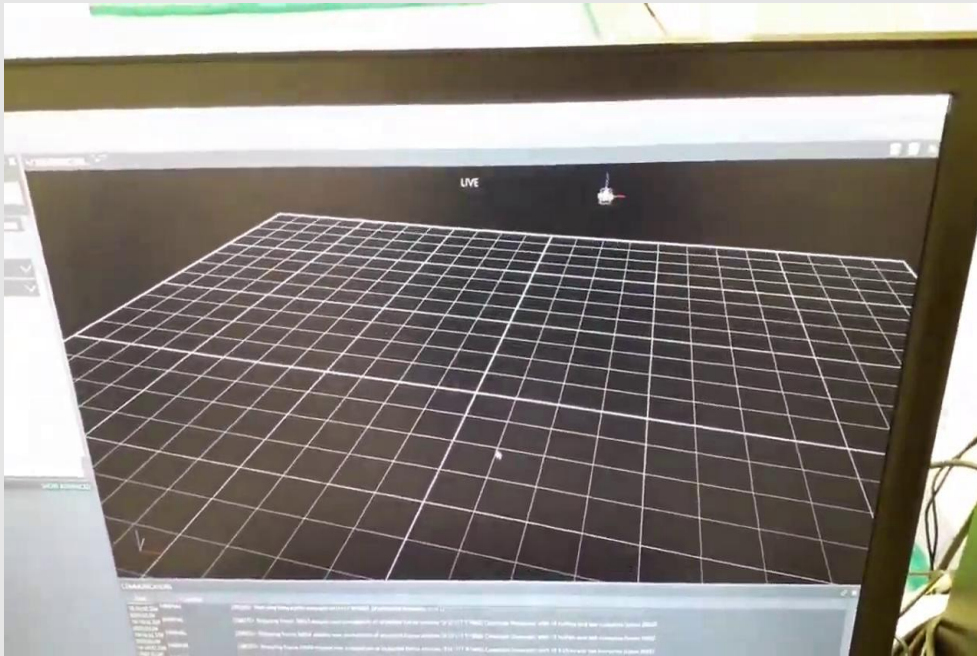
NAVLAB - Industrial Applications Laboratory:

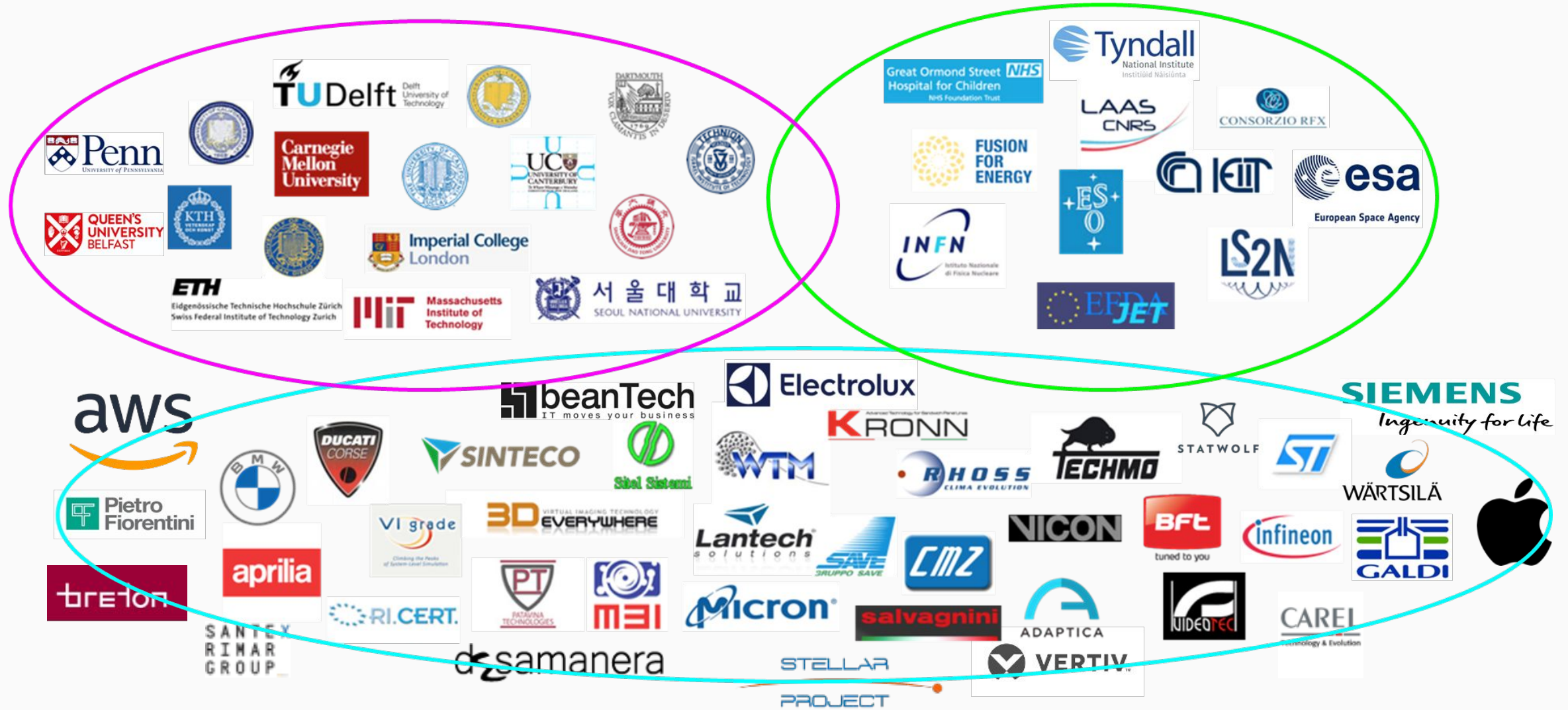
- Kuka robotic arm: industrial robot for man-machine collaborative action
- Duckietown: cooperative mobility in a miniature smart-city
- VI-Grade Driving simulator: motion cueing & control
- Mobile vehicle communication systems



