



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

**THEMATIC Research Field: ACTIVE PANTOGRAPH AND NEW METHODOLOGIES FOR  
PANTOGRAPH LAB TESTING AND VALIDATION**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1500.0**

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**

Pantograph-catenary interaction is one of the limiting factors for interoperability among different countries and for the speed-up of railway systems. The introduction of active pantograph control is considered as a possible source of improvement, giving the possibility to improve/optimize the dynamic interaction in different operating conditions. On the other hand the field testing of existing or new pantograph (passive or active) is usually costly and time consuming, therefore there is a strong interest by manufacturers and railway operators to reduce the field tests and perform at least part of the pantograph acceptance and homologation to laboratory tests or simulation with validated.

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

The research will focus on the development of active solutions for the optimization of pantograph dynamics and of new methodologies for laboratory testing, for both active and passive pantograph. Numerical tools will be adopted for preliminary design and evaluation of the pantograph active system. An active pantograph prototype will then be realized and tested. Considering laboratory testing, both Hardware-in-the-Loop methodologies and identification/validation techniques based on imposed and fixed excitation will be developed and exploited.

**Educational objectives**

The candidate will acquire high-profile skills and will be



	<p>dealing with both theoretical and experimental methodologies.</p> <p>He/she will develop knowledge in the following areas:</p> <ul style="list-style-type: none"> <li>- analysis of complex dynamic systems with different methods and approach (numerical simulation, co-simulation of interacting virtual and physical components, experimental identification and validation)</li> <li>- analysis and optimisation of the performance of complex systems</li> <li>- technology and innovation in pantograph design and testing</li> </ul> <p>Finally, the candidate will gain the capability of working and cooperating in a multidisciplinary team.</p>
<p><b>Job opportunities</b></p>	<p>Job opportunities may be found as: pantograph manufacturers, rail vehicle manufacturers, rail transport operators, railway infrastructure managers.</p> <p>Employment statistics of PhDs can be found at: <a href="https://cm.careerservice.polimi.it/en/employment-statistics/">https://cm.careerservice.polimi.it/en/employment-statistics/</a>.</p> <p>The following Universities and companies will be cooperating in the research activity: University of Huddersfield, Universitat Politècnica de València, Contact, Hitachi Rail, Trenitalia, RFI.</p>
<p><b>Composition of the research group</b></p>	<p>2 Full Professors 2 Associated Professors 0 Assistant Professors 0 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>Prof. Alan Facchinetti</p>

<b>Contacts</b>
<p><i>Phone:</i> +39 02 2399 8450 <i>Email:</i> alan.facchinetti@polimi.it</p> <p>For further information/support, please contact phd-dmec@polimi.it.</p>

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

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Financial aid is available for all PhD candidates (purchase of study books and materials, funding for participation in courses, summer schools, workshops and conferences) for a total amount of euro 6.114,50.</p> <p>Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 750 euro/month- net amount).</p> <p>Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. 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.</p>