



National Ph.D. Program in Autonomous Systems

<http://dausy.poliba.it>

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Full Professor in Automation

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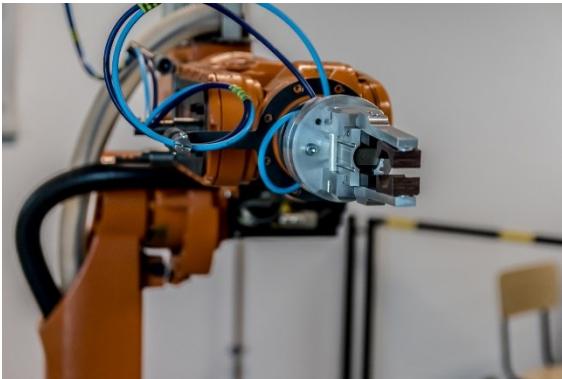
Coordinator of the National Ph.D. Program in Autonomous Systems

Outline

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Autonomous Systems

- Ongoing developments in Automation, Control Systems, Data Science, and Artificial Intelligence are expected to heavily influence the role of engineering in our society.
- One of the enabling technologies of the digital transition is **Autonomous Systems (AS)**, which are systems capable of automatically achieving a given goal without the intervention of a human operator.
- AS are capable of learning and independently performing decision-making tasks.
- AS are becoming the leading drive of technologies such as industry 4.0, autonomous vehicles, drones, smart grids, precision agriculture.



The DAUSY National Ph.D. Program

- The **Doctoral program (Ph.D.) in AUtonomous SYstems (DAUSY)** is a newly funded national program establishes a **doctoral school with critical mass and quality** to systematize the expertise on Autonomous Systems (AS) distributed in the country and involve **students from Italy and worldwide**.
- One of the enabling technologies of the digital transition is **AS, which are systems capable of automatically achieving a given goal without the intervention of a human operator.**
- The major focus will be on Automation Engineering, with its connections to Mechanics, Optimization, Communication Systems, Information Theory, Machine Learning, Computing, Mathematics, and Signal Processing.



General information on DAUSY

The National Ph.D. Program in Autonomous Systems DAUSY

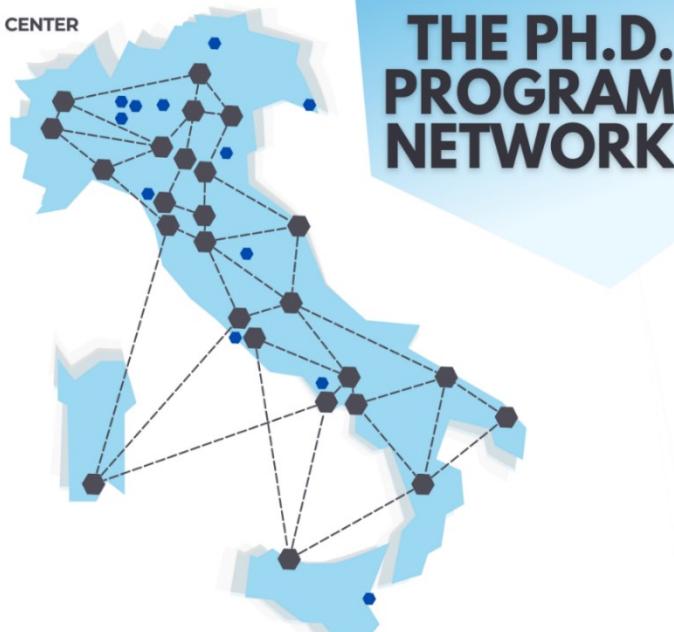
- Politecnico di Bari (Poliba) - administrative headquarters
- 25 participating institutions (24 universities and a national research center)
- 13 partner universities
- 46 Italian professors and researchers
- 22 foreign members of the Board of Professors

