POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

BORSE TEF Research Field: ADDITIVE MANUFACTURING AND ARTIFICIAL INTELLIGENCE FOR SPACE

Monthly net income of PhDscholarship (max 36 months)
1800.0 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 PhD project is done under the Tech Europe Foundation (TEF) https://tef.tech project and aims to develop new intelligent, plug-and-play platform for intelligent Additive Manufacturing (AM), with attention to the space sector (hard-to-print geometries, challenging materials, multimaterial AM, and in-orbit manufacturing). The objective is to create a modular, scalable solution that can identify and mitigate defects during the printing process—layer by layer—helping to ensure first-time-right production and reduce scrap. The research addresses concrete needs expressed by the space industry, where one-of-a-kind, complex-shaped components must be produced with zero defects and minimal waste. It also supports in-orbit manufacturing using recycled materials, which are typically difficult to print. Moreover, the project responds to a broader demand within the AM market: several industrial end-users in contact with the proposing group have highlighted that reducing waste and increasing process reliability are key levers for lowering production costs and accelerating AM adoption at scale.
Methods and techniques that will be developed and used to carry out the research	The research will be structured around the following core directions:- Additive manufacturing for space and in-space: challenges and solutions- AI for Defect mitigation and adaptive control: integration of real-time mitigation logic—such as recoating or laser re-fusion—based on detected anomalies. The goal is to transition from simple monitoring to autonomous, adaptive

	transition from simple monitoring to autonomous, adaptive quality assurance. This is crucial for hard-to-print jobs and in-orbit operations, where process optimization cannot rely on expert operators.- Sensor fusion and generative AI: To increase robustness and reduce false positives, sensor fusion strategies (pre- and post-scanning), leveraging generative AI solutions (foundation models and transfer learning), will be used to reduce calibration efforts and create a general-purpose software platform adaptable to new geometries, materials, and systems with minimal re-training. The research will integrate a diverse set of methodologies, including: • Data mining and machine learning • Generative AI • Image, video-images, multimodal signal data gathering • process monitoring, control and optimization • AM processes modelling (metal additive manufacturing) The doctoral candidate will operate within highly interdisciplinary teams and will be encouraged to adopt a systems-thinking approach to address complex, real-world manufacturing challenges.Hands-on activities will be conducted in state-of-the-art laboratories equipped with advanced platforms for Additive Manufacturing—**including the first installed system in Italy for multimaterial Powder Bed Fusion**.
Educational objectives	Doctoral candidates will acquire: In-depth knowledge of Artificial Intelligence and big data analytics; Expertise in sensing, monitoring, and process control; Advanced skills in Additive Manufacturing technologies; Insights into one or more key industrial application domains, including space, aerospace, life sciences, and energy
Job opportunities	At present, no commercial software exists that enables real-time comparison between printed and nominal geometry while also supporting in-situ correction strategies. The PhD project aims to fill this gap by developing a fully modular platform that can be easily deployed across various AM technologies. The outcome will be a market-ready software solution, suitable for both AM machine users and OEMs in the space

	sector.Leveraging foundation models and transfer learning, the platform will ensure high adaptability with minimal configuration effort, enabling rapid deployment across different machines, materials, and application domains.The modularity and technological flexibility of the new platform also open clear pathways to entrepreneurial ventures, including spin-offs and licensing opportunities—offering industrial users enhanced process control, reduced scrap, and increased productivity.After successfully completing the PhD, the candidate can find jobs in start-ups, space companies, research centers. Collaborating Institutions:The PhD project benefits from a strong international network, including collaborations with: 1. ESA and ASI – European and Italian Space Agencies 2. MIT – Massachusetts Institute of Technology (USA) 3. Georgia Tech University (USA) 4. Imperial College London (UK) 5. Camozzi Ingersoll Machine Tools (Italy/USA) 6. Leonardo (Italy) Italy—and Lombardy in particular—holds a leading global position in advanced manufacturing. The convergence of AI and manufacturing is fostering the emergence of highly sought-after professional profiles, with strong demand both in academia and industry.
Composition of the research group	1 Full Professors 3 Associated Professors 2 Assistant Professors 15 PhD Students
Name of the research directors	Prof.ssa Bianca Maria Colosimo

Contacts
Bianca Maria Colosimo (biancamaria.colosimo@polimi.it) 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	900.0 €
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 € 7.543,25. 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. 900/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 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.