



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

**Research Area n. 1 - Advanced Materials and Smart Structures**

**THEMATIC Research Field: FATIGUE AND FRACTURE 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>	The 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.
<b>Methods and techniques that will be developed and used to carry out the research</b>	The activity will be initially devoted to the analysis of a demonstrator printed in Ti6Al4V, in the frame of a research contract with MTC (Coventry, UK) 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 space applications, with a research directed to different directions (alternatives): i) analysis with probabilistic tools to derive partial safety factors to be applied in the assessment; ii) application to space components.
<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>	<p>List of Universities, Companies, Agencies and Institutions that are cooperating in the research: Auburn University - National Center for Additive Manufacturing Excellence (NCAME), European Space Agency, Avio-Aero (Rivalta, TO), BEAMIT (Pr), Thales Alenia Space.</p> <p>Our last survey on MeccPhD Doctorates highlighted a <b>100% employment rate</b> within the first year and a <b>35% higher salary</b>, compared to Master of Science holders in the same field.</p>
<b>Composition of the research group</b>	<p>1 Full Professors                  2 Associated Professors                  2 Assistant Professors                  3 PhD Students</p>
<b>Name of the research directors</b>	Prof. Stefano Beretta

<b>Contacts</b>	
<i>Email:</i> stefano.beretta@polimi.it <i>Phone:</i> 0223998246	
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>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
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.



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. 700 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.