PARTICIPANT UNIVERSITIES AND RESEARCH CENTER

Politecnico di Bari (administrative headquarters)
Politecnico di Torino
Scuola IMT Alti Studi - Lucca
Università degli Studi del Sannio di Benevento
Università degli Studi della Campania "L. Vanvitelli"
Università degli Studi dell'Aquila
Università degli Studi di Bologna
Università degli Studi di Cagliari
Università degli Studi di Firenze
Università degli Studi di Genova
Università degli Studi di Modena e Reggio Emilia
Università degli Studi di Padova
Università degli Studi di Palermo
Università degli Studi di Parma
Università degli Studi di Roma "Tor Vergata"
Università degli Studi di Salerno
Università degli Studi di Siena
Università degli Studi di Trento
Università degli Studi di Verona
Università degli Studi Roma Tre
Università del Salento
Università della Calabria
Università di Pisa
Università Politecnica delle Marche
Consiglio Nazionale delle Ricerche

PARTNER UNIVERSITIES

Politecnico di Milano
Libera Università di Bolzano
Scuola Superiore Sant'Anna
Università degli Studi di Brescia
Università degli Studi di Catania
Università degli Studi di Ferrara
Università degli Studi di Milano-Bicocca
Università degli Studi di Napoli "Federico II"
Università degli Studi di Napoli "Parthenope"
Università degli Studi di Pavia
Università degli Studi di Perugia
Università degli Studi di Roma "La Sapienza"
Università degli Studi di Trieste



Program overview

Ph.D. in Autonomous Systems

3 years **full-time (in presence)**

24 universities, 1 research center

Nov. 1, 2022 – Oct. 31, 2025

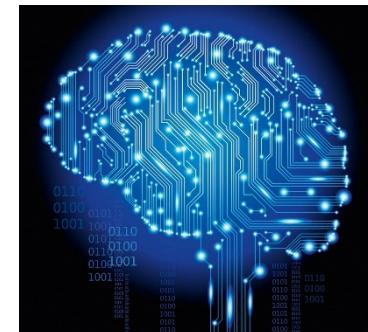
19 positions assigned

8 women (42%)

8 graduated abroad (42%)

Main research directions of DAUSY

- **Design and develop AS**, with applications to smart manufacturing, autonomous vehicles, smart grids, robotics, and many more engineering fields.
- **Develop smart control algorithms** (e.g., AI-enabled control, data-driven control, vision-based control) for smart AS environments such as smart cities, autonomous vehicles and mobile robots, smart grids, sustainable mobility systems, smart buildings, and smart homes.
- **Develop testing platforms** for emerging techniques to advance engineering AS applications (e.g., cyber-physical systems, digital twin techniques).
- **Design automated and high-performance industrial systems**, studying issues related to distributed control and supervision for systems composed of networks of sensors, actuators, and collaborative robots.
- Design and operation of **AS to guarantee their reliability and security**, ensuring their proper functioning even under uncertainty (robustness), monitoring and predicting failures, ensuring that confidentiality and privacy requirements are not violated, countering both physical and cyberattacks, and designing secure processes in environments where automated and human systems interact.

