



# PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 37th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

THEMATIC Research Field: MEMS METASTRUCTURES

**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

In recent years, there has been a growing interest in realizing artificial metasurfaces and metamaterials that provide novel and on-demand physical properties. Such metastructures can be designed on a variety of physical platforms to enhance or modify the interaction with wave species, including electromagnetic, acoustic, mechanical, spin and matter waves. These developments have engaged distinct but related communities, not only by introducing new wave physics phenomena arising from intriguing properties of such artificial structures, but also by a wide range of new potential applications. Mechanical metastructures open new ways to manipulate acoustic waves, which can be used for wave-steering, realizing generalized Snell's law and low-frequency noise insulation. Bringing them to the MEMS scale opens new challenges since the involved dimensions determine very high working frequencies while the typical frequency bands of interest are at much lower frequencies.

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

The goal of this PhD research is to demonstrate the advantages of MEMS coupled metastructures. In particular, metastructures will be studied

- for vibrations isolation with the aim of making them work at the working frequencies of MEMS sensors;
- for the focusing of vibrational energy in order to maximize the harvested energy (through graded



	metamaterials, auxetic metamaterials, ...);
<b>Educational objectives</b>	At the end of the PhD cycle the candidate will be able to define, design and carry out original research programs by working in a team or leading a research group in the field of MEMS. Opportunities will be offered for spending visiting periods hosted by project partners within scientific cooperation.
<b>Job opportunities</b>	All project activities are strongly connected to industrial needs and industrial partners are directly participating to project tasks. In this specific project, STMicroelectronics is directly involved in the research. Our last survey on MecPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary compared to Master of Science students in the same field.
<b>Composition of the research group</b>	2 Full Professors 2 Associated Professors 1 Assistant Professors 2 PhD Students
<b>Name of the research directors</b>	Prof. Francesco Braghin

<b>Contacts</b>
Phone +39 02 2399 8306; e-mail: francesco.braghin@polimi.it; 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>	564.01 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
Funding for educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences); funding per PhD student per year: 2nd year: per student euros 1.534 3rd year: per student euros 1.534 Accommodation in Politecnico's Residences ( <a href="http://www.residenze.polimi.it">http://www.residenze.polimi.it</a> ) is available for PhD



candidates; special rates will be applied to selected out-of-town candidates (detailed info in the call for application).

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. 550 euro/month - net amount).

Teaching assistantship: availability of funding in recognition of support to teaching activities by the PhD student; 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.