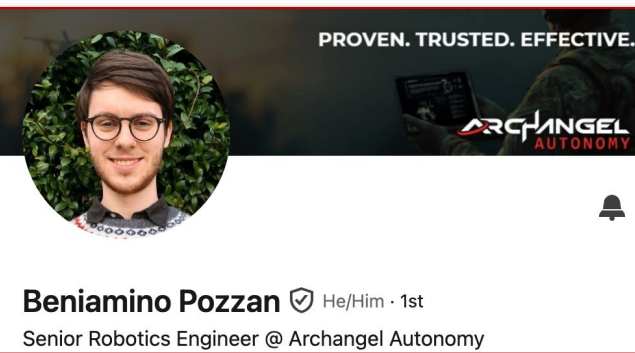
SPARCS Laboratory:

- Mobile robotics laboratory
- Multirotor platforms: design, simulation, estimation/perception, control, experiments
- Rapid-prototyping ROS/ROS2 architecture





- Our students find rewarding positions both in local and international companies in diverse areas, such as:
 - Automotive;
 - Automation and Robotics;
 - Home Appliances;
 - Power and Energy;
 - ...
- Several of our fellow students are faculties/hold positions at prestigious universities around the world.



Beniamino Pozzan ✓ He/Him · 1st
Senior Robotics Engineer @ Archangel Autonomy



Elisa Feltre · 1st
Software Development Engineer presso Skilled Group



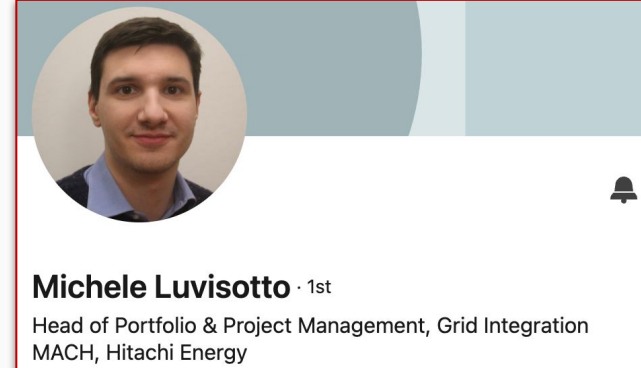
Gianluca Bianchin ✓ · 1st
Assistant Professor at Université catholique de Louvain



Diego Romeres ✓ · 1st
Senior Applied Scientist in Robotics at Amazon IRG



Laura Dal Col ✓ She/Her · 1st
Engineering Manager @Motherbrain AI EQT Group



Michele Luvisotto · 1st
Head of Portfolio & Project Management, Grid Integration MACH, Hitachi Energy



Sofia Girardello ✓ · 2nd
Robotics & AI @ BMW Group | MSc in Control Systems Engineering @ UniPd



Alberto Padoan ✓ · 2nd
Assistant Professor @ UBC | Host @ inControl Podcast
The University of British Columbia · Imperial College London



Giuseppe Belgioioso ✓ · 1st
Assistant Prof. @ KTH | Control 🎮 Games 🧑‍💻 Energy ⚡



Enrico Mion · 2nd
Control Strategies Engineer in KTM MotoGP, PhD
KTM AG · Università degli Studi di Padova



Chiara Favaretto · 1st
Data Scientist presso Nextbit s.r.l.



