



PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 3 - Systems and Control

Number of scholarship offered	6
Department	DIPARTIMENTO DI ELETTRONICA, INFORMAZIONE E BIOINGEGNERIA

Description of the Research Area

The research Area Systems and Control of the PhD Programme in Information Technology at the Department of Electronics, Information and Bioengineering (DEIB) is devoted to Control Systems Science, Systems Theory, Ecology, and Operations Research. Despite the rich variety of topics, both theoretical and application-oriented, a unifying system level viewpoint is generally adopted, which enables the analysis, the management, and the design of complex systems through the powerful theoretical tools of mathematical modeling. A significant part of the basic and applied research activity, together with advanced teaching, is supported by the experimental facilities available in the laboratories. The section's research activities can be grouped in the following lines:

- **Control systems:** focused on Control design, Model identification and data analysis, Automation of vehicles and transportation systems, Automation of energy systems.
- **Dynamics of complex systems:** focused on Nonlinear dynamical systems, Bifurcation analysis, Emerging collective dynamics in networks of systems.
- **Operations research and discrete optimization:** focused on Mathematical programming, Combinatorial optimization, Stochastic programming, Robust optimization, Bi-level programming and Continuous approximation models.
- **Planning and management of environmental systems:** focused on Mathematical models for quantitative analysis, Computer-based decision support tools, Sustainable use of resources.
- **Robotics and industrial automation:** focused on Mechatronics, Robotics, Process modeling, simulation and control, Automation of manufacturing systems and industrial plants.

Further information:

- Research at the DEIB Department: <https://www.deib.polimi.it/eng/>
- PhD Programme in Information Technology (IT PhD): <https://dottoratoit.deib.polimi.it/>
- Systems and Control Section at DEIB: <https://www.deib.polimi.it/eng/systems-and-control>



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Research Area n. 3 - Systems and Control

INTERDISCIPLINARY Research Field: DEVELOPMENT OF A GUIDE ROBOT FOR THE VISUALLY IMPAIRED TO BE USED IN STRUCTURED ENVIRONMENTS AND FOR PHYSICAL TRAINING

Monthly net income of PhDscholarship (max 36 months)

€ 1250.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Interdisciplinary PhD Grant
The PhD research will be carried out in collaboration with research groups of the PhD programme in "**DESIGN**".
See <https://www.dottorato.polimi.it/?id=422&L=1> for further information.

The objective is to develop an autonomous guide robot prototype, designed according to the specific needs of blind and visually impaired people. This objective will also be made possible thanks to the development of wearable sensors capable of providing information, to the control system of the guide robot, relating to the patient's status. This technology aims at enabling a satisfactory life for the visually impaired and the elderly encouraging the use of public spaces without barriers and independently.
<https://www.deib.polimi.it/ita/progetti-di-ricerca/dettagli/431>

Methods and techniques that will be developed and used to carry out the research

The project calls for the development of a full navigation system stack (perception and localization, path planning and path tracking) capable of interacting with the guided person through a haptic (force sensing) smart tether and other wearables



Educational objectives	The PhD candidate will develop the engineering skills required to design the autonomous navigation stack (algorithm design and implementation) as well as the Human Machine Interface aspects related to the well being of the user.
Job opportunities	The successful completion of the PhD programme will prepare the candidate to work as a developer of autonomous navigation systems both for the service robotics and automotive industries.
Composition of the research group	1 Full Professors 2 Associated Professors 0 Assistant Professors 3 PhD Students
Name of the research directors	Matteo Corno, Giuseppe Andreoni, Marcello Farina

Contacts
http://www.tedh.polimi.it/ https://www.move.deib.polimi.it/ Prof Corno 02-2399-4037 Prof. Andreoni 02 2399 8881

Additional support - Financial aid per PhD student per year (gross amount)			
	1st year	2nd year	3rd year
Housing - Foreign Students	1500.0 € per student	1000.0 € per student	1000.0 € per student
	max number of financial aid available: 2, given in order of merit ..		
Housing - Out-of-town residents (more than 80Km out of Milano)	--		

