



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

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

Number of scholarship offered	8
Department	DIPARTIMENTO DI MECCANICA

Description of the Research Area

Industrial production in Europe accounts for the 16% of the European GDP and is a keydriver for innovation, productivity and job creation. As stated in the 2014-15 road map of the PPP Factory of the Future "future factory will be clean, highly performing, environmentally friendly and socially sustainable". This research area focuses on improving the performance of the industry of the future through the innovative application of technologies, processes and methods to the design and manufacturing of industrial products. The entire life cycle of the product is considered and in particular:

- R&D&I activities for product and process innovation
- product ideation and development
- manufacturing process investigation, optimisation, planning and control
- manufacturing system design and planning
- product service and disposal

Hence, all the activities required to transform ideas into final products making use of zero defect, affordable, personalised, and eco-efficient manufacturing processes are integrated and investigated within the context of a highly competitive and globalized world from prototyping to mass production. PhD candidates working in this area will be involved in research activities that address the above targets through projects possibly involving other universities and research institutes, as well as Italian and international companies interested in the same topics.

There are 8 available scholarships in this area:

- 1 generic
- 7 thematic (to be specifically selected during application procedure)



One generic scholarship referring to the following field:

- Methods and Tools to Develop New Products for the Industry 4.0

7 thematic scholarships, on the following topics:

- Advanced, smart and sustainable manufacturing (three scholarships)
- Development of advanced monitoring systems (two scholarships)
- Solid state metal powder deposition for new additive design solutions
- Novel temporal and spatial laser beam shaping approaches for defect-free, flexible, and automatized welding

Applicants should select thematic scholarships following the instructions provided in the call for application/application procedure.

The PhD scholarships available in this area are partially funded with the support of the Italian Ministry of Education, University and Research, through the project Department of Excellence LIS4.0 (Integrated Laboratory for Lightweight e Smart Structures).



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**OPEN SUBJECT Research Field: METHODS AND TOOLS TO DEVELOP NEW PRODUCTS IN
INDUSTRY 4.0 CONTEXT**

Monthly net income of PhDscholarship (max 36 months)	
€ 1325.0	
In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 Industry 4.0 revolution does not only concern manufacturing but directly involves product development activities. This research field concerns the methods and tools providing systematic support to product development from idea generation to concept verification, embodiment, and detail phases, with the overall goal of increasing innovation success rates. The specific research objective of the thesis will concern at least one of the following topics: design creativity enhancement, early concept evaluation through functional digital mock-ups, Virtual and Augmented Reality applications, Digital Human Modeling, AI for Design Automation, Product Digital Twin, Green and Sustainable Design.
Methods and techniques that will be developed and used to carry out the research	The research will be developed by referring to both emerging and established methodologies and technologies such as: Collaborative creativity, Bio-Inspired Design, Interactive Virtual Prototyping, Augmented and Virtual Reality, Reverse Engineering, Knowledge Based Engineering (KBE) and AI for Design, multi-objective Optimization, Design for Additive Manufacturing, Design for Sustainable Behaviour, Digital Twin.
Educational objectives	Operational competencies on up-to-date methodologies



	and technologies for developing innovative and user-friendly products. Capability to interpret technology evolution and the dynamics of product innovation. R&D skills for scientific and industrial applications. Soft skills in the delivery of scientific talks, drafting project reports and scientific papers, delivery of presentations to industry.
Job opportunities	The research experience in this area will nurture the ability to develop research activities within an academic and/or an industrial context, according to the specific objectives of the thesis. Therefore, career opportunities will be related to academic research and educational positions, industrial R&D departments, key roles in the product development cycle such as product manager, process manager etc. 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	3 Full Professors 5 Associated Professors 5 Assistant Professors 12 PhD Students
Name of the research directors	Proff. Colombo, Cascini, Ferrise

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

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 5401, 42.

Accommodation in Politecnico's Residences (<http://www.residenze.polimi.it>) is available for PhD candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application). 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. 660 euro/month - net amount).

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.