POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 40th cycle

Research Area n. 3 - Systems and Control

INTERDISCIPLINARY Research Field: ADVANCED METHODS FOR THE OPTIMAL MANAGEMENT OF THE ELECTRICAL GRID

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	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**ELECTRICAL ENGINEERING**". See https://www.dottorato.polimi.it/?id=422&L=1 for further information. The increasing penetration of distributed energy resources (DERs) and renewables and the structuring of the electrical grid into multiple microgrids enabling the provision of new smart grid services are calling for suitable strategies for their operation and integration in the electrical grid.The goal of this research activity is the development of optimization and data-based methods for the management of smart- and micro-grids with high penetration of renewables and electric vehicles, coping with complexity aspects such as the presence of uncertainty, the mixed continuous and discrete nature of the decision variables, the large scale multi-agent structure of the system. Achieving this goal is key to ensure access to affordable, reliable, sustainable and modern energy for all (SDG7).

Methods and techniques that will be developed and used to carry out the research	We shall develop a multidisciplinary approach to address the challenges posed to the electrical grid operation. To master the increased complexity of energy systems operation, classical techniques for their modeling, prediction, and control will be enhanced via optimization and data-based approaches for the operation of multi-agent systems possibly affected by uncertainty. Envisioned applications are the provision of ancillary services to the grid by the aggregation of multiple prosumers, the scheduling of the charging of a fleet of electric vehicles, and the energy management of a building district. The resulting optimal management and coordination problems will be formulated in terms of constrained optimization problems and suitable distributed and data-driven approaches will be developed for their solution, while formally providing performance guarantees. On-field testing and experimental assessment of the proposed approaches will be conducted in the interdisciplinary multi-good micro-grid laboratory (MG2Lab) at the Bovisa Campus.
Educational objectives	The doctoral program offers advanced training in the research topics related to the proposed PhD project that are currently explored by the scientific community in academy and industry. The experimental assessment phase will allow the PhD candidate to acquire skills on how to target the research to be actually adopted in practice.
Job opportunities	PhD graduates with expertise on the optimal operation of the large-scale uncertain engineering systems can find job opportunities both in Italy and abroad, given the worldwide relevance of these skills. This is particularly the case for what concerns applications to the energy sector.
Composition of the research group	2 Full Professors 0 Associated Professors 2 Assistant Professors 3 PhD Students
Name of the research directors	Prof. Maria Prandini, Prof. Marco Mussetta

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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

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

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

DESK AVAILABILITY:
1st year: Yes
2nd year: Yes
3rd year: Yes