Gianluca Giorgini · 2nd
Electric & Electronic System Engineer
APRILIA RACING S.R.L. · MIT Professional Education



Giuliano Zambonin ✓ · 1st
Control Algorithms Developer, Ph.D. @ Electrolux
Electrolux · Università degli Studi di Padova

After 3 years from graduation:

95%



employment rate

40%



postgraduate education

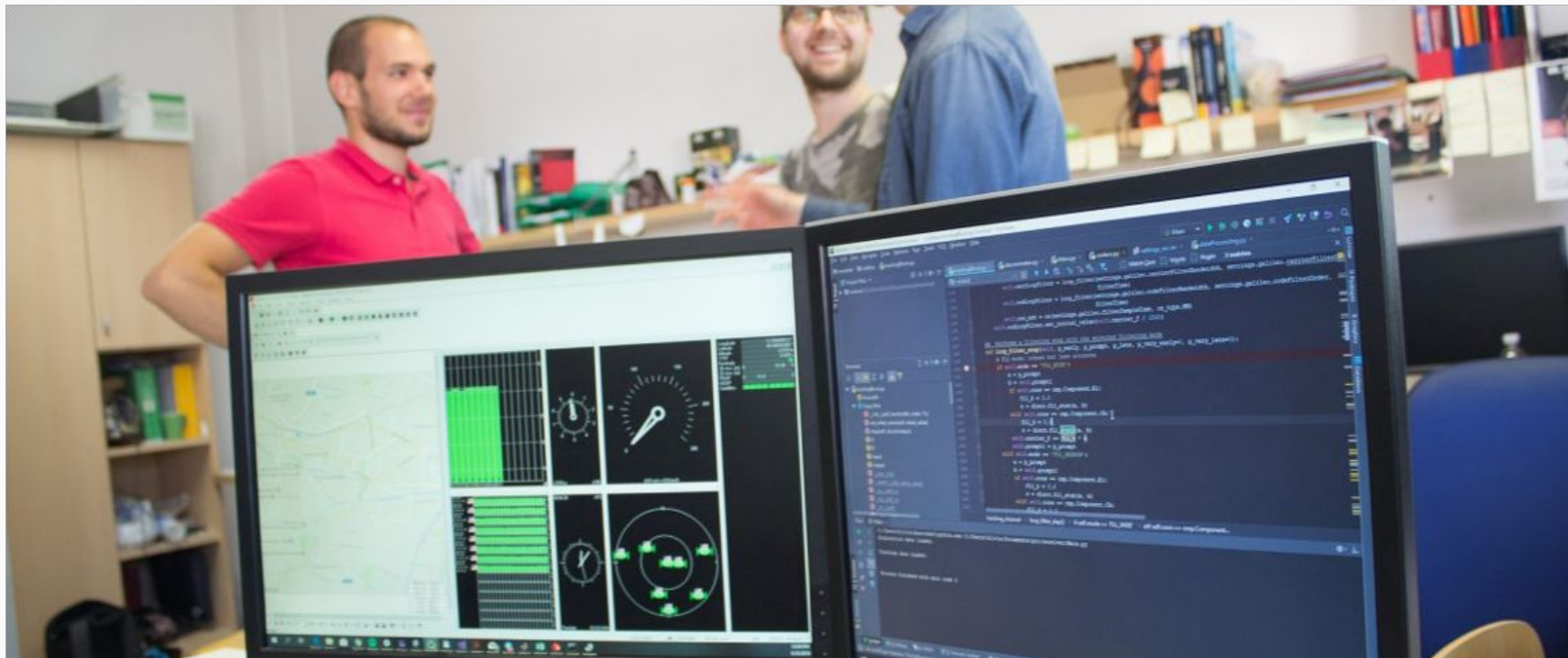
1,892€

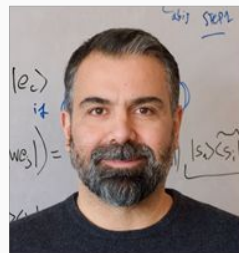


average salary*

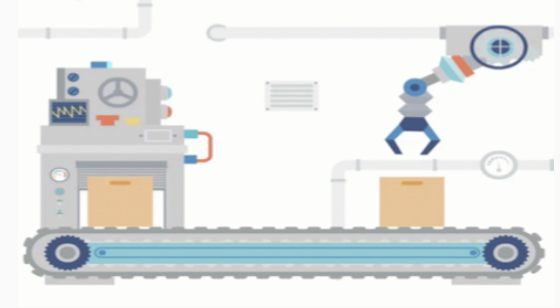
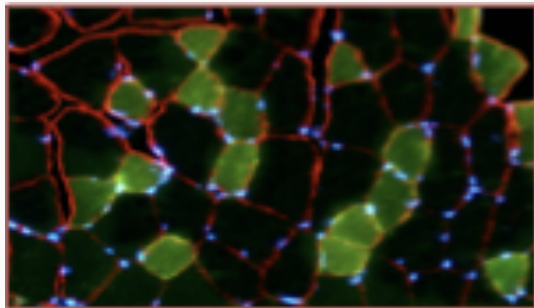
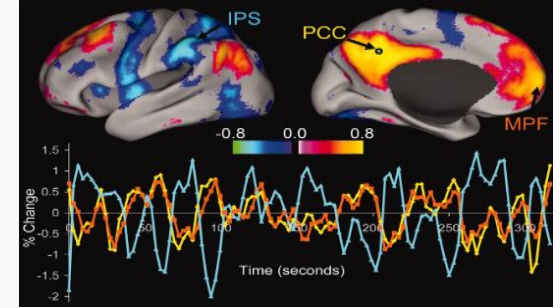
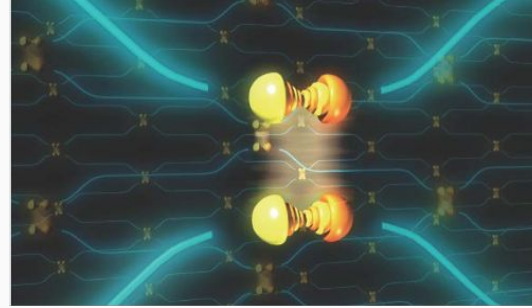
Data taken from Almalaurea (2023)

Some graduates continue their education by pursuing a PhD, which serves as a springboard for carrying out research activities in both **academic** settings (universities and research centers) and **industry**



**G. Baggio****L. Ballotta****A. Beghi****M. Bruschetta****R. Carli****A. Cenedese****A. Chiuso****A. Dalla Libera****P. Falco****A. Ferrante****A. Morato****M. Pezutto****G. Pillonetto****M. Rampazzo****L. Schenato****G.A. Susto****F. Ticozzi****M.E. Valcher****D. Varagnolo****S. Vitturi****S. Zampieri****M. Zorzi**

Research and Application Areas (rough list):



Research and Application Areas (rough list):

Robotics: Carli, Cenedese, Dalla Libera

Machine Learning: Chiuso, Pillonetto, Susto

Optimization, identification: Ferrante, Pillonetto, Zorzi

Switched systems: Valcher

Control Applications: Beghi, Cenedese, Rampazzo, Susto, Varagnolo

Automotive: Bruschetta

Industrial Automation: Vitturi

Networked Systems: Baggio, Schenato, Varagnolo, Zampieri

Quantum Information & Control: Ticozzi

Systems Biology: Schenato

More info: <https://automatica.dei.unipd.it/>

More info: <https://unipd.coursecatalogue.cineca.it/corsi/2025/2331>
<https://degrees.dei.unipd.it/master-degrees/control-systems-engineering/>



Students' Office: segredei@dei.unipd.it

MS-CSE People:

Coordinator: Prof. Angelo Cenedese - angelo.cenedese@unipd.it

Vice-Coordinator: Prof. Ruggero Carli - ruggero.carli@unipd.it

Study Plans: Prof. Mattia Bruschetta - mattia.bruschetta@unipd.it

Learning Agreements: Prof. Ruggero Carli - ruggero.carli@unipd.it



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