POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

PNRR 117 Research Field: DESIGN OF INNOVATIVE COMPOSITE STRUCTURES WITH REDUCED ENVIRONMENTAL IMPACT

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	Large composite structures pose the problem of the their high environmental impact in the dismission phase at their end of life. More environmentally friendly solutions are needed, e.g. by substituting thermosetting resins with thermoplastic ones. This, however, requires the redesign of the structures and their shape optimization, accounting for the different mechanical and thermal properties of the substitute materials.The objective of this research is the identification and characterization of new materials suitable for the design of environmentally friendly structures used in the field of cooling systems, and the redesign and optimization of the new structures.The research topic addresses a novel research and development topic which constitutes an important advancement in the industrial field of the design of large, reinforced thermoplastic polymer structures. These objectives are coherent with the M2 Green revolution and ecological transition of the PNRR, and also with the mission M4 Education and Research, M4C2 From Research to Business, particularly with respect to the line of action 1 aiming at strengthening Research and Development in the research system and in the economic system.
Methods and techniques that will be developed and used to carry out the research	To carry out this research, a combined experimental and numerical approach is needed. The candidate shall be able to conduct mechanical characterization of composite materials, to model the mechanical behaviour of

	materials, to model the mechanical behaviour of composite structures and to apply the concepts of optimization to the design of composite structures. A Finite Element based optimization approach will be applied and new methods will be developed, integrating the variability of the materials' properties as a result of the manufacturing process (e.g. different fibre orientation distributions).The candidate shall interact with experts on fluid dynamics, for the definition of the working conditions of the structures to be designed, and with experts on Life cycle Assessment, for the material selection.
Educational objectives	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 will be mastered.
Job opportunities	The holder of a PhD in Mechanical Engineering will have job opportunities in structures/organizations aimed at innovation and/or research and technical development, high-tech SMEs, and government departments ruling on public needs. Specifically, the proposed research topic can offer job opportunities in the field of advanced manufacturing of composite structures. The advisory team collaborates with Universities and Agencies in the field of composites materials and structures, like: University of Leeds UK, ENSMA Poitiers FR, CNR - IPCB. Companies, like suppliers of materials and of manufacturing services will be involved in the research. 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.
Composition of the research group	1 Full Professors 1 Associated Professors 1 Assistant Professors 6 PhD Students
Name of the research directors	Prof. Andrea Bernasconi

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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	700.0 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	MITA Cooling Technologies S.r.l.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
By number of months abroad	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.