



POLITECNICO
MILANO 1863

SCHOOL OF INDUSTRIAL
AND INFORMATION ENGINEERING

Automation and Control Engineering

Laurea Magistrale, equivalent to Master of Science

Open Day – May 27, 2021



More than **47.500**
students including
about **7.300**
international students

More than **1.400**
teachers and more
than **1.200**
administrative and
technical support staff



4 Schools

- Architecture Urban Planning
Construction Engineering
 - Design
- Civil, Environmental and
Land Management
Engineering
 - Industrial and
Information Engineering

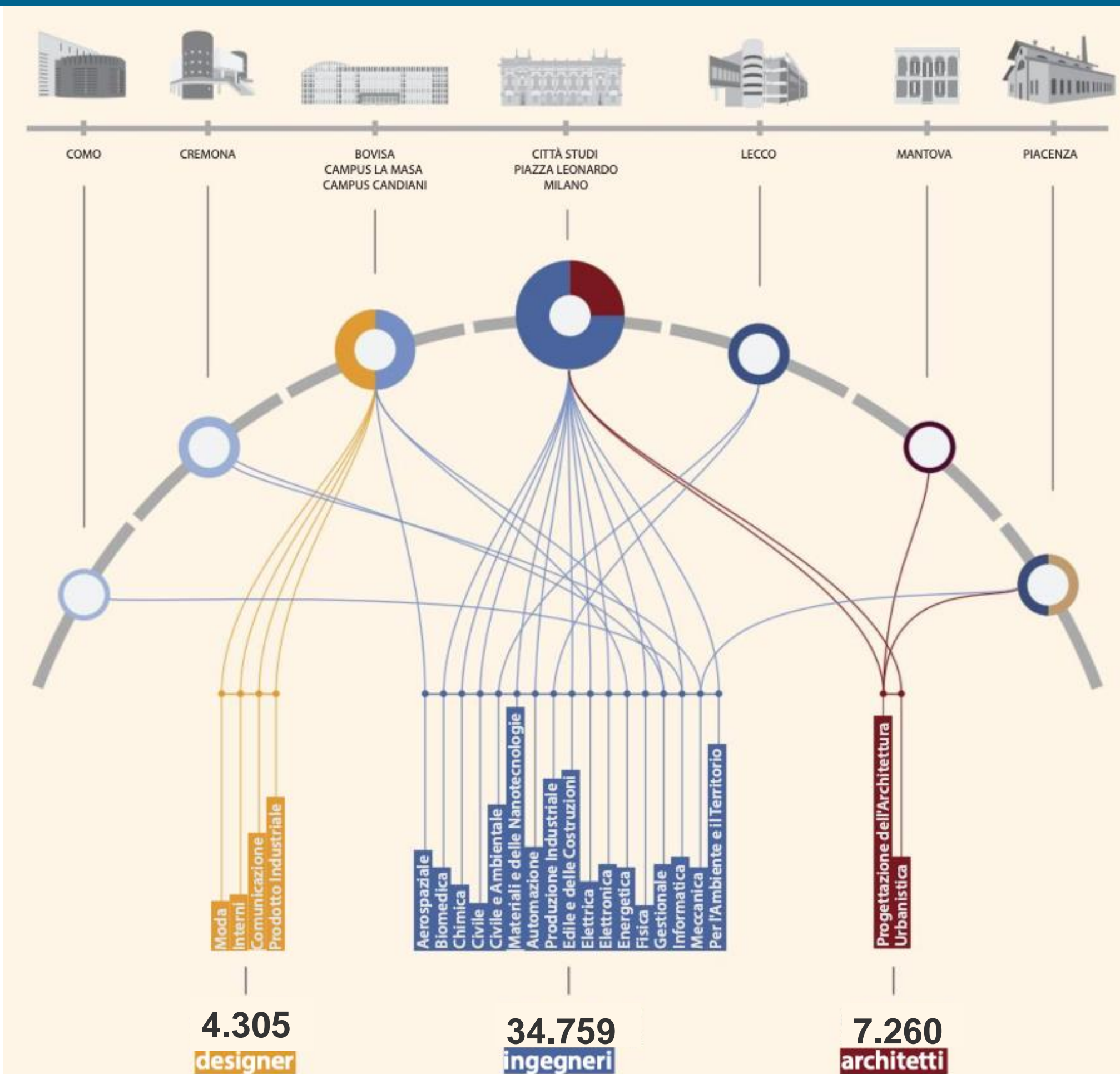
12
Departments

Classified **n. 1** in Italy, **n. 7** in Europe, **n. 20** in the world
under the “Engineering & Technology” category
QS World University Ranking 2020

Politecnico di Milano: Campuses



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Como

Cremona

Milano Bovisa

Milano Leonardo

Lecco

Mantova

Piacenza

■ engineering

■ design

■ architecture

Automation Engineering



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Study Programme in Automation Engineering:

- offered within the [School of Industrial and Information Engineering](#)
- based at [Milano Leonardo Campus](#)

Chair and vice-chair of the programme



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Chair

Prof. Maria Prandini

DEIB, building 20

tel: 02 2399 3441

e-mail: maria.prandini@polimi.it



Vice-chair

Prof. Alberto Leva

DEIB, building 20

tel: 02 2399 3410

e-mail: alberto.leva@polimi.it



Automation Engineering



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Why studying Automation Engineering?



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Automation is everywhere and is increasing in many domains, which makes the Automation Engineer a highly in-demand professional figure



Why studying Automation Engineering?



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A FUTURE THAT WORKS: AUTOMATION, EMPLOYMENT, AND PRODUCTIVITY

AUTOMATION

A global force that will transform economies and the workforce

Technical automation potential by adapting currently demonstrated technologies

While few occupations are fully automatable, 60 percent of all occupations have at least 30 percent technically automatable activities

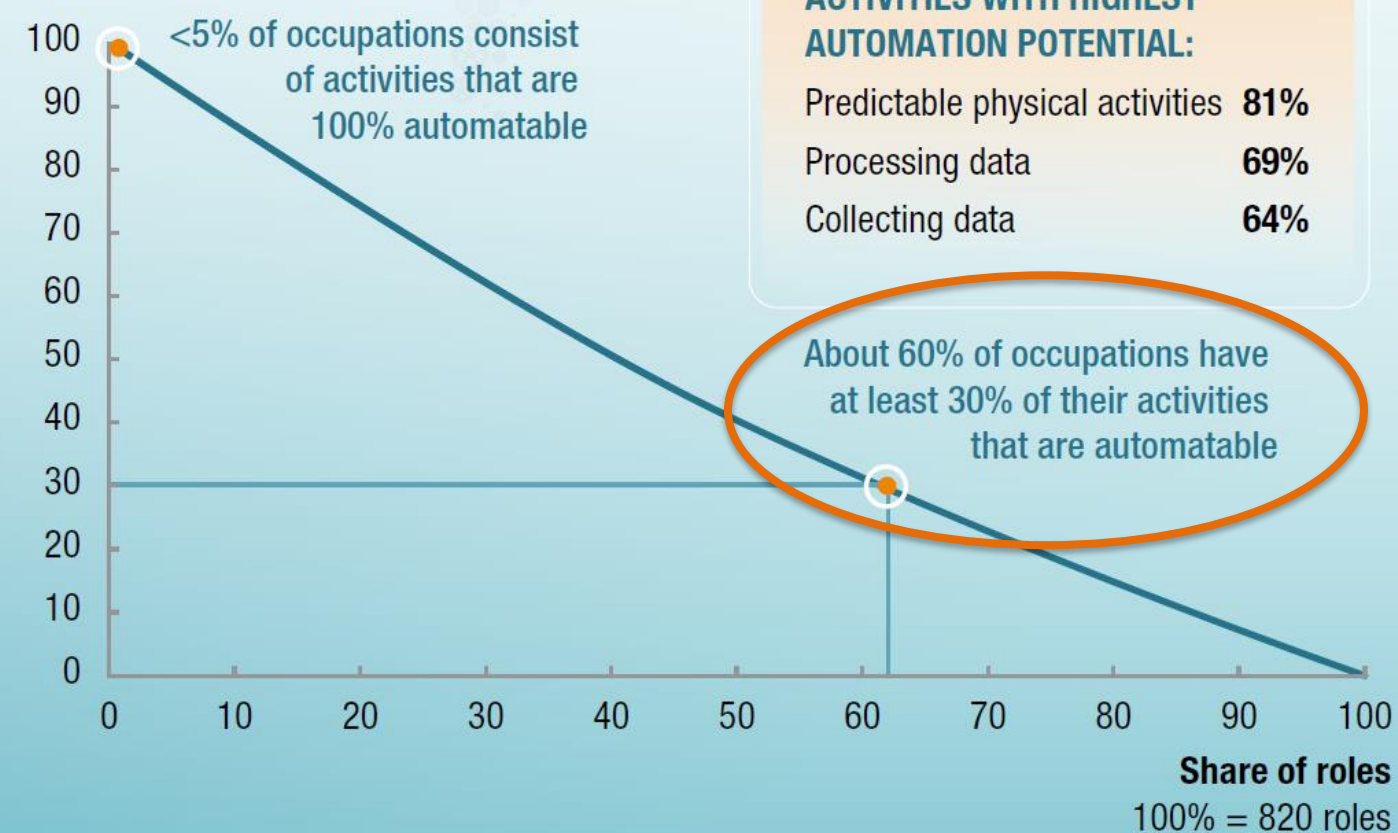
Technical automation potential
%

<5% of occupations consist of activities that are 100% automatable

ACTIVITIES WITH HIGHEST AUTOMATION POTENTIAL:

