



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 3 - Engineering Design and Manufacturing for the Industry of the Future

PNRR\_351\_DOTT\_RICERCA Research Field: **ADVANCED, SMART, AND SUSTAINABLE  
MANUFACTURING**

## Monthly net income of PhDscholarship (max 36 months)

**€ 1325.0**

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 fourth industrial revolution and European starting plans (Horizon, NextGenerationEU), with their strategic orientations for EU research and innovation, calls for accelerating the twin (i.e., green and digital) transition. A paradigm shifts to address various challenges including digital production, big data analysis and artificial intelligence, global production sustainability and circular economy, climate changes and smart cities is required. In this framework, advanced, smart, and sustainable manufacturing processes and systems act as key enabling technologies for providing high-precision, high-value, and high-performance custom-designed components at minimum waste. The research activity carried out with this scholarship can specifically focus on one or more subtopics within these main research frameworks.

*Advanced manufacturing processes:* among others, additive manufacturing for metals, ceramics, and polymers, micromachining, laser, and waterjet-based technologies are the available technological platform where production digitalisation and self-consciousness can be pursued. Research at this level can concern new process development as well as innovative hybrid solutions conception.

*Smart process monitoring, inspection, and control:* smart



	<p>solutions for sensing and inspection and innovative strategies for intelligent data fusion, big data analysis, quality process monitoring, control and inspection are key factors to achieve sustainable zero-defect manufacturing. <i>Advanced manufacturing systems</i>: innovative solutions for configuring and managing manufacturing and de-manufacturing systems are eventually needed to drive the whole production system toward smart, high-performance, and sustainable solutions.</p> <p>The described research activities are coherent with three of the six major areas of intervention on which the PNRR will have to focus and in particular green transition, digital transformation and smart, sustainable and inclusive growth. The research activity is characterized by a strong interdisciplinary approach, covering aspects and topics ranging from advanced sensing and measurement techniques to big data analytics, manufacturing process modelling and optimization. The industrial application framework is strongly intersectorial, embracing case studies from the aerospace, space, biomedical, energy and automotive sectors, involving the direct involvement of major industrial stakeholders. Eventually, the research environment is strongly multicultural, as the candidate will have the chance to contribute to national and international research &amp; innovation networks (EU funded projects, EIT Manufacturing, Vanguard) including the main academic and industrial players in the smart and sustainable manufacturing arena. 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><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>Rigorous experimental methods, physical models, and numerical simulations 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><b>Educational objectives</b></p>	<p>Doctoral candidates will acquire competences on design, optimisation, and sensing/controlling of new advanced manufacturing processes and systems.</p>



<b>Job opportunities</b>	<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 to Master of Science holders in the same field.</p> <p>The following Universities, Agencies and companies are cooperating in the research: MIT - Massachusetts Institute of Technology, TUM - Technical University of Munich, ESA - European Space Agency, Shanghai Jiao Tong University, Georgia Tech University, MUSP Lab (www.musp.it), STIIMA-CNR (www.stiima.cnr.it), ATV S.p.A., Ansaldo Energia S.p.A., Avio Aero, BLM Group, GE Avio s.r.l., GF Machining Solution, Leonardo - AgustaWestland S.p.A., Lima Corporate, Marposs S.p.A., Prima Industrie S.p.A., Tenova S.p.A.</p>
<b>Composition of the research group</b>	<p>7 Full Professors 7 Associated Professors 8 Assistant Professors 30 PhD Students</p>
<b>Name of the research directors</b>	Prof. Giovanni Moroni

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	662.5 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	
By number of months at the company	0
Institution or company where the	MIT - Massachusetts Institute of Technology



<b>candidate will spend the period abroad (name and brief description)</b>	
<b>By number of months abroad</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p>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 5.401,42.</p> <p>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.</p>