



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**PNRR 118 PNRR Research Field: THE DIGITAL TRANSITION OF MANUFACTURING  
PROCESSES AND ITS ROLE IN NEW PRODUCT DEVELOPMENT**

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

**€ 1400.0**

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**

Among the missions of the Italian National Recovery and Resilience Plan is the promotion of the digital transition of manufacturing systems. In such a context, it is fundamental to promote research activities focused on exploiting how cutting-edge digital technologies could be transferred to industries to innovate and make more efficient and sustainable production processes. Introducing these technologies could have a profound impact not only at the manufacturing level but also at the design one. Indeed, such digital technologies can optimize the design and validation phases of the product development process, for example, through virtual prototypes, and they can also support the development of collaborative design environments. The product itself could be completely rethought through the possibility to design and manage unconventional shapes and product configurations. Digital technologies can also support industries in the training of the operators to speed up and make more effective maintenance activities to extend product life. These are only a few examples of how introducing digital technologies in the production sector could promote product and process innovation. In such a scenario, this research field concerns the methods and tools that support the digital transition of industries and their product systems, from idea generation to concept verification, embodiment, and detail design. The goal is to support industries innovating the way new products are designed and manufactured to make them compete and



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|  | <p>led international scenarios. 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, eXtended and Augmented Reality applications, Digital Human Modeling, Artificial Intelligence (AI) for Design, Product Digital Twin, Green and Sustainable Design, Human-machine interactions.</p>        |
| <p><b>Methods and techniques that will be developed and used to carry out the research</b></p> | <p>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, eXtended 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.</p> |
| <p><b>Educational objectives</b></p>   | <p>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&amp;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.</p>                      |
| <p><b>Job opportunities</b></p>  | <p>Examples of universities that are cooperating in the research are: Blekinge Institute of Technology, Technical University of Denmark, Chalmers University of Technology, University of Strathclyde</p> <p>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><b>Composition of the research group</b></p>  | <p>4 Full Professors<br/>7 Associated Professors<br/>4 Assistant Professors<br/>15 PhD Students</p>   |
| <p><b>Name of the research directors</b></p>   | <p>Prof. Colombo, Bordegoni, Cascini, Ferrise</p>   |



| <b>Contacts</b>  |
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| <p>Prof. Giorgio Colombo: giorgio.colombo@polimi.it, +39 02 2399 8259<br/> <a href="https://www.mecc.polimi.it/ricerca/personale-docente/prof-giorgio-colombo">https://www.mecc.polimi.it/ricerca/personale-docente/prof-giorgio-colombo</a></p> <p>Prof. Monica Bordegoni: monica.bordegoni@polimi.it, +39 02 2399 8260<br/> <a href="https://www.mecc.polimi.it/ricerca/personale-docente/profssa-monica-bordegoni">https://www.mecc.polimi.it/ricerca/personale-docente/profssa-monica-bordegoni</a></p> <p>Prof. Gaetano Cascini: gaetano.cascini@polimi.it, +39 02 2399 8463<br/> <a href="https://www.mecc.polimi.it/ricerca/personale-docente/prof-gaetano-cascini">https://www.mecc.polimi.it/ricerca/personale-docente/prof-gaetano-cascini</a></p> <p>Prof. Francesco Ferrise: francesco.ferrise@polimi.it, +39 02 2399 8232<br/> <a href="https://www.mecc.polimi.it/ricerca/personale-docente/prof-francesco-ferrise">https://www.mecc.polimi.it/ricerca/personale-docente/prof-francesco-ferrise</a></p> <p>For questions about scholarship/support please contact phd-dmec@polimi.it</p> |

| <b>Additional support - Financial aid per PhD student per year (gross amount)</b> |    |
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| <b>Housing - Foreign Students</b>   | -- |
| <b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>             | -- |

| <b>Scholarship Increase for a period abroad</b> |         |
|---|---------|
| <b>Amount monthly</b>                           | 700.0 € |
| <b>By number of months</b>                      | 6       |

| <b>National Operational Program for Research and Innovation</b>   |               |
|---|---------------|
| <b>Company where the candidate will attend the stage (name and brief description)</b>                       |               |
| <b>By number of months at the company</b>   | 0             |
| <b>Institution or company where the candidate will spend the period abroad (name and brief description)</b> | to be defined |
| <b>By number of months abroad</b>   | 6             |

| <b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>  |
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| <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 5.707,13.</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> |