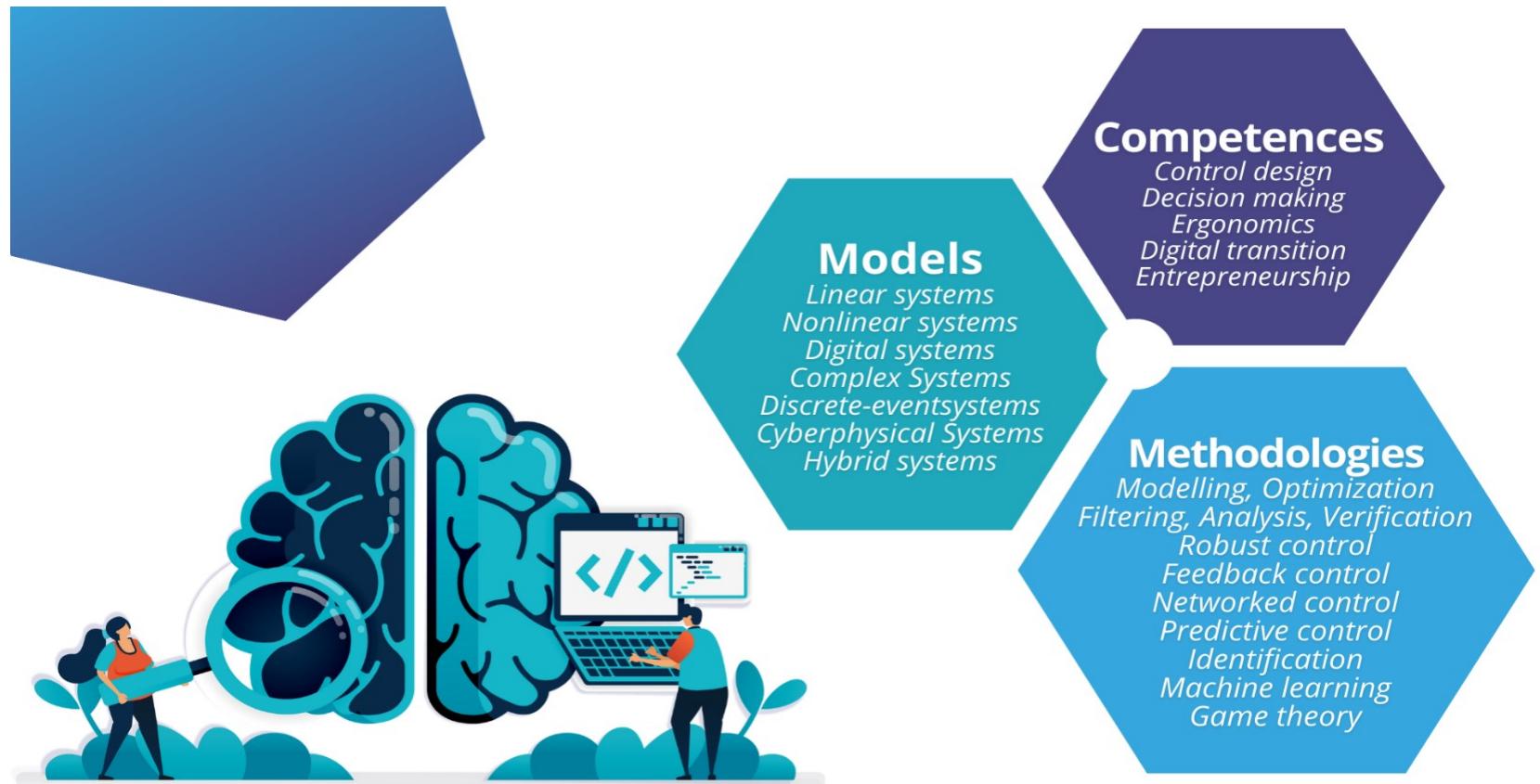


The Ph.D. is structured in 3 curricula that specifically address different topics and application areas and differ and complement each other in technological and methodological terms.



Curricula

The 3 curricula have as a common research base the cross-cutting methodologies and approaches that are foundational to systems engineering, such as modelling and control methodologies.



Coordinator

Prof. Mariagrazia Dotoli, Politecnico di Bari

mariagrazia.dotoli@poliba.it

<http://dclab.poliba.it/people/mariagrazia-dotoli/>



- Full Professor in Automatic Control at Politecnico di Bari
- Senior Editor of the IEEE TRANS. ON AUTOMATION SCIENCE AND ENGINEERING
- Associate Editor of the IEEE TRANS. ON SYSTEMS, MAN, AND CYBERNETICS.
- General chair of 2024 IEEE Conference on Automation Science and Engineering
- General chair 2021 29th Mediterranean Conference on Control and Automation
- Member of the International Program Committee of 80+ international conferences.
- Author of 270+ publications, h-index 42 in Google Scholar
- Expert evaluator of the European Commission since the 6th Framework Programme

C1 – AS for Automation

Curriculum Representative:

