



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

Research Area n. 3 - Systems and Control

**THEMATIC Research Field: DESIGN OF ADVANCED OPTIMAL CONTROL STRATEGIES  
FOR ENERGY-EFFICIENT OPERATIONS IN 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**

In our society, mobility and transportation are very relevant, and, in the last decades, automated vehicles have considerably grown. In this context, particular attention is devoted to the railway sector. Control of railway systems is indeed not only interesting for its sustainable impact on the environment, but highly motivating from the theoretical viewpoint. Controlling the exchange of power among trains connected to the same catenary grid, in order to recover braking energy and optimize the power consumption from the main grid, is indeed one of the main current challenges. Moreover, suitable eco-drive based strategies for trains collaborating among each other would provide positive consequences in terms of energy saving. Since all these trains are equipped with on-board devices, the presence of a networked layout spurs also towards new decentralized and distributed control architectures, aimed at optimizing the power allocation and guaranteeing benefits in terms of costs, flexibility and energy consumption.

**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.



<b>Educational objectives</b>	The research program offers advanced training in the topics related to dynamical systems, control and identification. The specific focus will be on railway applications in order to offer a strong preparation in this industrial field.
<b>Job opportunities</b>	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.
<b>Composition of the research group</b>	1 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students
<b>Name of the research directors</b>	Prof. Gian Paolo Incremona

<b>Contacts</b>	
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<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>	
<p><u>EDUCATIONAL ACTIVITIES</u> (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student.</p>	



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