Predictable physical activities	81%
Processing data	69%
Collecting data	64%

About 60% of occupations have at least 30% of their activities that are automatable



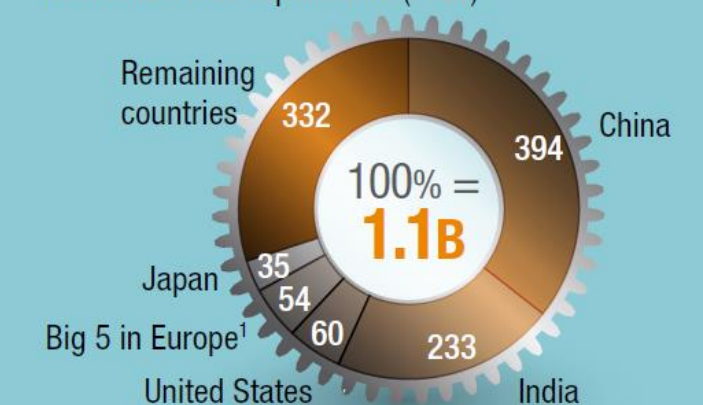
Wages associated with technically automatable activities

\$ trillion



Labor associated with technically automatable activities

Million full-time equivalents (FTEs)



¹ France, Germany, Italy, Spain, and the United Kingdom.

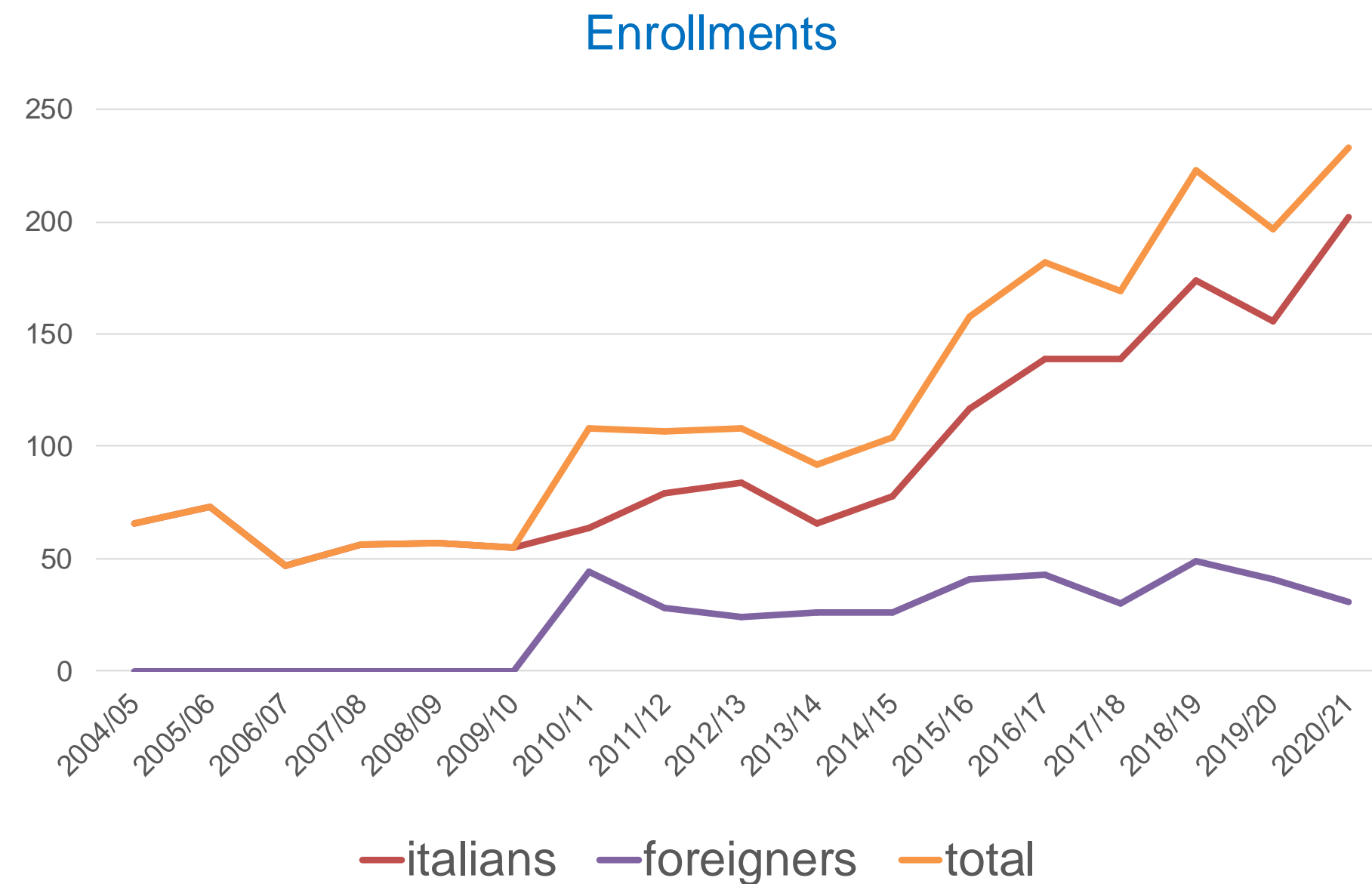
From the Executive Summary
McKinsey Global Institute
January 2017

Attractiveness of the MSc programme



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Year	Italians	Foreigners	Total
2004/05	66	0	66
2005/06	73	0	73
2006/07	47	0	47
2007/08	56	0	56
2008/09	57	0	57
2009/10	55	0	55
2010/11	64	44	108
2011/12	79	28	107
2012/13	84	24	108
2013/14	66	26	92
2014/15	78	26	104
2015/16	117	41	158
2016/17	139	43	182
2017/18	139	30	169
2018/19	174	49	223
2019/20	156	41	197
2020/21	202	31	233



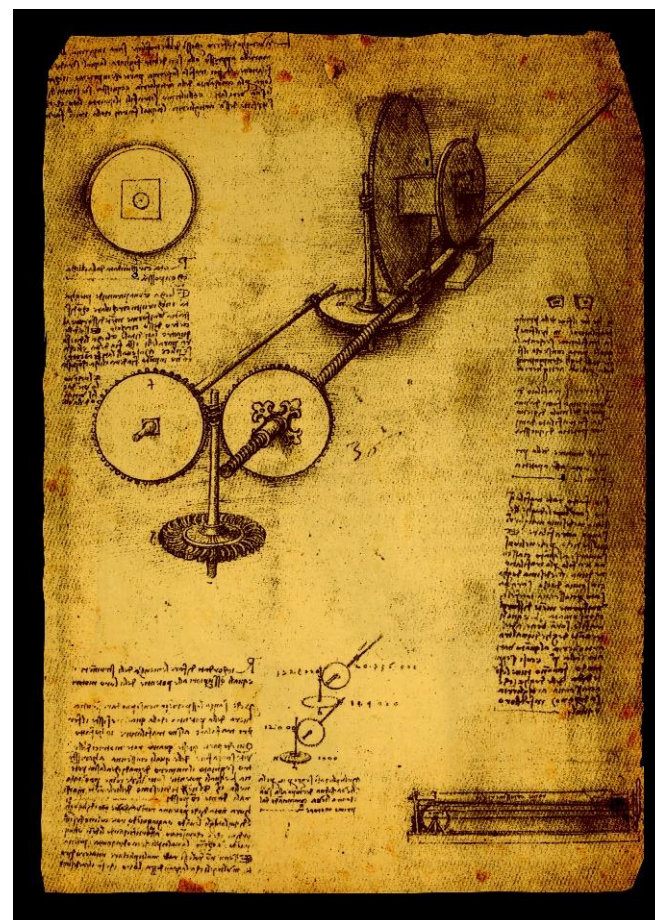
Learning objectives



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The Automation and Control
Engineering MSc Programme
aims at training engineers ...