Prof. CAVALLO Alberto, Università degli Studi della Campania Luigi Vanvitelli

alberto.cavall@unicampania.it

<http://dausy.poliba.it/phd/people/>



C1 - AS for Automation

Industry 4.0

Collaborative robotics

Automation in manufacturing

Sensor-actuator networks

Simulation and optimization

Supervisory control

Sustainability and green automation

Name	Affiliation
ABENI Luca	Scuola Superiore Sant'Anna
ARIOLA Marco	Università degli Studi di Napoli Parthenope
BASILE Francesco	Università degli Studi di Salerno
CARLI Raffaele	Politecnico di Bari
COLANERI Patrizio	Politecnico di Milano
CONSOLINI Luca	Università degli Studi di Parma
DABBENE Fabrizio	Consiglio Nazionale delle Ricerche
DELLI PRISCOLI Francesco	Università degli Studi di Roma "La Sapienza"
D'IPPOLITO Filippo	Università degli Studi di Palermo
GALEANI Sergio	Università degli Studi di Roma "Tor Vergata"
GIUA Alessandro	Università degli Studi di Cagliari
LONGHI Sauro	Università Politecnica delle Marche
MANCINI Adriano	Università Politecnica delle Marche
MOCENNI Chiara	Università degli Studi di Siena
NOTARSTEFANO Giuseppe	Alma Mater Studiorum - Università di Bologna
PINAMONTI Andrea	Università degli Studi di Trento
VISIOLI Antonio	Università degli Studi di Brescia
ZACCARIAN Luca	Università degli Studi di Trento

C2 – AS for Smart Environments

Curriculum Representative:

Prof. GIARRÈ Laura, Università di Modena e Reggio Emilia

laura.giarre@unimore.it

<http://dausy.poliba.it/phd/people/>



C2 - AS for Smart Environments

*Autonomous vehicles
Cyberphysical system
Consensus
Distributed optimization
Formation control
Mobile robotics
Networked control
Smart cities
Smart grids*

Name	Affiliation
BEMPORAD Alberto	Scuola IMT Alti Studi Lucca
CALAFIORE Giuseppe Carlo	Politecnico di Torino
CASAVOLA Alessandro	Università della Calabria
DE LELLIS Pietro	Università degli Studi di Napoli Federico II
DOTOLI Mariagrazia	Politecnico di Bari
FALCONE Paolo	Università di Modena e Reggio Emilia
FERRARA Antonella	Università degli Studi di Pavia
FRASCA Mattia	Università degli Studi di Catania
PARLANGELI Gianfranco	Università del Salento
SACONE Simona	Università degli Studi di Genova
SCHENATO Luca	Università degli Studi di Padova
VALIGI Paolo	Università degli Studi di Perugia
VASCA Francesco	Università degli Studi del Sannio

C3 – AS for Monitoring and Security

Curriculum Representative:

Prof. PASCUCCI Federica, Università degli Studi Roma Tre

federica.pascucci@uniroma3.it

<http://dausy.poliba.it/phd/people/>



C3 - AS for Monitoring and Security

*Cyberattacks
Fault diagnosis
Fault prognosis
Brain-computer interaction
Human-robot interaction
Safety of processes
Opacity*

Name	Affiliation
BEVILACQUA Vitoantonio	Politecnico di Bari
CHISCI Luigi	Università degli Studi di Firenze
DI BENEDETTO Maria Domenica	Università degli Studi dell'Aquila
FIORINI Paolo	Università degli studi di Verona
FREDDI Alessandro	Università Politecnica delle Marche
PALUMBO Pasquale	Università degli Studi di Milano Bicocca
PARISINI Thomas	Università degli Studi di Trieste
PIRO Giuseppe	Politecnico di Bari
POLLINI Lorenzo	Università di Pisa
SACILE Roberto	Università degli Studi di Genova
SIMANI Silvio	Università Degli Studi Di Ferrara
VON ELLENRIEDER Karl Dietrich	Libera Università di Bolzano

Academic Board

The Ph.D. has an international scope, cooperating with numerous European and non-European universities

Foreign members of the board:

