



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

PNRR 630 Research Field: ELECTRIC MOTORS DESIGN FOR NVH

Monthly net income of PhDscholarship (max 36 months)
€ 1500.0
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>Recent progress in the area of electric machines for automotive applications, including new materials, new manufacturing technologies, new power electronics and new conceptual topologies, require a systematic design approach to ensure adequate performance and/or reduced cost for new products. A multidisciplinary approach is needed. The design conflict between electromagnetic, thermal, mechanical, and even manufacturing requirements has to be managed. With reference to DM 352 (9-4-2022), the PhD researcher objectives will address Missions #1 and #2 of the National Plan for Restart and Resilience - PNRR (Piano Nazionale Ripresa e Resilienza) Mission #1 of PNRR focuses on digital transition, competitiveness of productive chains. The PhD researcher will aim at developing digital twins to evaluate the performance of electric motors for high-performance road vehicles. Mission #2 of PNRR focuses on Renewable Energy, Hydrogen, Grid and Sustainable Mobility.</p> <p>The PhD researcher will aim at developing electric motors with main focus on efficiency and comfort (NVH).</p>
Methods and techniques that will be developed and used to carry out the research	<p>The study will put special focus on the NVH behaviour of the electric motor. Numerical approaches like finite element method and finite difference method will be applied to evaluate the behaviour of electric motors in various conditions. Some recent AI techniques, like deep learning approaches, will be employed in optimisation as global approximation tools. Experimental tests will be</p>



	performed for models validation.
<p>Educational objectives</p>	<p>The Ph.D. candidate will be trained on advanced methods for the design and testing of automotive electric motors. The candidate will learn how to deal with complex design problems, how to define specific KPIs and to properly evaluate them after testing.</p> <p>Hard skills:</p> <ul style="list-style-type: none"> •computational mechanics •experimental mechanics <p>Soft skills:</p> <ul style="list-style-type: none"> •team leadership, problem solving, dissemination, communication and outreach activities, networking, research fund procurement and management. He/she will learn to manage research as well as to coordinate small research groups. Soft skills like dissemination, communication and outreach management will be taught during the PhD course.
<p>Job opportunities</p>	<p>Car manufacturers, Tier 1 suppliers, structures/organizations aimed at innovation and/or research and technical development, high-tech SMEs. 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> <p>Employment statistics of PhDs can be found at: https://cm.careerservice.polimi.it/en/employment-statistics/.</p> <p>List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research include: Cranfield University; University of Michigan.</p>
<p>Composition of the research group</p>	<p>2 Full Professors 2 Associated Professors 2 Assistant Professors</p>



	10 PhD Students
Name of the research directors	Proff. Massimiliano Gobbi, Giampiero Mastinu

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	750.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Ferrari S.p.A.
By number of months at the company	9
Institution or company where the candidate will spend the period abroad (name and brief description)	Siemens LMS R&D, Leuven
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 6.114, 50. 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>	