POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 3 - Systems and Control

Number of scholarship offered	4
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

PARTENARIATO PNRR Research Field: OPTIMIZATION PROBLEMS IN SOFT AND ACTIVE MOBILITY

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	Active and soft mobility is assuming a particular importance in the field of sustainable mobility. This is attracting a great deal of investments at national and local level, as well as from private subjects. It has been proved that the investments in the field of active mobility are able to create value and employment, besides mitigating the air pollution and improving the health and wellness in the population.The availability of decision support tools that enables the administrators to plan the infrastructure (cycleways, multimodal hubs, charging stations?) become thus of utmost importance. (see the site of an EIT climate kick project: http://metropolidipaesaggio.it) In the framework of PNRR - CN-MS CENTRO NAZIONALE DELLA MOBILITA' SOSTENIBILE Avviso - D. D. 3138 del 12/16/2021 rettificato con D.D. 3175 del 18/12/2021 ?Avviso pubblico per presentazione Proposte di intervento per il Potenziamento di strutture di ricerca e creazione di ?campioni nazionali" di R&S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.4 ?Potenziamento strutture di ricerca e creazione di ?campioni nazionali di R&S? su alcune Key Enabling Technologies? finanziato dall'Unione europea -

	NextGenerationEU? CUP: D43C22001180001 DECRETO DI CONCESSIONE: D.D. 1033 del 17/06/2022
Methods and techniques that will be developed and used to carry out the research	The optimization literature is moving the first steps in this direction, but the area leaves much space to the innovation and the study of models and efficient algorithms that can consider the multiple interests of the involved stakeholders. The candidate will have to develop mathematical models, implement them in Python-MIP or other libraries and include them in a GIS tool, such as QGIS.
Educational objectives	The main objective is to build the knowledge of the candidate in the development of mathematical models for decision making, in particular applied in the planning of soft mobility infrastructures. The candidate will learn how to visualize the results in a suitable graphic interface.
Job opportunities	Besides the academic career in the field of transportation, optimization and civil engineering, the candidate will acquire the skill to work in local authorities technical offices (as for example mobility agencies) that are in charge of proposing solutions that foster soft and active mobility.
Composition of the research group	1 Full Professors 2 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Pietro Belotti, Prof. Federico Malucelli

Contacts
Professor Pietro Belotti pietro.belotti@polimi.it Professor Federico Malucelli federico.malucelli@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--

Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

The candidate will interact with the group of Prof. Paolo Pileri in the design of cycleways. This activity is part of the project MOST: Spoke 5 sustainable mobility.

List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:
1. University of Bergamo
2. University of Brescia
3. Ecole de Technologie Superieure, Monteral (Canada)

Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student per year:
1st year: max (1/3 * Column ?Budget dottorando?)
2nd year: max (1/3 * Column ?Budget dottorando?)
3rd year: max (1/3 * Column ?Budget dottorando?)

Teaching assistanship: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*

In the framework of PNRR - CN-MS CENTRO NAZIONALE DELLA MOBILITA' SOSTENIBILE Avviso - D. D. 3138 del 12/16/2021 rettificato con D.D. 3175 del 18/12/2021 ?Avviso pubblico per presentazione Proposte di intervento per il Potenziamento di strutture di ricerca e creazione di ?campioni nazionali" di R&S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.4

Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 Investimento 1.4
?Potenziamento strutture di ricerca e creazione di ?campioni nazionali di R&S? su alcune Key
Enabling Technologies? finanziato dall'Unione europea - NextGenerationEU?
CUP: D43C22001180001
DECRETO DI CONCESSIONE: D.D. 1033 del 17/06/2022

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PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 3 - Systems and Control

OPEN SUBJECT Research Field: SYSTEMS AND CONTROL

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
In case of a change of the welfare rates during the three-year period, the amount could be modified.

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: - **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

	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. *More information can be found at* *https://www.deib.polimi.it/eng/systems-and-control*
Methods and techniques that will be developed and used to carry out the research	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.
Educational objectives	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. http://dottoratoit.deib.polimi.it/
Job opportunities	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.
Composition of the research group	17 Full Professors 17 Associated Professors 11 Assistant Professors 56 PhD Students
Name of the research directors	Any faculty member can act as research director

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

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	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

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.
5.707,20 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: Yes
2nd year: Yes
3rd year: Yes