



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

Research Area n. 3 - Systems and Control

**THEMATIC Research Field: ENERGY EFFICIENT MANAGEMENT FOR CONTROL AND
OPTIMIZATION OF RAILWAY SYSTEMS**

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**

Nowadays, trains are considered the most energy efficient means of transportation. Indeed, over the years, many strategies for energy savings of railroads and rail transit systems have been introduced relying on energy-efficient design of locomotives and traction units, apart from adequate maintenance of trains and tracks. However, the increasing need to address environmental concerns have made control methodologies instrumental for automated railway systems. In particular, apart from the train control oriented to eco-driving objective, energy management systems for all the auxiliary services inside the locomotives are mandatory. Auxiliary devices are indeed typically supplied by power converters, but the presence of advanced energy sources, such as batteries and fuel cells, makes the design of optimal control strategies promising both from the point of view of energy savings and from economical viewpoint, allowing the realization of more efficient, more robust and less expensive power networks.

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

The research will be carried out by using a subset of control techniques taken from switching control, model predictive control, sliding mode control, decentralized and distributed control, consensus.



Educational objectives	The research program offers advanced training in the topics related to dynamical systems, control and identification. The specific focus will be on railway applications and power systems in order to offer a strong preparation in these industrial fields.
Job opportunities	The PhD graduates have opportunities both in the university and in the industry. The intensive collaboration with industrial partners allows to find a satisfactory job position in industry. Job opportunities abroad are also frequently offered.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Gian Paolo Incremona

Contacts
<p>Prof. Gian Paolo Incremona, Associate Professor gianpaolo.incremona@polimi.it</p> <p>Prof. Alessio La Bella, Assistant Professor alessio.labella@polimi.it</p> <p>Prof. Patrizio Colaneri, Full Professor patrizio.colaneri@polimi.it</p>

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 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