Scholarship Increase for a period abroad	
Amount monthly	625.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
This programme is designed to closely interact with the ongoing Polisocial award BUDD-e (Blind-assistive aUtonomous Droid Device) https://www.deib.polimi.it/ita/progetti-di-ricerca/dettagli/431



LIST OF UNIVERSITIES, COMPANIES, AGENCIES AND/OR NATIONAL OR INTERNATIONAL INSTITUTIONS THAT ARE COOPERATING IN THE RESEARCH: Yape srl; Unione Italiana dei Ciechi e degli Ipovedenti (UICI) ONLUS-APS; Fondazione Istituto dei Ciechi di Milano (ICM); ASST Grande Ospedale Metropolitano Niguarda

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student

5.095,96 Euro per student

TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student)

There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY:

1st year: individual use

2nd year: individual use

3rd year: individual use

DESK AVAILABILITY:

1st year: individual use

2nd year: individual use

3rd year: individual use



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Research Area n. 3 - Systems and Control

OPEN SUBJECT Research Field: SYSTEMS AND CONTROL

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Context of the research activity

Motivation and objectives of the research in this field

The research in this area is devoted to Control Systems Science, Systems Theory, Ecology, and Operations Research. Despite the rich variety of topics, both theoretical and application-oriented, a unifying system level viewpoint is generally adopted, which enables the analysis, the management, and the design of complex systems through the powerful theoretical tools of mathematical modeling. A significant part of the basic and applied research activity, together with advanced teaching, is supported by the experimental facilities available in the laboratories. The section's research activities can be grouped in the following lines:

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- **Planning and management of environmental**



	<p>systems: focused on Mathematical models for quantitative analysis, Computer-based decision support tools, Sustainable use of resources.</p> <ul style="list-style-type: none"> • Robotics and industrial automation: focused on Mechatronics, Robotics, Process modeling, simulation and control, Automation of manufacturing systems and industrial plants. <p><i>More information can be found at</i> https://www.deib.polimi.it/eng/systems-and-control</p>
Methods and techniques that will be developed and used to carry out the research	<p>The research is carried out within a group under the guidance of a supervisor. Higher level courses are offered that foster an interdisciplinary approach to the research. Development of advanced models as well as laboratory activity are usually part of the workplan.</p>
Educational objectives	<p>The doctoral program offers advanced training in the research topics currently explored by the scientific community in academy and industry. A period of study in worldwide most recognized research institutions is supported by the doctoral school and the supervisor.</p> <p>http://dottoratoit.deib.polimi.it/</p>
Job opportunities	<p>The Ph.D. graduates have opportunities both in academy and industry. The intensive collaboration with industrial partners allowed several past PhD graduates to find a satisfactory job position in private companies. Job opportunities abroad are also frequently offered.</p>
Composition of the research group	<p>17 Full Professors 17 Associated Professors 11 Assistant Professors 56 PhD Students</p>
Name of the research directors	Any faculty member can act as research director

Contacts
<p>Prof. Sergio M. Savaresi Coordinator of the Systems and Control area E-mail: sergio.savaresi@polimi.it Phone: +39 02 2399 3545 Web: http://www.deib.polimi.it/eng/people/details/358496</p>



Prof. Lorenzo Mario Fagiano

Vice-coordinator of the Ph.D. IT Programme for the Systems and Control area

E-mail: lorenzo.fagiano@polimi.it

Phone: +39 02 2399 9609

Web: <https://www.deib.polimi.it/eng/people/details/1190542>

Prof. Luigi Piroddi

Coordinator of the Ph.D. IT Programme

E-mail: luigi.piroddi@polimi.it

Phone: +39 02 2399 3556

Web: <https://www.deib.polimi.it/eng/people/details/318548>

Additional support - Financial aid per PhD student per year (gross amount)			
Housing - Foreign Students	1st year	2nd year	3rd year
	1500.0 € per student	1000.0 € per student	1000.0 € per student
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TEACHING ASSISTANTSHIP: availability of funding in recognition of supporting teaching activities by the PhD student

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COMPUTER AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes



DESK AVAILABILITY:

1st year: Yes

2nd year: Yes

3rd year: Yes