



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

**THEMATIC Research Field: FRACTURE-BASED ASSESSMENT FOR HIGH TEMPERATURE
AM COMPONENTS**

Monthly net income of PhDscholarship (max 36 months)

€ 1500.0

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 structural integrity assessment of 3D printed components is the open point for the application of new manufacturing techniques to critical components. Traditionally the assessment is able to provide requirements for the quality and NDI of the additively manufactured components. However, the most interesting development is the development of qualification criteria, in which the NDE uncertainties are taken into account.

Methods and techniques that will be developed and used to carry out the research

The activity will be initially devoted to the analysis of specimens containing small surface features (channels, netshape surfaces) subjected to LCF and dwell conditions. After an identification of the cyclic plasticity model for the material, 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 experimental tests. The analysis will be supported by tomographic analysis of the surface features and their statistical description.

The activity after the first year will be devoted to: i) the development of crack propagation models for short cracks able to account for TMF cycles ; ii) application to 3D printed components in relation to the uncertainties of NDE inspection (sizing error, probability of detection) with an adequate probabilistic model.



Educational objectives	The main educational objective of the position is to setup new techniques for the structural integrity assessment of 3D printed parts subjected to low cycle fatigue and high temperature conditions. 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.
Job opportunities	<p>List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:</p> <p>Universities</p> <ol style="list-style-type: none"> 1. Auburn University, National Center for Additive Manufacturing Excellence (NCAME) 2. ENSAM, Angers <p>Agencies and Research Centres</p> <ol style="list-style-type: none"> 1. European Space Agency <p>Companies</p> <ol style="list-style-type: none"> 1. Avio-Aero, Rivalta (To) 2. BEAMIT (Pr) 3. Thales Alenia Space <p>Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary, compared Master of Science holders in the same field.</p>
Composition of the research group	<p>1 Full Professors</p> <p>2 Associated Professors</p> <p>1 Assistant Professors</p> <p>3 PhD Students</p>
Name of the research directors	Prof. Stefano Beretta

Contacts	
<p>Phone +39-0223998246</p> <p>Email stefano.beretta@polimi.it</p> <p>Email luca.patriarca@polimi.it</p> <p>For questions about scholarship/support: phd-dmec@polimi.it</p>	

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--



Housing - Out-of-town residents	--
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Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

Stage and period abroad	
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<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 €6,114.50.</p> <p>PhD candidates benefiting from this scholarship are required to spend a research period of at least 3 months abroad, joining high-level research groups in their specific research field, as agreed upon with their Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approximately €750/month – net amount). Additionally, candidates who spend at least 3 months abroad are eligible for an extra reimbursement of €3.000 to cover travel expenses.</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 related to teaching support. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.</p>