POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

PARTENARIATO PNRR Research Field: RECYCLED PATCHED COMPOSITE LAMINATES FOR LOAD-BEARING COMPONENTS AND THE AUTOMOTIVE SECTOR

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	The research here proposed falls within a PRIN project (PRIN 2022 PNRR - SELF-RE-PREG - Prot. P2022SLZY4 - CUP D53D23018700001) aiming to develop self-sensing recycled composite materials for load-earing applications.The objective of the activities is to study, define and validate a new generation of recycled composite material made from patches cut out from prepreg scrap.Nowadays up to 35% of the purchased prepreg is tossed out as cut outs and end-of-rolls: this project aims to develop a strategy to make use of such scraps to develop a new material to be used for lamination of new components. This mew material shall possess properties that make it favorable in comparison of traditional SMC, and for such reason its configuration and architecture shall be optimized. Alongside with the definition of the new material, a numerical study shall also follow in order to define a model to be used for designing new components.On the basis of a preliminary work already carried out at Politecnico di Milano, the researcher will have to: •Propose a few configurations of patched laminates; •Build up an appropriate test campaign to evaluate the mechanical response of each configuration; •Collect and process data from experiments; •Define and run a numerical model for the said material;

	•Identify the combination of parameter that would maximize the performance of the material. The researcher is expected to learn and work with numerical, analytical ad experimental approaches to make a comprehensive study of the new material.The researcher will also be encouraged to spend 6 month abroad in university where he/she could deepen and expand the understanding of the specific problem but also of the composite materials in general.
Methods and techniques that will be developed and used to carry out the research	The design and optimization of the new material involves several competences and skills. The developed methodology will be based on the combination and integration of the following elements: •Theory of laminates •Analysis of failure modes •Composite material behaviour •Stress analysis and Finite Element simulation •Optimisation Validation and testing.
Educational objectives	The challenges that the candidate will have to face are both theoretical and experimental: •Perform a systematic analysis of the concept of patched laminates, understanding their properties and application potentials •Understand how discontinuous composite laminates work •Define suitable models to simulate the behaviour of the material •Apply analytical and numerical stress analysis models to support the structural design of the material and of components made with it •Define and apply validation methods and tests •Apply optimisation techniques.
Job opportunities	Being the research carried out in the field of composite material, the job opportunities the candidate will have to choose from once completed the PhD will be in the widest range of sector: from automotive to aerospace, form

	sports equipment to high-end components, in a broad type of industries, both at national and international level. Collaborations are expected with both industries and other universities (e.g. University of Bologna). Our last survey on MeccPhD Doctorates highlighteda 100% employment rate within the first year and a 35% higher salary, compared Master of Science holders in the same field.
Composition of the research group	0 Full Professors 2 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Roberto Palazzetti

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

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 6.114,50. Our candidates are strongly encouraged to spend a research period abroad, joining high-level esearch 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. 750 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 theteaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.