Name	Affiliation	Curricula
ASTOLFI Daniele	UNIVERSITÉ CLAUDE BERNARD LYON 1	C3. AS FOR MONITORING AND SECURITY
BAMIEH Bassam	UNIVERSITY OF CALIFORNIA SANTA BARBARA	C2. AS FOR SMART ENVIRONMENTS
BAUSO Dario	UNIVERSITY OF GRONINGEN	C1. AS FOR AUTOMATION
BULLO Francesco	UNIVERSITY OF CALIFORNIA SANTA BARBARA	C2. AS FOR SMART ENVIRONMENTS
DAHLEH Munther	MASSACHUSETTS INSTITUTE OF TECHNOLOGY	C1. AS FOR AUTOMATION
DESCUTTER Bart	DELFT UNIVERSITY OF TECHNOLOGY	C2. AS FOR SMART ENVIRONMENTS
DELLE MONACHE Maria Laura	UNIVERSITY OF CALIFORNIA BERKELEY	C2. AS FOR SMART ENVIRONMENTS
DEY Subhrakanti	UPPSALA UNIVERSITY	C2. AS FOR SMART ENVIRONMENTS
FRANCHI Antonio	UNIVERSITY OF TWENTE	C2. AS FOR SMART ENVIRONMENTS
GRAMMATICO Sergio	DELFT UNIVERSITY OF TECHNOLOGY	C2. AS FOR SMART ENVIRONMENTS
JOHANSSON Karl H.	ROYAL INSTITUTE OF TECHNOLOGY	C2. AS FOR SMART ENVIRONMENTS
MCLOONE Sean	QUEEN'S UNIVERSITY BELFAST	C1. AS FOR AUTOMATION
MORBIDI Fabio	UNIVERSITY OF PICARDIE JULES VERNE	C2. AS FOR SMART ENVIRONMENTS
PAPPAS George J.	UNIVERSITY OF PENNSYLVANIA	C2. AS FOR SMART ENVIRONMENTS
PORFIRI Maurizio	NYU TANDON SCHOOL OF ENGINEERING	C2. AS FOR SMART ENVIRONMENTS
QUEINNEC Isabelle	UNIVERSITÉ FÉDÉRALE TOULOUSE MIDI-PYRÉNÉES,	C1. AS FOR AUTOMATION
SASTRY Shankar	UNIVERSITY OF CALIFORNIA BERKELEY	C3. AS FOR MONITORING AND SECURITY
SERRANI Andrea	OHIO STATE UNIVERSITY	C3. AS FOR MONITORING AND SECURITY
SHORTEN Robert N.	IMPERIAL COLLEGE LONDON	C2. AS FOR SMART ENVIRONMENTS
STEFANOPOULOU Anna G.	UNIVERSITY OF MICHIGAN, ANN ARBOR	C1. AS FOR AUTOMATION
TARBOURIECH Sophie	UNIVERSITÉ FÉDÉRALE TOULOUSE MIDI-PYRÉNÉES	C1. AS FOR AUTOMATION
VALAVANIS Kimon P.	UNIVERSITY OF DENVER	C1. AS FOR AUTOMATION

Network of Collaborations

Companies and research centres that are co-financing or hosting Ph.D. scholarships

- **Public administrations**

- ARST – Trasporti Regionali della Sardegna S.p.A.
- ENEA - Smart Cities and Communities Laboratory
- IEIIT-CNR, Torino



Consiglio Nazionale
delle Ricerche

- **Companies**

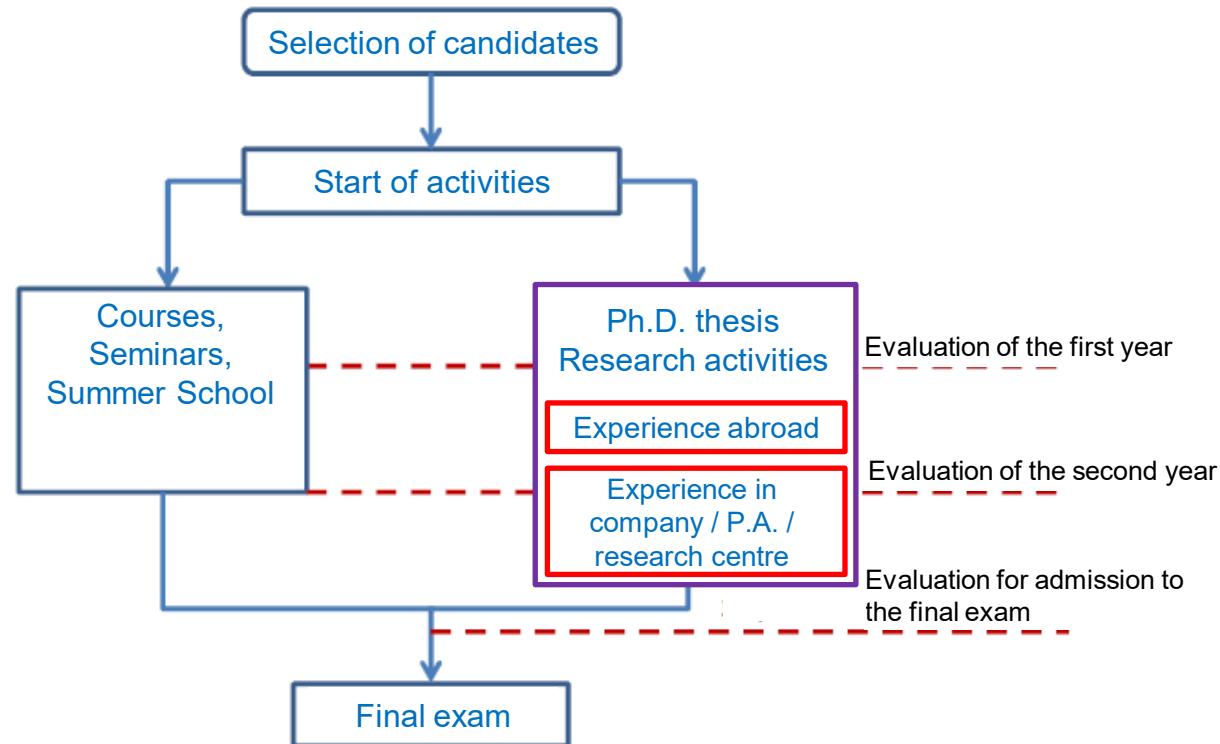
- COMAU
- BluHub
- GlaxoSmithKline S.p.A
- Thales Alenia Space Italia S.p.A.



