



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

Research Area n. 1 - Advanced Materials and Smart Structures

**PNRR\_352 Research Field: METAMATERIALS FOR THIN LAYER VIBRATION AND  
ACOUSTIC ISOLATION**

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

**€ 1325.0**

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 research aims at developing thin insulation layers for the absorption/reflection of mechanical vibrations and/or acoustic noise. This can be achieved either through viscoelastic material or through metamaterials that exhibit much higher performances than traditional materials. These isolating layers could greatly benefit several industrial sectors, from the mobility to the civil engineering one.

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

The challenge of this research is the thickness of the isolating layer that, according to a well established approach, should be related to the wavelength of the incoming wave (either mechanical or acoustical). However, thick layers cannot be used in many applications. Thus, a thin isolating layer (with respect to the incoming wavelength) obtained through metamaterials would determine a significant industrial advantage. To obtain this result, state of the art multiphysics simulation methods will be used and further developed, always taking into account the production process required to economically produce the thin layer at industrial scale. Different topologies of metamaterials will be investigated and new ones will be proposed. The research is coherent with missions M2C3: EFFICIENZA ENERGETICA E RIQUALIFICAZIONE DEGLI EDIFICI and M4C2: DALLA



	RICERCA ALL'IMPRESA of PNRR.
<b>Educational objectives</b>	The candidate will gain expertise in the field of metamaterials multiphysics modelling and production as well as their laboratory and outdoor testing. The research activity can be subdivided into the following steps: definition of design criteria and requirements for thin isolating layers, multiphysics modelling of the thin layer made of metamaterials, optimization of the metamaterial topology to achieve the desired performance in the thinnest possible layer, always taking into account the industrial production process, production and testing of the thin isolating layer developed for different industrial sectors (from the automotive to the civil engineering one).
<b>Job opportunities</b>	The main job opportunity is within Phononic Vibes Srl. However, the acquired competences will allow the candidate to be employed by companies in the field of mobility, aerospace, civil engineering, material engineering, etc. Moreover, also an academic career can be pursued after this PhD. 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.
<b>Composition of the research group</b>	2 Full Professors 1 Associated Professors 1 Assistant Professors 3 PhD Students
<b>Name of the research directors</b>	Prof. Francesco Braghin, Prof. Alberto Corigliano

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



Scholarship Increase for a period abroad	
Amount monthly	662.5 €
By number of months	6

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Phononic Vibes S.r.l.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Georgia Institute of Technology
By number of months abroad	6

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 5.401,42 euro.</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>