... able to **design, implement and manage** automation systems characterized by a **strong technological content**, in inherently **multidisciplinary contexts**

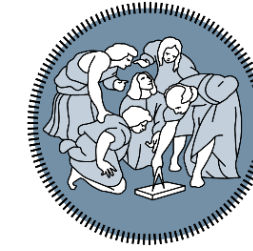
Competences of our MSc students



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- **solid background on the mathematical tools** necessary for the analysis and design of complex automation systems
- a thorough **understanding of the technologies and processes** typical of industrial sectors where automation plays an increasingly important role
- **ability to explore and evaluate the offer and market trends** in the field of instrumentation and system components, in view of innovative applications
- **familiarity with the most advanced techniques** for identification and learning from data, simulation, optimization and control of dynamical systems of all kinds, and **ability to integrate them** in an effective and creative manner
- aptitude for **teamwork** and ability to embrace the **principles and methods of organization**

Programme requirements



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How is the programme organized?

Single curriculum, organized in two years, four semesters, with courses taught in English, except for a few optional ones in Italian.

Most courses are held at Leonardo Campus, a few at Bovisa Campus.

Programme requirements



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What are the rules to obtain your MSc degree?

You have to earn **120 credits**:

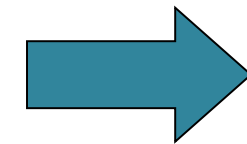
- 60 credits of **mandatory courses**:
 - 45 on qualifying subjects (systems and control, identification, converters and drives, applied mechanics)
 - 15 credits on subsidiary subjects (computer science, electronics, measurements, industrial production technologies)
- 40 credits of **complementary courses**
- a **final thesis** corresponding to 20 credits on new methods and techniques for automation and control with application in high-tech areas

60 credits of mandatory courses

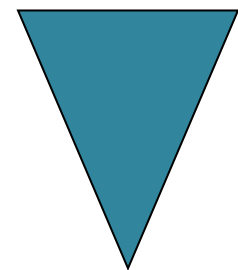


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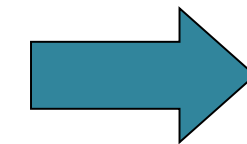
1st year



Course title	Credits (CFU)	Semester
Computer aided manufacturing	10	1
Dynamics of mechanical systems	10	1
Model identification and data analysis	10	1
Advanced and multivariable control	10	2
Dynamics of electrical machines and drives	10	2
<i>Complementary courses</i>	10	2



2nd year



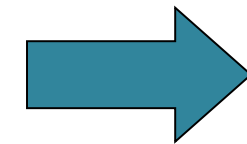
Course title	Credits (CFU)	Semester
Software Engineering (for Automation)	5	2
Automation and Control Laboratory	5	2
<i>Complementary courses</i>	30	1, 2
Thesis	20	1, 2

40 credits of complementary courses

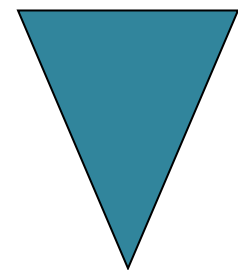


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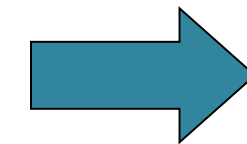
1st year



Course title	Credits (CFU)	Semester
Computer aided manufacturing	10	1
Dynamics of mechanical systems	10	1
Model identification and data analysis	10	1
Advanced and multivariable control	10	2
Dynamics of electrical machines and drives	10	2
<i>Complementary courses</i>	10	2



2nd year



Course title	Credits (CFU)	Semester
Software Engineering (for Automation)	5	2
Automation and Control Laboratory	5	2
<i>Complementary courses</i>	30	1, 2
Thesis	20	1, 2



Courses can be classified in the following categories:

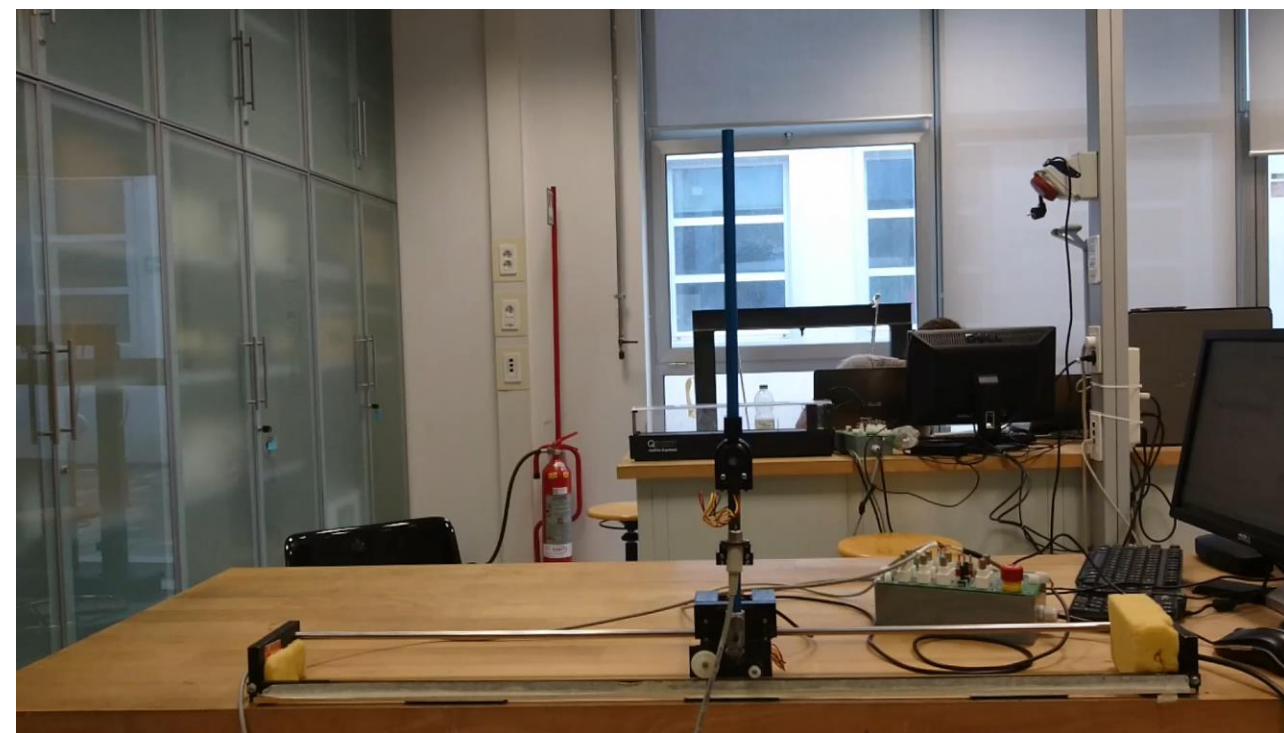
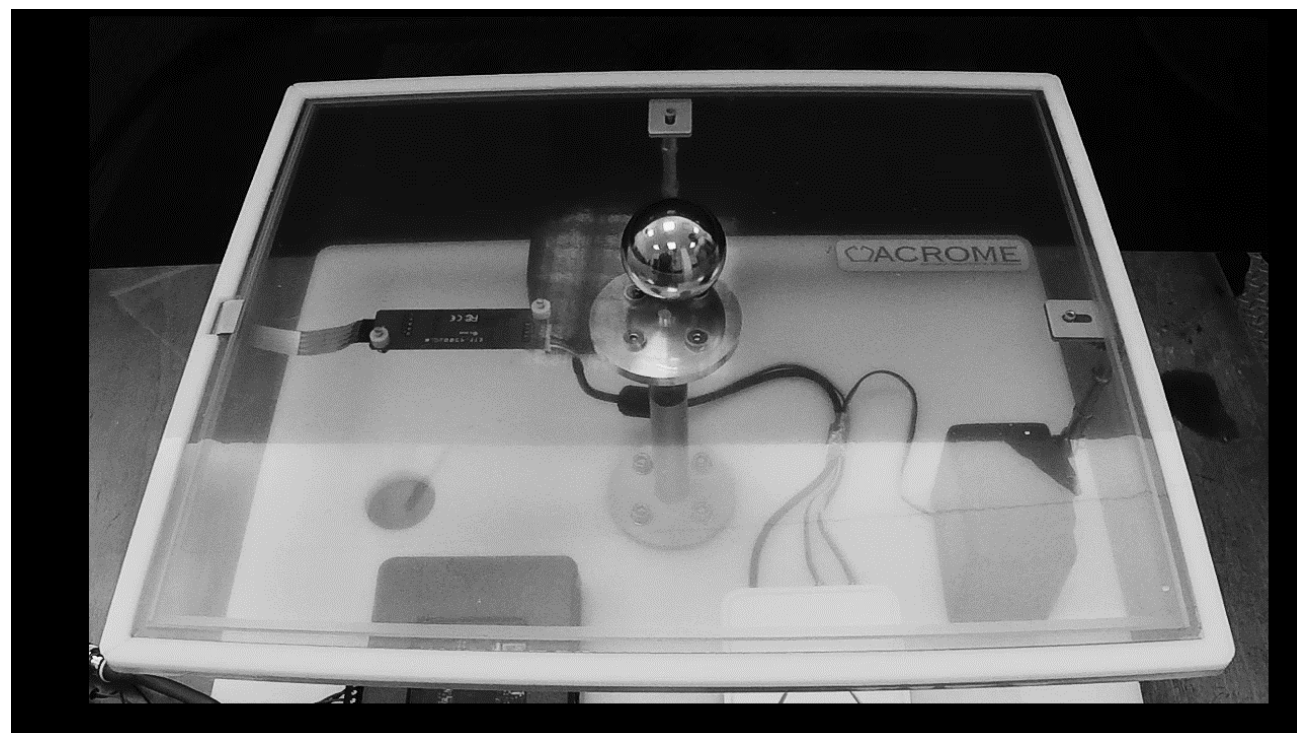
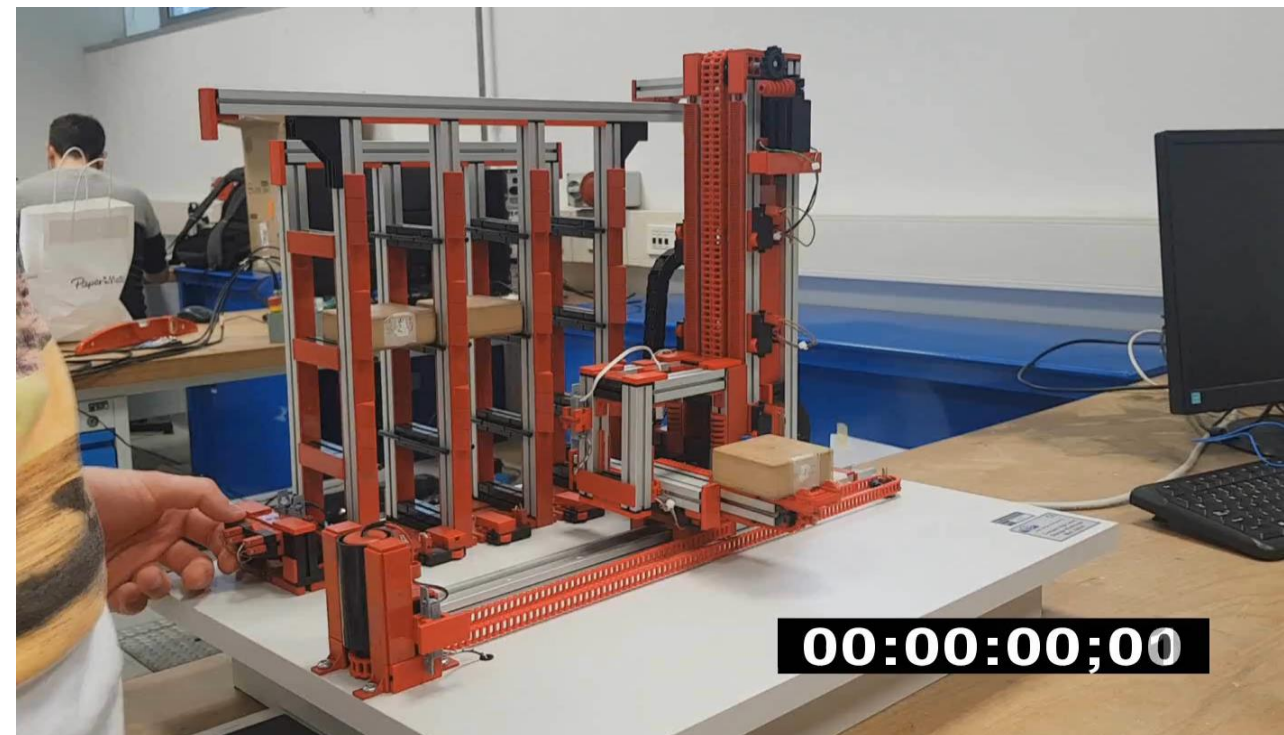
- **methodological**, on advanced techniques of learning from data, identification, simulation, optimization and control
- **technological**, on process instrumentation including advanced actuation and measurement systems for control applications
- **application-oriented**, on the application of control and automation to key areas such as industry, energy, and transportation
- **experimental and professionalizing**, including a **lab course** and a **project work** with companies to reach a full mastery of methods and techniques, and improve soft skills

Automation and Control Laboratory



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- course held in a lab
- students divided in groups, working on various experimental set-ups
- mandatory course in the second semester of the second year



Project work



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Project works are innovative courses in **collaboration with companies**

- companies propose **open innovation topics**, on design activities in the field of automation and control
- each project work is run under the supervision of **an academic and an industrial tutor**
- students work in small groups during the semester
- at the end they **prepare a report and discuss the project** in front of the academic and industrial tutors and the other students



Examples of proposed topics

- Control system for an autonomous micro-vehicle for urban goods delivery
- Development of a communication and control system for the supervisory control of tethered drone formations
- Development of an electronic suspension control system for bicycle
- Intelligent collaborative robotics

Complementary courses on core topics



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Course title	Credits (CFU)
Advanced measurement systems for control applications	5
Advanced process control	5
Advanced topics in automation and control engineering	5
Automation and control in autonomous vehicles	5
Automation and control in electric and hybrid vehicles	5
Automation of energy systems	5
Constrained numerical optimization for estimation and control	5
Control of industrial robots	5
Control of mobile robots	5
Data driven control system design	5
High-tech entrepreneurship	5
Networked control	5
Nonlinear control	5
Numerical analysis	5
Power electronics and supplies	5
Production systems control	5
Robust control	5
Safety in automation systems	5
Simulation techniques and tools	5
Systems theory	5
Vibration control and diagnostics of mechanical systems	5

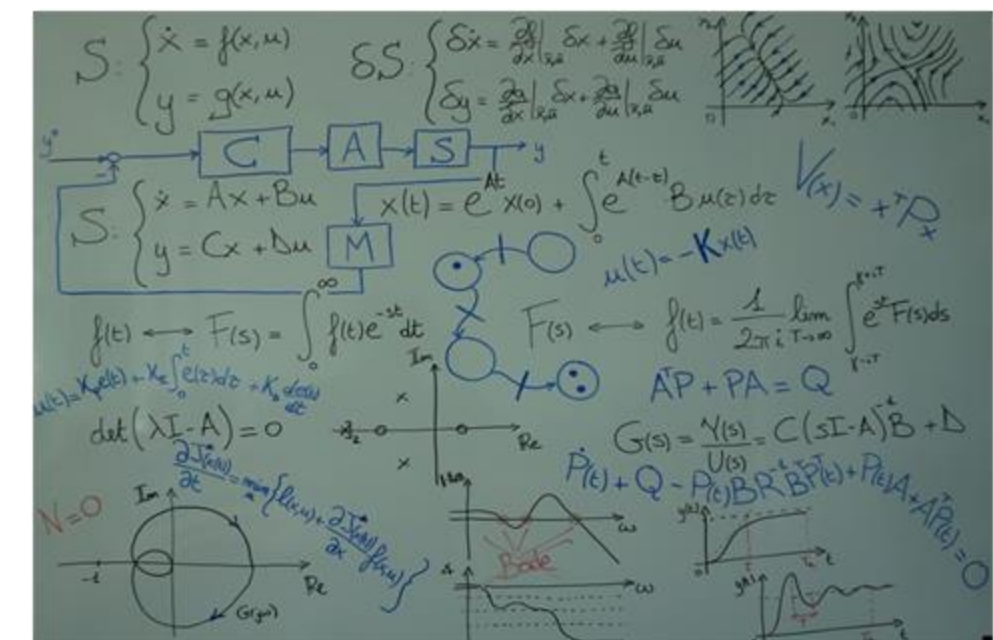
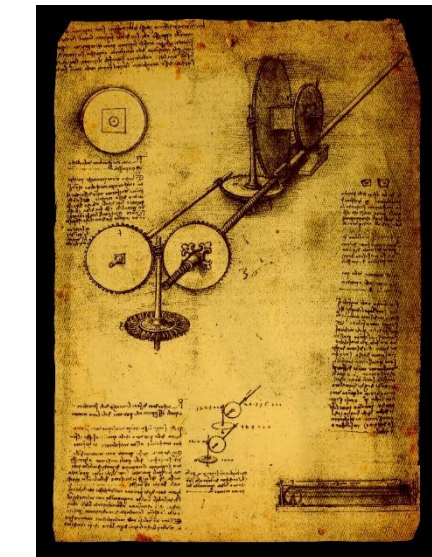
Complementary courses on core topics