Course Schedule

The course lasts 3 years-180 ECTS, including any period of study and research abroad and internships in public/ private institutions

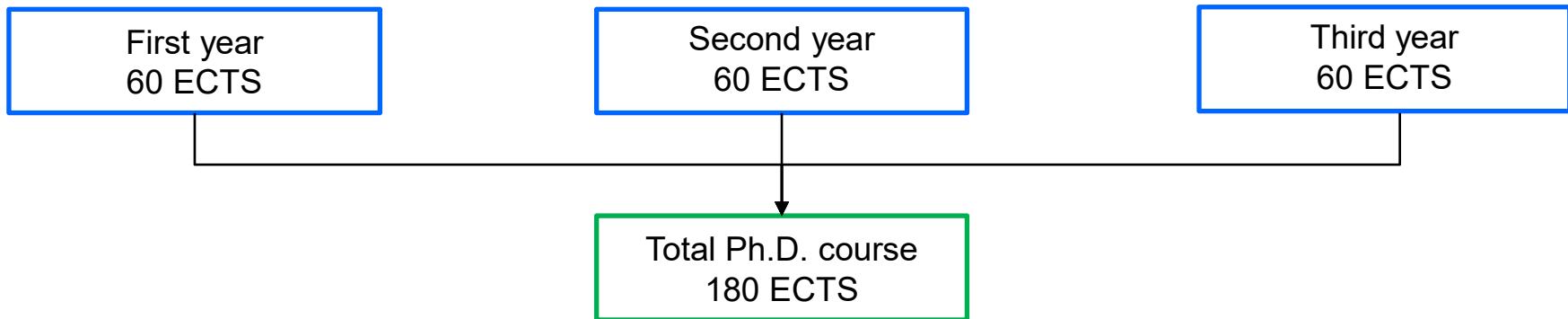
General planning of activities:



NOTE: MINIMUM REQUIREMENT FOR ADMISSION TO FINAL EXAM:

The Ph.D. student is co-author of 1 paper in an international journal or 2 papers in proceedings of international conferences indexed in Scopus or ISI/Web of Science

Activities Carried out by the Ph.D. Candidates



- The Ph.D. student is required to carry out activities for an amount of 60 ECTS per year, for a total of 180 ECTS throughout the academic course.
- At the beginning of the **first year**, the Academic Board requires a detailed plan of activities (**provisional plan**) of the three years.
- The Ph.D. student and the tutor(s) define the provisional plan and submit it to the approval of the Academic Board.
- A guide is available here http://dausy.poliba.it/phd/wp-content/uploads/Guida_PhD_DAUSY.pdf

Activities Carried out by the Ph.D. Candidates

The activities carried out by the Ph.D. student are divided into:

