



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 2 - Sustainable Mobility

PNRR_352 Research Field: TRAIN AERODYNAMICS, ANALYSIS OF THE AERODYNAMIC INTERACTION BETWEEN TRAIN AND TUNNELS TO OPTIMIZE THE DESIGN

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	<p>The design of the train structure and of its components must consider the aerodynamic loads produced by train-tunnel intersection and train-train crossings both in open air and in tunnel. Simulations are required to take into account of the issues such as the overpressure dependence on how trains cross together (trains speed, time delay, open air/tunnel) and on the different tunnel characteristics along the line. In addition, for the computation of the aerodynamic loads that depend on the differential pressure, the internal pressure has to be computed starting from the external one considering specific models for sealed and unsealed trains. Aim of this research is to develop and validate a code able to simulate the crossings of trains within a tunnel in order to estimate both the external and internal pressures. The idea is to start from the analysis of experimental data recorded both on-board and at trackside in order to develop proper models able to reproduce the pressure evolution along the tunnel and within the trains. The developed code will be tested for different railway lines and trains so that it can become a useful support for the design stage of new trains in order to increase safety and performance one hand and reduce costs and weight on the other.</p>



<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The PhD candidate will identify the right models to reproduce the evolution of the pressure waves when one or more trains cross a tunnel. An initial analysis of the system and of all its components will be performed starting from experimental data already available or to be obtained through ad-hoc designed tests. In the next phase, the PhD candidate will develop a numerical code and a proper algorithm to estimate the pressure loads acting on the chassis of a train. Finally, the reliability of the results will be tested considering the actual trains running in different railway lines in order to solidly tests the code in different configurations varying all the parameters that affect the phenomenon (train speed, length and type, tunnel length, section and friction).</p>
<p>Educational objectives</p>	<p>The PhD candidate will be working in one of the most challenging research fields of railway aerodynamics. The PhD candidate will become an expert in advanced modelling belonging to different fields of engineering. The candidate is supposed to provide original contributions to the development and verification of numerical and experimental tools for simulating the evolution of the pressure within a tunnel and a train. The relationships established with international experts in this field will enable the candidate to develop the capability to cooperate within an international high level research team.</p>
<p>Job opportunities</p>	<p>Future job opportunities are primarily in the vehicle aerodynamics field, including railway companies or automotive industry, engineering companies, operators and infrastructure managers. In a more general way, the competence acquired will indisputably be of interest for R&D departments of companies dealing with issues related to flow-infrastructure/vehicle interactions. Besides this, job opportunities will be with national and international academic and non-academic institutions and organizations, engaged in innovation, research and technical development. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared Master of Science holders in the same field.</p>



Composition of the research group	1 Full Professors 1 Associated Professors 2 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Daniele Rocchi, Ing. Claudio Somaschini

Contacts	
<i>Phone:</i> +39 02 2399 8458 <i>E-mail:</i> daniele.rocchi@polimi.it	
phd-dmec@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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Hitachi Rail STS S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Hitachi Rail STS UK Ltd
By number of months abroad	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 5.707, 13.</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>	