



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**PNRR 117 Research Field: A METHODOLOGY FOR CORRELATING TYRE GRIP IN INDOOR
AND OUTDOOR TESTS**

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	
<p>Motivation and objectives of the research in this field</p>	<p>One of the main targets of the Italian PNRR is the transition towards greener and more sustainable practices (Mission 2). The automotive industry embraced this paradigm, constantly trying to reduce polluting emissions. For what tyres is concerned, the challenge is to reduce wear particles and rolling resistance (which reduces fuel/energy efficiency), whilst maintaining high performance in terms of grip, which is essential to guarantee good vehicle handling properties and safety during emergency manoeuvres. It is clear that procedures able to correlate the results of indoor tests on the new compounds with the performance the tyre would have outdoor could significantly accelerate the process of designing greener tyres. The proposed research falls within these scopes. In fact, the identification of tyre model parameters is usually carried out through indoor tests. Although indoor tests provide a good representation of tyre behaviour on outdoor surfaces in most of the cases, there still exist differences between indoor and outdoor test results in particular manoeuvres. The aim of the present project is to study the parameters most affecting the differences between indoor and outdoor tests (road surface roughness, temperature, etc.) for what concerns tire grip. To achieve this target, indoor/outdoor tests involving different tyres will be analysed to characterize friction models able to account for tyre compound/structure characteristics, road surface properties (e.g. surface roughness) and environmental</p>



	<p>conditions (e.g. temperature). This will allow the development of correlation methodologies to scale the indoor data to outdoor ones.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research will be carried out in cooperation with Pirelli Tyre S.p.A. The project involves a critical review of the friction laws/models and of the indoor/outdoor testing methodologies for evaluating tire-road maximum friction (or grip). The data collected during indoor/outdoor tests will be used to identify the parameters, which affect the most tire grip (roughness of the surface, temperature, sliding speed, etc.). This analysis will allow to characterize the friction models and to define their range of applicability for scaling the indoor test results to outdoor tests. The activity will be carried out in part at the Department of Mechanical Engineering of Politecnico di Milano and in part at Pirelli Tyre S.p.A.</p>
<p>Educational objectives</p>	<p>Combine and master different modelling techniques Develop competences on innovative components Multi-disciplinary competencies Methodological competences at both the theoretical and applied level Problem setting and solving capabilities Develop team-working attitude</p>
<p>Job opportunities</p>	<p>Future job opportunities include:</p> <ul style="list-style-type: none"> •Automotive industry •Tyre manufacturers •Vehicles manufacturers •Test benches manufacturers <p>Besides this, job opportunities comprise national and international academic and non-academic institutions and organizations, engaged in innovation, research and technical development.</p> <p>Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared to Master of Science holders in the same field.</p>



Composition of the research group	2 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Sabbioni, Melzi, Vignati

Contacts	
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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)	Pirelli Tyre 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)	Pirelli Deutschland GmbH (or) RWTH Aachen
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>	