



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

## PARTENARIATO PNRR Research Field: UNMANNED VEHICLES FOR AGRICULTURAL APPLICATIONS

### 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

Automation plays a crucial role in the agricultural sector, revolutionizing traditional farming practices. It offers numerous benefits, enhancing efficiency, productivity, and sustainability. Automated systems streamline tasks such as planting, irrigation, and harvesting, reducing manual labor and costs. This technology enables precise control over processes, optimizing resource utilization and minimizing waste. Furthermore, automation facilitates the adoption of innovative techniques like vertical farming and hydroponics, enabling year-round production and mitigating environmental impact. The research objective is to develop autonomous guidance systems for agricultural applications, addressing the challenges unique to this field. The primary focus lies in tackling the complex environment interaction, which differs from that of a typical road vehicles. Vehicle dynamics and sensor measurements are heavily influenced by the terrain, necessitating specific control systems that account for mechanical and geometric constraints of the involved vehicles. Additionally, the research will explore various agricultural applications that differ in their processing objectives and the different modes of interaction with the environment and human operators. The aim is to overcome these obstacles and create robust autonomous systems tailored to the agricultural setting.

The research activity is financed and developed within the Sustainable Mobility Center (*Centro Nazionale per la*



	<p><i>Mobilità Sostenibile - CN - MS) - Spoke 6 (Connected and autonomous vehicle - Guida autonoma e veicolo connesso) CN00000023, as part of the National Plan for Recovery and Resilience (PNRR, M4 C2 Dalla Ricerca all'impresa, Investimento 1.4), finanziato dall'Unione Europea - Next GenerationEU.</i></p> <p>Norms of reference: CUP D43C22001180001 - D.D. 1033 del 17/06/2022;</p> <p>D. D. 3138 del 16/12/2021 rettificato con D.D. 3175 del 18/12/2021 Avviso pubblico per presentazione Proposte di intervento per il Potenziamento di strutture di ricerca e creazione di "campioni nazionali" di R&amp;S su alcune Key Enabling Technologies da finanziare nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4, Componente 2, Investimento 1.4 "Potenziamento strutture di ricerca e creazione di "campioni nazionali di R&amp;S" su alcune Key Enabling Technologies" finanziato dall'Unione Europea - Next GenerationEU.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research will be carried firstly in simulation (using specific simulation software) and part of the developed algorithms will be verified and evaluated by means of experimental campaigns. Data analysis from sensors will be performed both for state estimation and for environment reconstruction by means of sensor fusion and ML techniques. Optimal control techniques as well as data driven approaches will be evaluated. Matlab/Python/C++ will be considered in the development of the different algorithms.</p>
<p><b>Educational objectives</b></p>	<p>The PhD student will gain and interdisciplinary knowledge of technologies and processes related to autonomous vehicles: from vehicle dynamics, to control in presence of significant delays, and to communication protocols.</p>
<p><b>Job opportunities</b></p>	<p>Skills and competences in the field are extremely interesting for all the companies involved in automotive industry. 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</p>



	holders in the same field.
<b>Composition of the research group</b>	1 Full Professors 0 Associated Professors 0 Assistant Professors 0 PhD Students
<b>Name of the research directors</b>	Prof. Francesco Braghin

<b>Contacts</b>	
<p>The research project will be carried out in the Department of Mechanical Engineering, Politecnico di Milano.</p> <p><i>E-mail:</i> francesco.braghin@polimi.it</p> <p>For questions about 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>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<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>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 the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month- net amount).</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>