



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

PNRR 117 Research Field: DEVELOPMENT OF A METHODOLOGY FOR EVALUATING TYRE WEAR THROUGH INDOOR 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	
Motivation and objectives of the research in this field	<p>One of the main purposes of the Italian plan for recovery and resilience (PNRR) is the reduction of particulate emissions in order to reach the target of a greener and more sustainable mobility (PNRR Mission 2). It is clear that, under this point of view, considering the electric transition of the automotive industry, the reduction of tyre-wear particles is gaining more and more attention. In order to enhance the design of tyres from a wear-particle perspective, the development of an indoor procedure for assessing tyre wear plays a crucial role. At present, in fact, tyre wear is still mainly assessed by means of expensive, time-consuming and polluting outdoor tests on ordinary roads. The main concern with these tests is the low reactivity of the results due to the uncontrollable environmental conditions (temperature, traffic, road conditions, considered vehicles, etc.). These issues can be addressed by indoor tests, but several challenges must be faced to replicate on a testing machine the same wear rate the tyre would experience on a real road, namely the definition of proper load cycles (tyre forces), the identification of tyre operating conditions (camber, slip angle, slip ratio, etc.), machine operating parameters (testing surface roughness, additive, etc.). To this aim, the research program will analyse the outcomes of on-road tests presently used to evaluate wear. Both statistical and energy methods (which require using a vehicle model) will be used on the purpose. This will allow the identification of the load cycles to give as an input to the indoor testing</p>



	<p>machine taking into account the influence of the vehicle model and of the indoor test parameters. The final goal is the optimization of the load cycles so to perform accelerated wear tests. This will allow a significant push in achieving a greener and more sustainable design of tyres.</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 research will involve:</p> <ul style="list-style-type: none"> • Statistical methods to cluster the outdoor tracks from tyre-wear point of view • Fusion of statistical and energy methods based on vehicle models to identify the load cycle to give as input to the indoor test machine so to reproduce a wear rate similar to the one measured during on-road tests • Advanced data-processing tools for analysing the experimental data and correlating indoor and outdoor test results • Optimization techniques for accelerating the tests <p>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>Possible job opportunities might be found as tyre manufacturers, vehicles manufacturers, test benches manufacturers, developers for predictive maintenance systems.</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 0 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Edoardo Sabbioni, prof. Stefano Melzi

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>