- **Didactic activities:** min 36 – max 60 ECTS (of the total 180 ECTS)
 - Courses
 - Attendance of institutional university courses in order to integrate basic knowledge;
 - Attendance of third level courses to acquire specific knowledge;
 - Ph.D. school courses;
 - Improvement of the knowledge of foreign languages;
 - Soft skills.
 - Participation at conferences, seminars, etc.
 - Participation at seminars, national and international conferences on topics of interest;
 - Contribution (poster, proceedings ...) to international congresses/workshops.
- **Research activity:** min 120 – max 144 ECTS (of the 180 total ECTS)
 - Activities with the supervision of the tutor
 - Training activities with the tutor.
 - Laboratory activities
 - Laboratory activities to acquire operative skills.
 - Research and individual study activities
 - Research and individual study activities on topics of interest.
 - Research activities abroad
 - Any possible internships abroad, as internships at companies, universities and institutions, to acquire specific technical skills.

XXXVIII cycle: starting Nov. 1st 2022, ending Oct. 31st 2025

19 positions were assigned:

- 16 different institutions
- 8 women, 42%
- 8 graduated abroad, 42%

XXXVIII cycle

Surname	Name	Institution	Tutor	Research topic
Akbari	Shima	<u>Università di Roma "Tor Vergata"</u>	Sergio Galeani; Laura Menini	Advanced control allocation techniques for large multi-agent systems and large sensors/actuators networks
Antonucci	Daniele	<u>Università di Parma</u>	Luca Consolini; Gianluigi Ferrari	Predictive maintenance, fault and anomaly detection for chemical and pharmaceutical processes
Askari Noghani	Saba	<u>Politecnico di Bari</u>	Mariagrazia Dotoli - Raffaele Carli	Smart control systems for rural energy communities
Bonagura	Valeria	<u>Università di Roma Tre</u>	Pascucci Federica - Panzieri Stefano	Model based security and monitoring system for resilient industrial control systems
De Paola	Pierluigi Francesco	<u>Consiglio Nazionale delle Ricerche</u>	Fabrizio Dabbene; Alessandro Borri	Advanced learning and control methods with life science applications
Di Girolamo Silvia		<u>Università di Palermo</u>	Filippo D'Ippolito; Antonino Sferlazza	Sensor network and data analysis to support decision and governance of complex systems
Gaetan	Elisa	<u>Università di Modena e Reggio Emilia</u>	Laura Giarre; Paolo Falcone	Exploiting Predictive capabilities in motion control for autonomous vehicles operating in crowded environments
Hameed	Alaa Ali Hameed	<u>Politecnico di Bari</u>	Dotoli Mariagrazia; Carli Raffaele	Decision and Control Techniques for Energy Management of Smart Cities
Li	Yike	<u>Università di Cagliari</u>	Alessandro Giua	Fault Diagnosis and Security in Smart Cities
Moshiri	Ali	<u>Università del Salento</u>	Gianfranco Parlangueli; Giuseppe Notarstefano	Model-based and data-driven learning and control of complex network systems
Perin	Marco	<u>Università di Padova</u>	Luca Schenato; Angelo Cenedese	Advanced modeling and control of complex systems
Prunella	Michela	<u>Politecnico di Bari</u>	Vitantonio Bevilacqua; Mariagrazia Dotoli; Domenico Buongiorno; Antonio Brunetti; Raffaele Carli	Decision and Control Techniques for Intelligent Diagnostic and Surgery Using Digital Twins
Sartoni	Matteo	<u>Università di Bologna</u>	Giuseppe Notarstefano; Andrea Pietropaolo; Carlo Ciancarelli	Artificial Intelligence and Control Tools for Cognitive Satellite SAR Systems
Scardigno	Roberto Maria	<u>Politecnico di Bari</u>	Vitantonio Bevilacqua; Mariagrazia Dotoli; Domenico Buongiorno, Raffaele Carli, Nicola Longo	Study, development and design of Intelligent Systems for automated diagnostics in the industrial and biomedical fields
Shaikh	Bushra	<u>Università dell'Aquila</u>	Elena De Santis; Mario Di Ferdinando	Control, coordination and monitoring of autonomous agents, with application to the agrifood field
Siyyal	Shafqat Ali	<u>Università Politecnica delle Marche</u>	Sauro Longhi; Alessandro Freddi; Francesco Ferracuti	Model-based design for increasing reliability and safety of autonomous systems
Taddei	Sebastiano	<u>Università di Trento</u>	Francesco Biral; Gastone Rosati Papini	Shared-control framework for smart human-vehicle cooperation in the context of autonomous and assisted driving
Tesso Woaflo	Paul Christian	<u>Università della Calabria</u>	Alessandro Casavola; Francesco Tedesco	Control Strategies for Energy Harvesting Systems
Vitanza	Eleonora	<u>Università di Siena</u>	Chiara Mocenni; Domenico Prattichizzo	Awareness in human-human and human-robot interactions

