



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**PNRR 118 INTERDISC Research Field: 5G-ADVANCED TECHNOLOGIES FOR AUTONOMOUS AND SUSTAINABLE DRIVING**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>One of the main objectives of the Italian plan for recovery and resilience (PNRR) is the development of a digital and modern infrastructure supporting a more sustainable and connected mobility (PNRR-Mission 3). To achieve this purpose, it is essential sensorizing the most critical infrastructure elements (such as blind crossroads, roundabouts, etc.) and establishing a real-time exchange of data between vehicles, infrastructure and other connected road users. This would be extremely beneficial for a more efficient managing and coordination of the road-users movements and for increasing safety.</p> <p>Specifically, the proposed research project focuses on V2X(vehicle-to-everything) communications. V2X in fact allows the real-time exchange of data between vehicles, infrastructure and other road users (pedestrians, cyclists, etc.), enabling cooperative systems for automated driving. These systems, fusing in real-time the information provided by sensors (GPS, cameras, lidars, radars) distributed among infrastructure and road users will allow to improve the decision process for automated driving (which currently rely only on the data provided by sensors placed on-board vehicle), since they are expected to enhance:</p> <ul style="list-style-type: none"> <li>- the perception of the environment and localization accuracy;</li> <li>- the coordination between the road users.</li> </ul> <p>Within this framework, the research will focus specifically</p>



	<p>on the following aspects:</p> <ul style="list-style-type: none"> <li>- the development of new-generation V2X technologies (5G-advanced cellular V2X), enabling cooperative perception systems, thanks to the low-latency and the high-transmission-rate capability;</li> <li>- the integration of the cooperative perception system into the control strategies of vehicle with high automation level.</li> </ul>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research project will investigate both from a numerical and an experimental point of view cooperative systems for supporting autonomous and remote driving based on V2X communication and enabled by 5G-advanced technology. The research will involve:</p> <ul style="list-style-type: none"> <li>- the study and the modelling of 5G-V2X solutions able to fuse in real-time the data provided sensors placed on vehicles and infrastructure;</li> <li>- the integration of the abovementioned solutions into the control strategies of the vehicle in order to evaluate their influence on the existing systems for driver assistance and remote/autonomous driving and new functionalities enabled by the developed cooperative perception systems;</li> <li>- the analysis of the communication system performance (in terms of latency, data transmission rate and packet loss probability) on the performance of the vehicle control systems.</li> </ul> <p>Experimental tests will be carried out using the autonomous vehicles developed at the Department of Mechanical Engineering of Politecnico di Milano.</p>
<p><b>Educational objectives</b></p>	<p>The PhD candidate will:</p> <ul style="list-style-type: none"> <li>- develop competences on innovative components;</li> <li>- multi-disciplinary competencies;</li> <li>- methodological competences at both the theoretical and applied level;</li> <li>- problem setting and solving capabilities;</li> <li>- develop team-working attitude.</li> </ul>
<p><b>Job opportunities</b></p>	<p>Future job opportunities include automotive industry and in particular:</p> <ul style="list-style-type: none"> <li>- Connected driving/mobility;</li> </ul>



	<ul style="list-style-type: none"> <li>- Autonomous driving;</li> <li>- Traffic management;</li> <li>- IoT solutions;</li> <li>- Localization systems.</li> </ul> <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>
<b>Composition of the research group</b>	1 Full Professors 1 Associated Professors 2 Assistant Professors 0 PhD Students
<b>Name of the research directors</b>	Prof. Edoardo Sabbioni, Prof. Monica Nicoli

<b>Contacts</b>
<p><i>Phone:</i>+39-02-2399-8417 <i>Email:</i> edoardo.sabbioni@polimi.it</p> <p>For questions on scholarship/support, please contact phd-dmec@polimi.it.</p>

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	700.0 €
<b>By number of months</b>	6

<b>National Operational Program for Research and Innovation</b>	
<b>Company where the candidate will attend the stage (name and brief description)</b>	
<b>By number of months at the company</b>	0
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	Delft University of Technology - Universidad Carlos III de Madrid - TU Dresden
<b>By number of months abroad</b>	6



**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

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.

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.