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Robust control	5
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Simulation techniques and tools	5
Systems theory	5
Vibration control and diagnostics of mechanical systems	5

- methodological courses



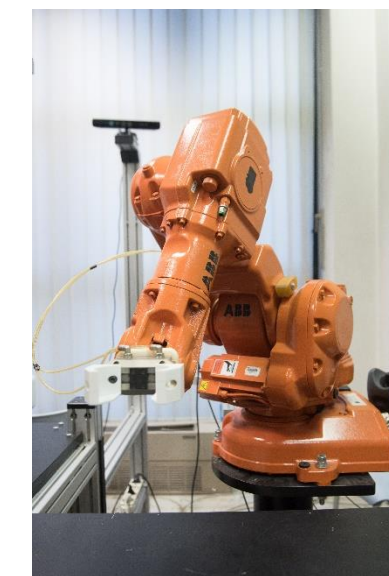
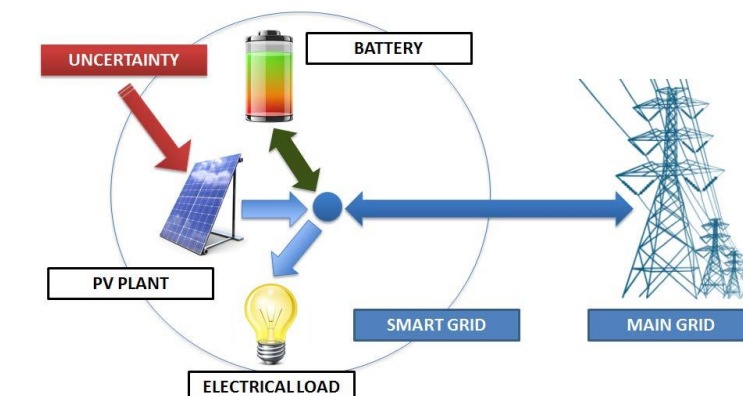
Complementary courses on core topics



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Nonlinear control	5
Numerical analysis	5
Power electronics and supplies	5
Production systems control	5
Robust control	5
Safety in automation systems	5
Simulation techniques and tools	5
Systems theory	5
Vibration control and diagnostics of mechanical systems	5

- application-oriented courses



Thesis



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	Thesis with reviewer “Tesi”	Thesis without reviewer “Tesina”
Expected outcome	an innovative project in the field of automation and control	a (maybe less) innovative project in the field of automation and control
Reviewer required	yes	no
Maximum increment for the final grade	7/110	4/110

Study plan



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- Each student is expected to present his/her study plan
- If the study plan is compliant with the study plans suggested in the Educational Rules, it is automatically approved (“pre-approved”)
- Otherwise the study plan will be considered “autonomous” and then subjected to approval by a committee

Study plan Committee



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Prof. Simone Garatti

DEIB, building 20

tel: 02 2399 3650

e-mail: simone.garatti@polimi.it



Prof. Marcello Farina

DEIB, building 20

tel: 02 2399 3599

e-mail: marcello.farina@polimi.it



Training beyond the MSc programme



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Massive Online Open Courses (MOOCs) – www.pok.polimi.it

POLIMI portal of free online courses to support students in their academic and professional career. A certificate of attendance is provided if the final test is passed.

Passion in action – www.polimi.it/en/programmes/innovative-teaching/

open participation teaching activities that the Politecnico offers to its students to support the development of transversal, soft and social skills. Acquired skills will be accredited on the Diploma Supplement.

High level training courses



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Honours Programme 'Scientific Research in Information Technology'

- extracurricular programme to train MSc students in conducting scientific research in Information technology
- the Honours Programme title is reported in the students' transcript together with a description of the conducted activities
- three main topics for Automation and Control Engineering:
 - Theory and application of control systems
 - Optimization and control of complex systems
 - Robotics, Mechatronics, and Industrial Automation

www.honours-programme.deib.polimi.it

High level training courses



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honours-programme.deib.polimi.it

High level training courses

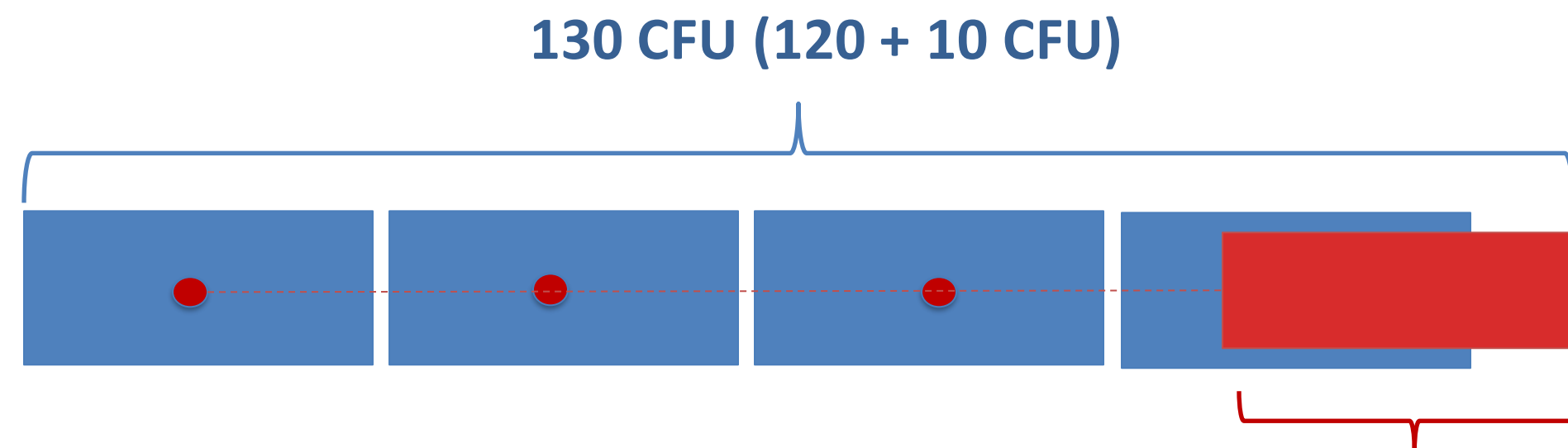


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AMBASSADOR ^{POLIMI}
SMART INFRASTRUCTURES

AMBASSADOR ^{POLIMI}
GREEN TECHNOLOGIES

Starting from 20-21, Polimi is activating high-level training courses to create new professional figures in Green Technologies and Smart Infrastructures within some MSc study programmes



30 CFU smart/green with 20 CFU of transversal courses on topics different from the ones characterizing the specific MSc programme

www.polimi.it/en/polimi-ambassador

High level training courses



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AMBASSADOR ^{POLIMI}
SMART INFRASTRUCTURES

AUTOMATION AND CONTROL ENGINEERING
BIOMEDICAL ENGINEERING
COMPUTER SCIENCE AND ENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
TELECOMMUNICATION ENGINEERING
MANAGEMENT OF BUILT ENVIRONMENT
CIVIL ENGINEERING

AMBASSADOR ^{POLIMI}
GREEN TECHNOLOGIES

CHEMICAL ENGINEERING
ENERGY ENGINEERING
MANAGEMENT ENGINEERING
MATERIALS ENGINEERING AND
NANOTECHNOLOGY
NUCLEAR ENGINEERING
BUILDING AND ARCHITECTURAL ENGINEERING
ENVIRONMENTAL AND LAND PLANNING
ENGINEERING

The Smart/Green Ambassador certification will be reported in the Diploma Supplement and an electronic badge will be issued.

www.polimi.it/en/polimi-ambassador

Initiatives for our students



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Degree awards for the Best MSc Thesis in Automation and Control Engineering entitled to

