



# PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 37th cycle

**THEMATIC Research Field: SMART SENSORS FOR MICROFLUIDICS**

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

**€ 1400.0**

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

Microdevices and sensors for microfluidics are often characterized by very small defects which can affect their readings. They are also characterized by a coupled multi-physics, partially due to the fluid-structure interaction, which might be different from the standard one affecting macro-devices. Within a hybrid numerical-experimental approach to the analysis of these devices, as solution to monitor e.g. the flow and the fluid composition in micro-channels for beverage and medical solutions, the main objective of this research activity is to assess the potentialities of commercial-off-the-shelf sensors and, if not appropriate, to design new ones. For this purpose, a daily, tight collaboration with the firms supporting this activity is envisaged.

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

Computational mechanics: multi-physics and multi-scale approaches to model e.g.: particle manipulation and trapping in fluidic channels under the action of elastic waves propagated in a piezo-actuator; effects of imperfections and of the fabrication process (even with 3D printing solutions) on the response of the devices; stochastic methods to account for the statistics of imperfections at the microscale.

Experimental mechanics: tests of available solutions to measure the flow and the composition of the fluid in micro-channel in a contactless way.

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	Tech, to be carried out in the Politecnico JRC lab or in theirs, whenever necessary.
<b>Educational objectives</b>	The research field is across electronics, mechanical, materials and structural engineering. Hence, Ph.D. students are expected to develop a multidisciplinary approach to the analysis of (micro)fluidic devices, also in relation to the coupled multi-physics of the problem at hand.
<b>Job opportunities</b>	The collaboration with a major player in the field of microelectronics and an emergent payer in the field of fluidic industrial solutions, allows to get exposed to real-life situations. Job opportunities are therefore expected in these specific and important fields. Other opportunities can be in firms working to provide instrumentation and facilities to allow the mass production of tiny, cheap devices especially linked to microfluidics.
<b>Composition of the research group</b>	1 Full Professors 3 Associated Professors 1 Assistant Professors 1 PhD Students
<b>Name of the research directors</b>	S.Mariani, F. Braghin, G.Cazzulani, M.Roveri

<b>Contacts</b>
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<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>
Educational activities (purchase of study books and material, funding for participation to courses,



summer schools, workshops and conferences): The Ph.D. course supports the educational activities of its Ph.D. students with an additional funding equal to 10% of the scholarship, starting from the second year. In some cases, students will be allowed to use part of this funding also in the first year.

Teaching assistantship (availability of funding in recognition of support to teaching activities by the PhD student): Ph.D. students are encouraged to apply, upon prior authorization, to the calls to support teaching activities at the undergraduate and Master levels at Politecnico, being paid for that. The teaching assistantship will be limited up to about 80 hours, maximum half of them devoted to teaching and classroom activities and the rest to support classworks and exams.

Computer availability and desk availability: Each Ph.D. student has his/her own computer for individual use. Each Ph.D. student has his/her own desk, cabinet and locker.