



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

**PNRR 118 PNRR Research Field: STRUCTURAL INTEGRITY ASSESSMENT OF AM  
COMPONENTS**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1400.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>The full exploitation of AM materials and 3D printing for lightweight design is challenged by the presence of manufacturing anomalies. Therefore, structural integrity assessment of 3D printed components is the open point for the application of new manufacturing techniques to critical components. It is especially important because the structural assessment is able to provide requirements for the quality and NDI of the additively manufactured components. The activity is focused on the Mission M1C2 "Digitalizzazione, Innovazione E Competitività Nel Sistema Produttivo" of the PNRR, aiming to strengthen the economy of the space and the monitoring.</p>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>The activity will be initially devoted to the analysis of a demonstrator printed, in the frame of current research activities for ESA (European Space Agency). The analysis will be based on fracture-based fatigue assessment of the machined components and to assess the effect of the surface inhomogeneities considering the fracture properties of the material, comparing numerical estimates with full-scale fatigue tests carried out by ESA. The activity after the first year will be devoted to enlarge the database of fatigue properties for materials relevant for AM applications, with a research directed to different directions (alternatives):</p> <ul style="list-style-type: none"> <li>i) analysis with probabilistic tools to derive partial safety factors to be applied in the assessment;</li> <li>ii) application to space components.</li> </ul>



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<b>Educational objectives</b>	The main educational objective of the position is to setup new techniques for the structural integrity assessment of 3D printed parts. This goal can be pursued by properly combining specific reliability techniques with an experimental analysis of the mechanical response of the material and damage analyses.
<b>Job opportunities</b>	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.  List of Universities, Companies, Agencies and/or International Institutions that are cooperating in the research: European Space Agency (ESA), Avio-Aero (Rivalta - TO), BEAMIT (PR), Thales Alenia Space.
<b>Composition of the research group</b>	2 Full Professors 2 Associated Professors 1 Assistant Professors 4 PhD Students
<b>Name of the research directors</b>	Prof. Stefano Beretta

<b>Contacts</b>	
Research supervisors:	
Prof. Stefano Beretta ( <i>e-mail</i> : stefano.beretta@polimi.it; <i>phone</i> : 02 2399 8246)	
Dr. N. Shamsaei (Auburn University)	
For questions about scholarship/support please contact phd-dmec@polimi.it	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<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>	Auburn University, National Center for Additive Manufacturing Excellence (NCAME)
<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 5.707, 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>