- prof. Claudio Maffezzoni
for the Best thesis on the Application of advanced techniques for automation and control in highly technological fields
- prof. Nicola Schiavoni
for the Best thesis on the Development of innovative methodologies for automation and control

Automation and Control Industry Seminars

held by people working in different industries and addressed primarily to students enrolled in the third year of the Bachelor Degree and both years of the Master Degree, started this year

Services and opportunities



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Career Service – www.careerservice.polimi.it/
the service for connecting the job market and students and for supporting students in their first job search



POLIHUB – www.polihub.it
the startup District & Incubator that gives you opportunities for turning your ideas into a startup company

Services and opportunities



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- lodging, dining, sport activities



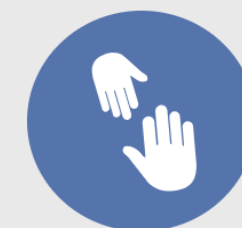
- scholarships, remunerated collaborations, associations and cultural activities



SCHOLARSHIPS
AND FINANCIAL
AID



STUDENTS
REMUNERATED
COLLABORATION
ACTIVITIES



ASSOCIATIONS
AND CULTURAL
ACTIVITIES



LIBRARIES AND
ELECTRONIC
RESOURCES

www.polimi.it/en/services-and-opportunities/

Support and listening services



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Multi Chance Poli Team – polimi.it/en/footer/rights/disabilities-and-spld/
Service for Students with Disability and Learning Disabilities

PoliPsi – polimi.it/en/services-and-opportunities/other-services-and-opportunities/support-and-listening-services/polipsi/
Counselling and Psychological and Psychotherapeutic Support
Service for students

Tutoring – ingindinf.polimi.it/en/1/translate-to-english-studenti/services/tutoring
activities designed to guide and assist students throughout their studies,
removing obstacles to successful course attendance

www.polimi.it/en/services-and-opportunities/other-services-and-opportunities/

International mobility



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Opportunities for gaining experience abroad:

- **study mobility**
attending courses or working on the thesis
- **double degree**
two degrees in three years with at least 60 CFU of exams @POLIMI

A first call at the end of the year, and one around April for re-assignment

www.polimi.it/en/services-and-opportunities/experience-abroad/

Active agreements



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International context: on this page are listed, broken down by country, Erasmus exchange programs, bilateral international agreements and double degree agreements.



Academic Year	2021/2022	▼
School	School of Industrial and Information Engineering (225)	▼
Programme	Automation and Control Engineering (473)	▼
Exchange type	All exchange programmes	▼

Refresh

Australia

University ID	University	Exchange programmes type
AUS KENSING01	University Of New South Wales	Bilateral Agreement Extra Ue

Austria

University ID	University	Exchange programmes type
A WIEN02	Technische Universitat Wien	Erasmus Programme

Belgium

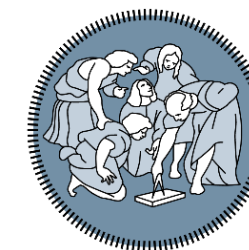
University ID	University	Exchange programmes type
B LEUVEN01	Katholieke Universiteit Leuven	Erasmus Programme
B LOUVAIN01	Universite' Catholique De Louvain	Erasmus Programme
B BRUXEL04	Universite' Libre De Bruxelles	Erasmus Programme

Brazil

University ID	University	Exchange programmes type
BRA SAOPAU04	Universidade De Sao Paulo	Bilateral Agreement Extra Ue

www4.ceda.polimi.it/manifesti/manifesti/controller/extra/ScambiInternazionaliPublic.do

Preparing a learning agreement



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Degree - Final exam ▼

Application forms ▼

Post degree ▼

Mobility ▲

Course archive validated within international exchange Programmes ☆

Resolutions concerning international exchange programmes ☆

Language courses catalogue ☆

Assessment of international mobility applications ☆

University ICT services ▼

Competitions and selections ▼

www.polimi.it/servizi-online/

Preparing a learning agreement



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SCHOOL OF **INDUSTRIAL AND INFORMATION ENGINEERING**

SCHOOL

TEACHING

STUDENTS

[Home](#) / [Students](#) / [Opportunities](#) / Experience Abroad

Experience abroad

The Politecnico di Milano offers the School's students the opportunity to participate in high quality international projects based on joint programmes and special agreements with many partner universities.

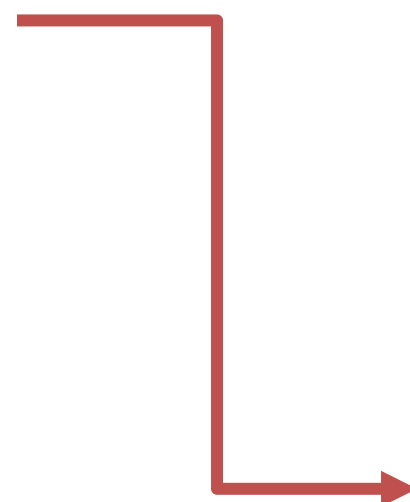
[Experience abroad opportunities](#)

[Further information on experience abroad](#) (in italian)

You can also contact you programme coordinator for more details and to arrange an experience abroad.

Rules to

- prepare a learning agreement
- convert marks



www.ingindinf.polimi.it/en/1/translate-to-english-studenti/opportunities/experience-abroad

International mobility Beep channel



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INTERNATIONAL MOBILITY

The space to exchange experiences among students undertaking international mobility programmes

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beep.metid.polimi.it/web/mobilita-internazionale

International mobility Committee



POLITECNICO
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Prof. Luca Bascetta

DEIB, building 20

tel: 02 2399 3440

e-mail: luca.bascetta@polimi.it



Prof. Matteo Corno

DEIB, building 20

tel: 02 2399 4037

e-mail: matteo.corno@polimi.it

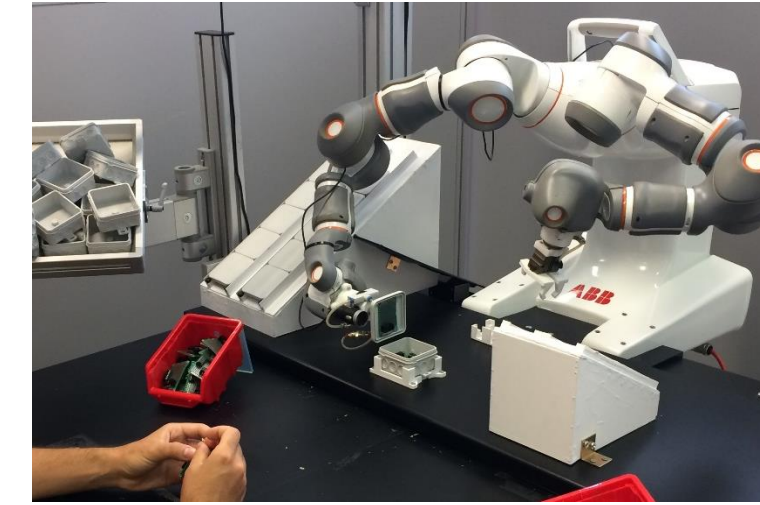
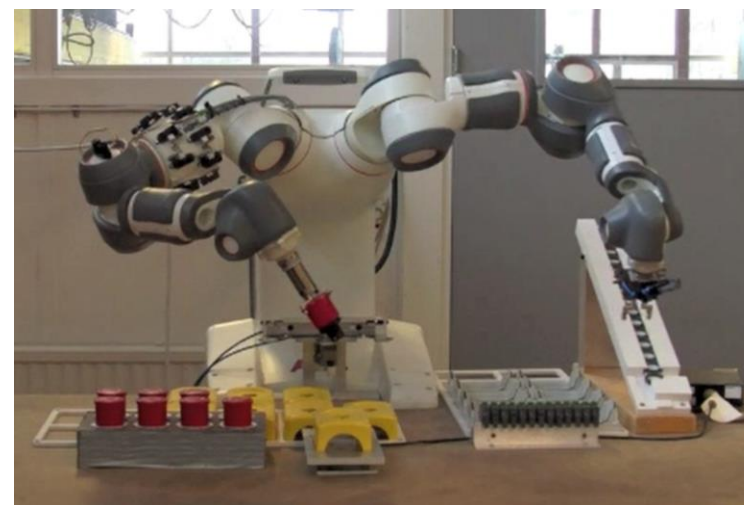


Some research areas



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- automation in vehicles and transportation systems
- collaborative robotics and mechatronics
- automation in energy systems and integration of renewables



