



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 2 - Sustainable Mobility

Number of scholarship offered	4
Department	DIPARTIMENTO DI MECCANICA

Description of the Research Area
<p>In order to address the societal challenges defined by EU and referring to CO2 emission, energy efficiency, noise pollution, zero accidents and renewable energy, a wide range of solutions need being studied and developed, which are applicable to the design, integration of design and manufacturing, testing and monitoring of transport systems, vehicles and infrastructures.</p> <p>This research area encompasses a wide range of applications related to road, rail, air and waterborne transport modes. The main topics related to this area are systems and components design, vehicle dynamics and control, vehicle-infrastructure dynamic interaction, vehicle aerodynamics and vibroacoustics, active, passive and preventive safety, intelligent transport systems, diagnostics and prognostics, new and advanced propulsion systems, energy harvesting solutions and innovative charging methods for ground and maritime applications.</p> <p>There are 4 available scholarships in this area:</p> <ul style="list-style-type: none"> - 1 generic - 3 thematic (to be specifically selected during application procedure) <p>The generic scholarship available refers to the following theme:</p> <ul style="list-style-type: none"> - Railways and automotive <p>3 thematic scholarships, on the following topics:</p> <ul style="list-style-type: none"> - Experimental data, driving simulator, digital twins for automotive product design - Reduction of vibration and noise emissions of an electric axle for a high-performance vehicle - Optimal Routing and Rebalancing of Mobility-on-Demand Systems in Mixed Traffic <p>Applicants should select thematic scholarships following the instructions provided in the call for application/application procedure.</p> <p>The PhD scholarships available in this area are partially funded with the support of the Italian Ministry of Education, University and Research, through the project Department of Excellence LIS4.0 (Integrated Laboratory for Lightweight e Smart Structures).</p>



Further information on the thesis topics available in this can be found at the following link: <https://www.mecc.polimi.it/us/phd/admission/>



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OPEN SUBJECT Research Field: RAILWAYS AND AUTOMOTIVE

Monthly net income of PhDscholarship (max 36 months)

€ 1325.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Railway and automotive fields are experiencing a revolution over the last years. Although railways are among the safest means to move passengers and freights over a wide range of distances, a continuing improvement of safety measures is sought after, so to further reduce the occurrence of failures and accidents. At present, research activities, being carried out in this field at the Department of Mechanical Engineering, encompass the following areas: 1) new methods for health monitoring and fault detection applied to both rolling stock (bogies, suspension components, axles and wheelsets) and infrastructure (track, overhead equipment); 2) mechatronic solutions for railway vehicle suspensions; 3) mathematical modelling of train-track interaction in the high frequency range and rolling noise; 4) numerical methodologies to model the emission and propagation of aerodynamic noise; 5) train aerodynamics; 6) monitoring systems to detect derailment risk/occurrence and limit derailment consequences; 7) mechatronic solutions for pantograph. On the other hand, the automotive field is facing new challenges related to the increasing environmental concerns and the introduction of vehicle with increasing level of automation. Thus, research is focused on advanced HEV (Hybrid Electric Vehicles) or FEV (Full Electric Vehicles) architectures as well as on innovative control strategies.



	<p>Possible research topics in this area are:</p> <ul style="list-style-type: none"> • vehicle dynamics and control (including modelling, testing, virtual sensing, parameter identification) • vehicle aerodynamics • ride and acoustic comfort (NVH) • tyre dynamics, tyre-road contact and tyre noise (modelling and indoor/outdoor testing) • V2V, V2I and I2V communication systems • hybrid and fully electric architectures (including innovative charging solutions and high efficiency powertrains) • advanced control logics for autonomous and/or connected road vehicles • vehicle-infrastructure interaction • virtual reality simulators and human-in-the-loop simulations • motorbike dynamics modelling and testing
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The PhD candidate's activity will deal with the numerical modelling the control logics and the experimental testing both in labs and/or on the field to validate the simulation models and to measure the parameters required in the numerical simulations. Remarkable research labs are described in Departmental laboratories, wind tunnel and drive simulator.</p>
<p>Educational objectives</p>	<p>We provide doctoral candidates with high-level scientific training, fostering and refining research and problem-solving abilities by focusing on both theoretical and experimental skills. A PhD in Mechanical Engineering will be able to layout, draft and carry on original research, by leading a research group or working in a team.</p>
<p>Job opportunities</p>	<p>National and international academic and non-academic institutions and organizations, engaged in innovation research and technical development; high-tech SMEs, government departments. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to</p>



	Master of Science holders in the same field.
Composition of the research group	13 Full Professors 13 Associated Professors 12 Assistant Professors 50 PhD Students
Name of the research directors	Prof. Marco Francesco Boccione, Roberto Corradi

Contacts	
<p>Prof. Marco Francesco Boccione (marco.boccione@polimi.it) Prof. Marco Belloli (marco.belloli@polimi.it) Prof. Stefano Bruni (stefano.bruni@polimi.it) Prof. Andrea Collina (andrea.collina@polimi.it) Prof. Federico Cheli (federico.cheli@polimi.it) Prof. Francesco Braghin (francesco.braghin@polimi.it) Prof. Edoardo Sabbioni (edoardo.sabbioni@polimi.it) Prof. Roberto Corradi (roberto.corradi@polimi.it) Prof. Daniele Rocchi (daniele.rocchi@polimi.it) Prof. Alberto Zasso (alberto.zasso@polimi.it)</p> <p>For further information visit: www.mecc.polimi.it http://www.mecc.polimi.it/ricerca/sezioni/meccanica-dei-sistemi/ or contact phd-dmec@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	662.5 €
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 5401, 42.</p> <p>Accommodation in Politecnico's Residences (http://www.residenze.polimi.it) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application). 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</p>



the Supervisor.

An increase in the scholarship will be applied for periods up to 6 months (approx. 660 euro/month - net amount).

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.