POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

THEMATIC Research Field: INNOVATIVE LASER-BASED SOLUTIONS FOR CRITICAL MANUFACTURING NEEDS

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	In the evolving global manufacturing landscape, Europe is increasingly focusing on maintaining strategic capabilities in the production of critical and high-value components, particularly in sectors such as defense, energy, and aerospace. Under the mounting pressure of global competition, especially from Asian countries, and the gradual reshoring and closure from the United States, European manufacturing must reposition itself around resilient, sovereign, and technologically advanced production models. In this context, the future of manufacturing in Europe lies in the ability to produce complex, highly functionalized parts through flexible, automated, and intelligent technologies. The decreasing availability of expert technical labor further drives the need for adaptive, autonomous systems capable of self-monitoring, correction, and reconfiguration. Laser-based processes represent a key enabling technology in this transition. Their inherent precision, non-contact nature, and high adaptability, combined with the recent widespread availability of laser sources, cost reduction, and innovations in beam shaping (in terms of wavelength, shape, and temporal control), make them uniquely suited for the development of smart, sustainable, and high-performance manufacturing. The research activity carried out with this scholarship will contribute to this framework, with specific focus on one or more topics related to advanced and additive laser processing for the creation of unique, optimized, and functionally enhanced

	components.
Methods and techniques that will be developed and used to carry out the research	The research will combine rigorous experimental methods with digital twins, AI-driven models, and advanced numerical simulations to design, monitor, and validate innovative laser processes. Multidisciplinary teamwork will be encouraged in a context where industrial partners often bring forward real-world research questions, fostering integrated and data-informed approaches to solve practical manufacturing challenges.
Educational objectives	Doctoral candidates will acquire competences in the design and investigation of advanced laser-based manufacturing processes. They will learn to integrate contemporary tools such as machine learning and artificial intelligence to enable process design, optimisation, modelling, and sensing The educational path will provide a comprehensive understanding of laser–matter interaction, beam modulation strategies, and system-level integration of laser technologies, preparing the candidates to contribute to the development of smart, efficient, and sustainable manufacturing systems.
Job opportunities	Italy and Lombardy Region have leading positions in manufacturing worldwide. 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. 1. Ansaldo Energia S.p.A. 2. Avio Aero 3. BLM Group 4. Ima Automation 5. Precitec 6. Prima Industrie S.p.A. 7. Prysmian 8. Sacmi 9. Sice Previt 10. Tenova S.p.A.
Composition of the research group	1 Full Professors

	2 Associated Professors 2 Assistant Professors 14 PhD Students
Name of the research directors	Proff. Barbara Previtali, Ali Gokhan Demir

Contacts
For questions about scholarship/support: phd-dmec@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

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, fundingfor participation in courses, summer schools, workshops and conferences) for a total amount of € 6.114,50. Our candidates are strongly encouraged to spend a research period abroad, joining highlevelresearch 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). Additionally, PhD candidates who spend at least 3 months abroad are eligible for an extra reimbursement of €3,000 to cover travel expenses. Teaching assistantship: availability of funding in recognition of supporting teaching activitiesby 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.