



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

Research Area n. 3 - Systems and Control

THEMATIC Research Field: SIMULATION AND OPTIMIZATION OF GAS NETWORKS

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

A JRC between SNAM and PoliMi, active since 2020, is working towards establishing an integrated system for the simulation of the national gas network and its dynamic optimization to minimize emissions by the compression stations. Preliminary results have been achieved so far that demonstrate the feasibility of such objectives, but a number of research questions remain open, in particular regarding a) the set-up of effective receding horizon optimization policies, b) the reduction of the computational times for the optimization via suitable decomposition strategies, c) the operability of the system with real data in an actual industrial context, and d) the potential of optimal control on the network with the substitution of gas turbines with electrical motors as compressor drivers.

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

Efficient equation-based simulation techniques and tools for the network; MILP and NLP optimization models; application-oriented techniques and strategies to solve such problems by decomposition, to reduce computational times; receding-horizon MPC formulations for the network management problem; realization of a digital twin of the network fed by real-time operating data, including state estimation, data reconciliation and detection of missing measurement data;

Educational objectives

The PhD candidate will become an expert in the modelling



	of gas networks, in their simulation, and in the application of optimization techniques to their management, bridging the gap between modelling, control, and optimization theory and their effective use in a challenging industrial context.
Job opportunities	After completing the PhD programme, the candidate could be hired by companies managing gas networks or, more in general, by companies managing complex energy systems, or by consultancy companies offering services in these areas, with in-depth competences regarding the application of simulation and optimization techniques to the improvement of their operation.
Composition of the research group	0 Full Professors 2 Associated Professors 2 Assistant Professors 3 PhD Students
Name of the research directors	Prof. Francesco Casella, Prof. Emanuele Martelli

Contacts	
Prof. Francesco Casella (DEIB) Francesco.casella@polimi.it	
Prof. Emanuele Martelli (DENG) Emanuele.martelli@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
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.



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

Premiality

Premialities will be recognized to the PhD candidate.

Up to 3000 euros (gross amount) after the completion of the 1st year;

Up to 3000 euros (gross amount) after the completion of the 2nd year;

Up to 4000 euros (gross amount) after the completion of the 3rd year.

The premialities will be assigned provided that she/he demonstrates a significant contribution to the growth of scientific excellence, the industrial valorization of research, the networking and communication activities of the Department