Teaching-course Catalogue

The course catalogue of the DAUSY Ph.D. program includes courses offered in international, national, and local doctoral schools, offering a unique educational network.

More information: <http://dausy.poliba.it/phd/teaching-course-catalogue/>

	Final Exam	Cost	Teaching mode
DAUSY Courses (11 scheduled courses)	Courses with a final examination	Free	Hybrid (online/in presence)
DAUSY Seminars (13 scheduled seminars)		Free	Hybrid (online/in presence)
SIDRA Summer School Courses	Courses with a (optional) final examination	Registration fee	In presence
EBCI International Graduate School in Control Courses	Courses with a (optional) final examination	Registration fee	In presence
Poliba Scudo Courses	Courses with a (optional) final examination	Free	
Partner Universities Courses	Courses with a (optional) final examination	Free	Hybrid (online/in presence)
Other Teaching Activities		Free	

DAUSY Courses and Seminars

- The DAUSY national Ph.D. program offers several courses and seminars focusing on specific topics of autonomous systems.
- The calendar of the 2022-2023 academic year is available at:
 - <http://dausy.poliba.it/phd/dausy-courses-seminars/>

Recent events:

- Industry 4.0 Fundamentals in Bosch Applications, 23 – 26 Jan. 2023

Courses with final examination

Title
+ Course 01: Analysis and control of cyber-physical systems
+ Course 02: Introduction to modeling, analysis and control of complex systems
+ Course 03: Modeling, filtering and controlling aerospace systems
+ Course 04: Stochastic approaches in Systems Biology
+ Course 05: Linear algebra for control applications
+ Course 06: Fault detection techniques in condition monitoring: model-based and data-driven methods
+ Course 07: Modeling and simulation of biological and medical systems
+ Course 08: Optimal control for Climate change and air quality
+ Course 09: Linear and nonlinear Kalman filtering: theory and applications
+ Course 10: Navigation systems for autonomous systems
+ Course 11: Duality-based decentralized and distributed optimization

Seminars

Title
+ Seminar 01: Introduction to dynamic control allocation
+ Seminar 02: Applied data-driven fault diagnosis
+ Seminar 03: Introduction to fault diagnosis and fault prognosis
+ Seminar 04: Virtual constraints for mechanical systems
+ Seminar 05: Safety vs security in risk based vehicle routing
+ Seminar 06: Network dynamics and control
+ Seminar 07: Hacking the control systems
+ Seminar 08: Learning influences in large scale dynamical social networks
+ Seminar 09: Opinion dynamics
+ Seminar 10: Sustainable exploitation of renewable energy sources
+ Seminar 11: Linear matrix inequalities in systems and control
+ Seminar 12: Complex Systems Modeling

More information

More practical information available at:

<http://dausy.poliba.it/phd/guidelines-regulations-and-forms/>

A practical guide in PDF:

http://dausy.poliba.it/phd/wp-content/uploads/Guida_PhD_DAUSY.pdf

Frequently asked questions:

<http://dausy.poliba.it/phd/faq/>

- **Teaching**
 - Establishing Double Degrees with other PhD courses at foreign universities
 - Extending the course catalogue of the Poliba PhD School
- **Research**
 - Monitoring of PhD students' results (publications/patents/software, etc.)
- **Internationalization**
 - Increasing collaborations with foreign universities
- **Technology Transfer**
 - Monitoring of placement of future PhDs
 - Consolidating collaborations with companies
- **Dissemination**
 - Promoting communication activities (e.g., course website, newsletter)
 - Participating in workshops and fairs





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