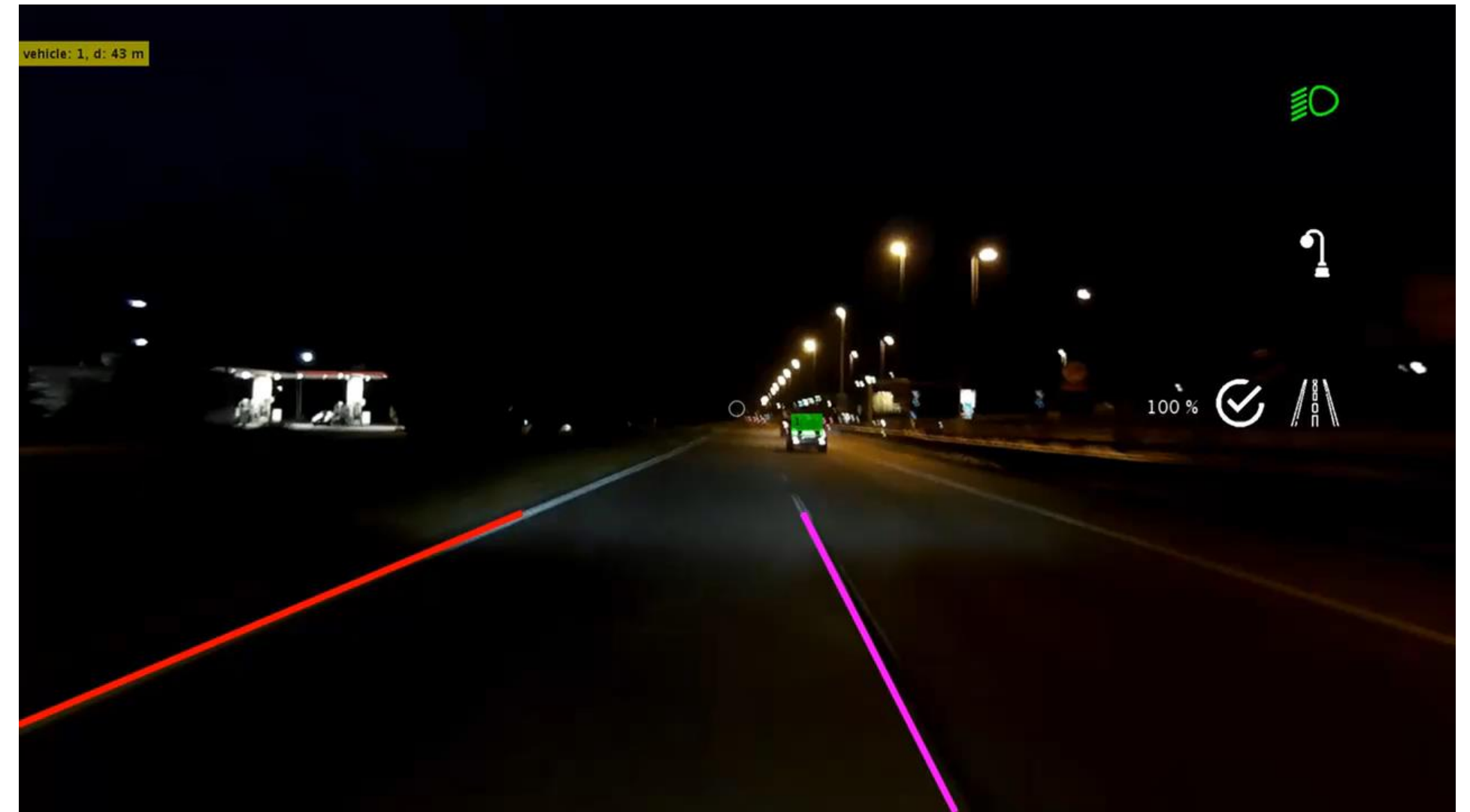
Automation in vehicles and transport



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self-charging e-bike



advanced driver assistance system

Collaborative robotics



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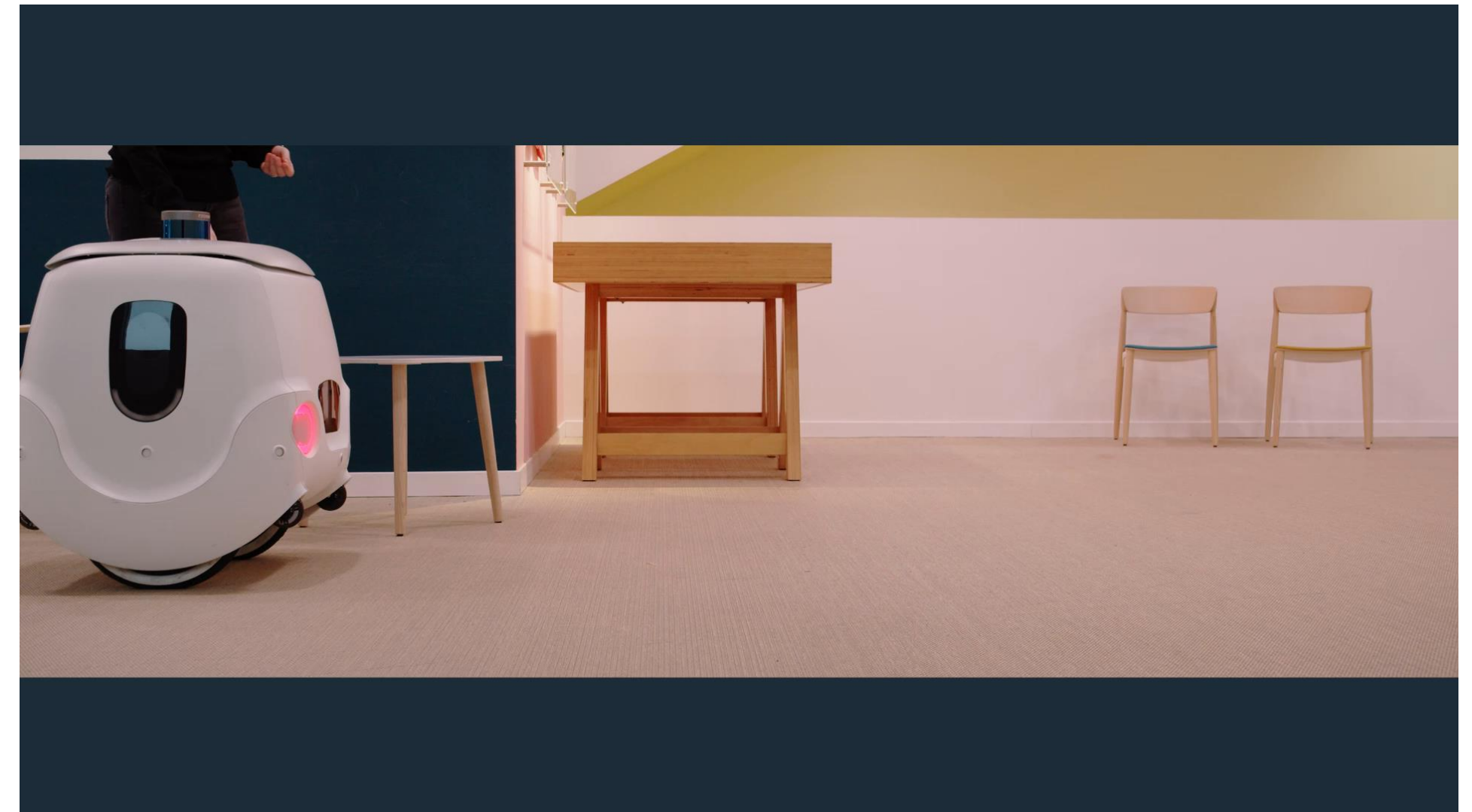
dual-arm robot



industrial manipulator



in the countryside



in town

Energy systems and renewables



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power kite to convert wind energy into electricity

Study of methods and algorithms



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New applications call for the development of suitable methods and algorithms for

- prediction
- learning from data
- planning and trajectory tracking
- predictive control in presence of constraints
- verification and control of cyber-physical systems
- distributed optimization of interconnected systems

...

