



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 40th cycle

PNRR 630 Research Field: SMART BIG AREA ADDITIVE MANUFACTURING FOR THE CIRCULAR AND SUSTAINABLE TRANSITIONS

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| 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 | |
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| Motivation and objectives of the research in this field | <p>The Industry 4.0 framework together with ongoing and future European strategic plans (Horizon, ManuFuture, NextGenerationEU), with their strong orientation towards EU research and innovation, call for accelerating the twin (i.e., green and digital) transition. In this framework, advanced and smart additive manufacturing processes represent key enabling technologies for a more sustainable product value chain, opening to innovative zero-defect solutions with minimum waste of materials and resources. The research activity carried out with this scholarship will specifically focus on the development of novel digital and smart methods to enable a zero-defect and first-time-right additive manufacturing capability for very large parts, as a building block towards an increased competitiveness in the framework of the circular and sustainable transitions. The aim is to anticipate the identification of the onset of defects while the part is being produced, and to adapt - in line and in situ - the process parameters to prevent the defect growth and propagation from one layer to another. The described research activities are coherent with three of the six major areas of intervention (pillars) on which the PNRRs will have to focus and in particular:</p> <ul style="list-style-type: none"> •Green transition •Digital transformation •Smart, sustainable and inclusive growth <p>The research activity is characterized by an</p> |



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| | <p>interdisciplinary approach, covering aspects and topics ranging from advanced sensing and measurement techniques to big data analytics, additive manufacturing process characterization and optimization. The industrial application framework is strongly focused on strategic sectors for the European industrial competitiveness, involving the direct involvement of a leading player in the field of big area additive manufacturing of high-value-added parts, namely Camozzi Research Center. The research environment is intensely multicultural, as the candidate will have the chance to contribute to national and international research & innovation networks and consortia including the main academic and industrial players in the smart and sustainable manufacturing arena (see also the job opportunity section below). The period spent broad will allow the candidate to further strengthen her/his own international network, fostering a multidisciplinary attitude towards complex problem solving.</p> |
| <p>Methods and techniques that will be developed and used to carry out the research</p> | <p>The research has a strong focus on the study, development, characterization, comparison and validation of novel smart methods to enhance the quality and stability of big area additive manufacturing processes. Thus, rigorous experimental techniques, mechatronics methods, physical models, and advanced statistical and machine learning algorithms will be combined to design, implement, and validate the innovative solutions proposed. Team-working will be stimulated with the aim of providing appropriate solutions to actual challenges, which require multidisciplinary skills.</p> |
| <p>Educational objectives</p> | <p>Doctoral candidates will acquire competences on design, optimisation, and sensing/controlling of additive manufacturing processes and systems.</p> |
| <p>Job opportunities</p> | <p>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. Job opportunities will be evaluated within the Camozzi Group, but also in</p> |



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| | agencies and top level universities that are collaborating with the research group on the specific topics of this call. List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research include: Camozzi Group, Ingersoll Machine Tools, MIT - Massachusetts Institute of Technology, TUM - Technical University of Munich, ESA - European Space Agency, Georgia Tech University. |
| Composition of the research group | 1 Full Professors 2 Associated Professors 3 Assistant Professors 10 PhD Students |
| Name of the research directors | Prof. Bianca Maria Colosimo |

| Contacts | |
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| <i>Phone:</i> +39 02 2399 8530 | |
| For questions about scholarship/support please contact phd-dmec@polimi.it | |

| 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 | 750.0 € |
| By number of months | 6 |

| National Operational Program for Research and Innovation | |
|---|--------------------------------|
| Company where the candidate will attend the stage (name and brief description) | Camozzi Research Center 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) | Ingersoll Machine Tools (USA) |
| By number of months abroad | 6 |

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| 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. 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.