



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

**THEMATIC Research Field: ADVANCED MODELLING AND TESTING OF MATERIALS AND
STRUCTURES FOR MACHINE DESIGN**

Monthly net income of PhDscholarship (max 36 months)

€ 1325.0

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**

Working in the Machine and vehicle design group requires motivation in developing experimental and computational methods for the assessment of the structural integrity and advanced design of mechanical components and vehicles. The objectives of the research may range from the definition of new models of materials behaviour to the assessment of the structural integrity of large structures, from the experimental investigation on new materials to the design of components or vehicles with innovative features, with special focus on lightweight design. Among the problems related to Machine and vehicle design group, a fundamental topic is represented by the general need to reduce environmental pollution and CO₂ emission. With this last aim, hydrogen is one of the most suitable candidates to replace hydrocarbons. Specifically, hydrogen is a valuable energy carrier, potentially clean and renewable but has few characteristics, such as high flammability and low density that must be considered when stored or distributed, especially in relation to safety aspect. It is therefore fundamental to improve knowledge related to storage, transportation, and distribution, also improving the resilience of current infrastructures in the event of greater hydrogen diffusion. All these aspects require a deep investigation to increase knowledge on safety of hydrogen and thus enlarging its exploitation.



	<p>However, hydrogen safety is a broad topic which involves several disciplines, and several objectives are related to expertises of Machine and vehicle design group: e.g. material behaviour and structural integrity under extreme loading conditions as well as modelling approaches.</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>Depending on the specific research topic assigned, methods and techniques will comprise Finite element modelling, Boundary element modelling, Fracture mechanics, structural health monitoring and prognosis, Digital Twin for structural integrity purposes, low and high velocity impact on structures, multi-axial fatigue tests on specimens or on parts, non-destructive tests, high temperature tests, residual stress tests, tests on vehicle components, tests on gears, tests on power transmission, driving simulator tests.</p>
<p>Educational objectives</p>	<p>The Doctor in Mechanical Engineering will be able to define, start and carry out original research by working in a team or leading a research group. Both theoretical and experimental skills are mastered. We provide doctoral candidates with high-level scientific training, fostering and refining research and problem-solving abilities.</p>
<p>Job opportunities</p>	<p>Job opportunities related to the research activity include structures/organizations aimed at innovation and/or research and technical development, high-tech SMEs, government departments ruling on public needs. 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. Specifically, the skills and know-how developed during the PhD will allow to cover positions for design and integrity assessment of advanced systems and components in aerospace, automotive and mechanical companies involved in the green transformation.</p>
<p>Composition of the research group</p>	<p>1 Full Professors 1 Associated Professors 1 Assistant Professors 7 PhD Students</p>
<p>Name of the research directors</p>	<p>Prof. Laura Vergani, Prof. Andrea Manes</p>



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

Scholarship Increase for a period abroad	
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Amount monthly	662.5 €
By number of months	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 5.401,42.

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. 662,50 euro/month- net amount).

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.