Collaborations: some companies



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ABB
Alfa Romeo
Alstom
Aprilia
Argotractors
BLM Group /Adige
Bosch
Brembo
COMAU
Ducati
Eldor
Electrolux
E-Novia
ENEL

Ferrari
Fives-Intralogistics
Gruppo Camozzi
Huawei
Hyundai
INDEVA
Lamborghini
Leonardo spa
Magneti Marelli
MAN
Maserati
MV-Agusta
NUM
Peugeot Motorcycles

Piaggio
Pirelli
RSE
Safim
Same-Deutz-Fahr
Schneider Electric
Siemens
Tenaris
TT-Control/Hydac
Unipol
Vodafone
Whirlpool
Yamaha
Yanmar

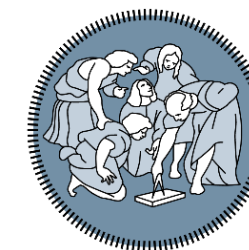
Career opportunities



POLITECNICO
MILANO 1863

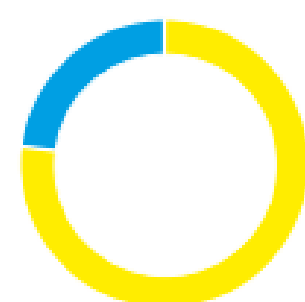
- companies that produce hardware and software for automation
- companies that design and manufacture machines or plants with high level of automation
- companies that manage automated production plants
- corporations or companies that manage large-scale networks and services
- engineering and consulting firms that design complex and technologically advanced plants and systems
- start-up companies, possibly with the support of PoliHub, the Innovation District & Startup Accelerator of Politecnico di Milano

Offers for Automation Engineers



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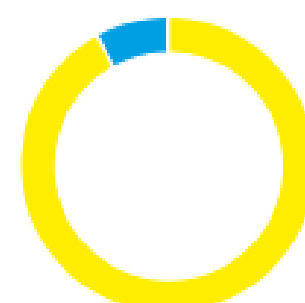
TOTAL OFFERS: 3446



Jobs: 2638
Internship: 808

77%
23%

WHERE THEY WORK

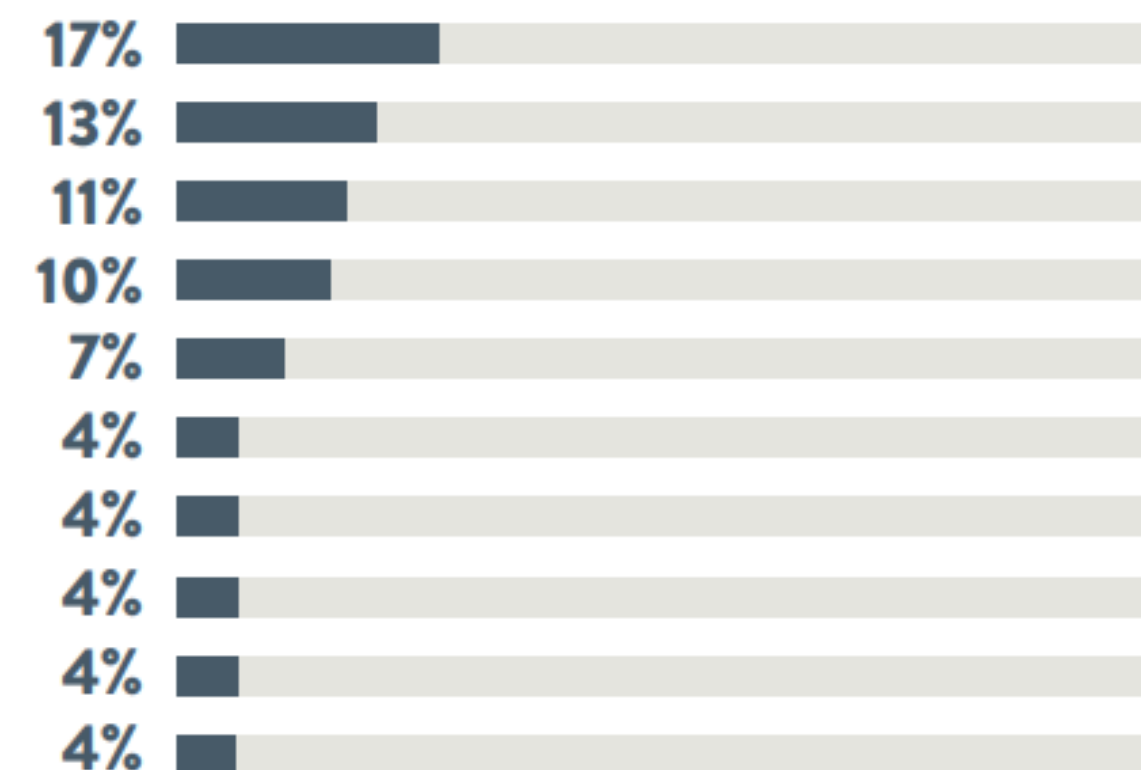


Italy
Abroad

92%
8%

TOP 10 SECTORS

Electronics and Automation
Metallurgy and Metalworking
ICT
Mechanics and Installation
Business Consultancy
Automotive
Energy Oil&Gas
Business Services
Scientific Research and Dev
IT Consultancy



Employment statistics



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2020 Survey – MSc students graduated in 2018

EMPLOYED

97%



1 YEAR AFTER GRADUATION

EMPLOYED WITHIN 6 MONTHS

92%



PERCENTAGE CALCULATED ON
EMPLOYED WITHIN 1 YEAR
AFTER GRADUATION

Career Service

Employment statistics



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2020 Survey – MSc students graduated in 2014

EMPLOYED

100%



100% PERMANENT CONTRACT

SATISFIED WITH THEIR MSC TITLE

95%



Career Service

Admission to the MSc Programme



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When to apply?

EEA (European Economic Area) or Non EEA resident in Italy

- 1st semester: 1st call Sept – Nov '20; 2nd call Jan – May '21; 3rd call July '21
- 2nd semester: 1st call May – July '21; 2nd call January '22

Non EEA

- 1st semester: 1st call Sept – Nov '20; 2nd call Jan – March '21
- 2nd semester: May – July '21

How?

the application procedure is described at

www.polimi.it/en/international-prospective-students/

Students from foreign Universities

Admission to the MSc Programme



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Requirements

- Laurea (BSc) degree or equivalent title obtained abroad by August 2021 (1st semester) or January 2022 (2nd semester)
- English proficiency certificate
- CV related conditions
 - Admission decided on a case-by-case basis by the admission committee, based on the resumé and the final mark of the BSc programme
- A description of the educational background needed to successfully attend the main subjects of the MSc programme is reported in the prerequisites document available at www.ccsatm.polimi.it/wp-content/uploads/2019/07/Prerequisites_Automation_Control_Engineering.pdf

Students from foreign Universities

MSc programme admission Committee



POLITECNICO
MILANO 1863

Prof. Paolo Bolzern

DEIB, building 20

tel: 02 2399 3598

e-mail: paolo.bolzern@polimi.it



Other members: Alan Facchinetti, Simone Formentin, Riccardo Scattolini

AUTOMATION AND CONTROL ENGINEERING



PROGRAMME ▾

STUDENTS ▾

BACHELOR DEGREE ▾

MASTER OF SCIENCE ▾

CAREERS ▾

www.ccsatm.polimi.it

Questions?



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Maria Prandini



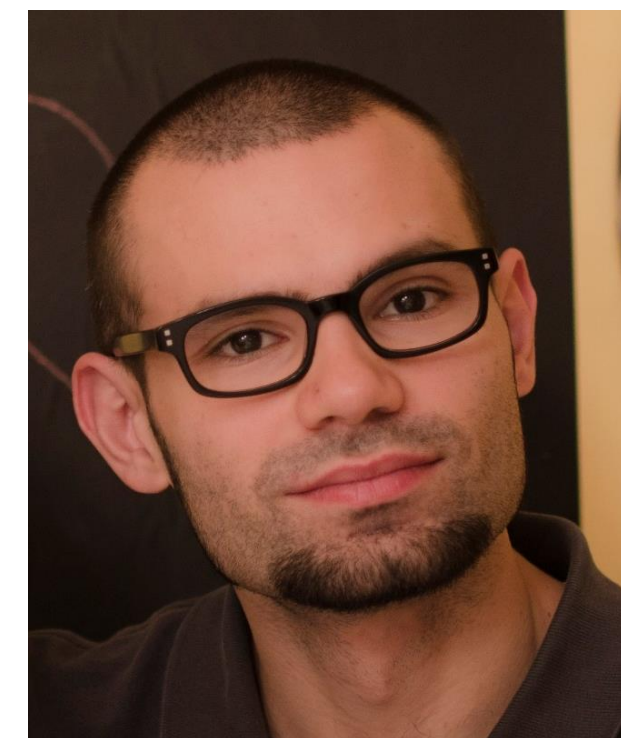
Alberto Leva



Paolo Bolzern



Luca Bascetta



Matteo Corno



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