



PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 38th cycle

THEMATIC Research Field: MULTI-SCALE AND MULTI-PHYSICS CHARACTERIZATION OF MEMS DEVICES

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 (MEMS) are characterized by sub-micron defects, which affect their response to the external stimuli. Such defects can be accounted for within a multi-scale and multi-physics framework as sources of variability of the MEMS behavior, and need to be appropriately defined and modeled. Within a hybrid numerical-experimental approach to the reliability analysis of the devices, the main objective of this research activity is to assess in a proper, statistical way the effects of the aforementioned variability of the mechanical and geometrical properties of the devices on their actual response to the external actions. For this purpose, specific on-chip test structures will be tested and further designed.

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

Computational mechanics: multi-physics and multi-scale approaches to model the effects of imperfections and of the microfabrication process on the response of real MEMS devices; stochastic (Monte Carlo like) methods to account for the statistics of imperfections.
Experimental mechanics: tests of available on-chip testing devices to assess the toughness of Si and the residual stresses; re-design of the available devices. Research funded by STMicroelectronics, to be carried out in our labs and in the ST's, whenever necessary.

Educational objectives



	The research field is across mechanical, materials and structural engineering. Hence, Ph.D. students are expected to develop a multidisciplinary approach to the analysis of MEMS devices, in relation to the coupled multi-physics of the problem at hand.
Job opportunities	The collaboration with a major player in the field of microelectronics allows to get exposed to real-life situations. Job opportunities are therefore expected in this specific field, knowing that in Milan other main players already have an R&D division. Other opportunities can be in firms working to provide instrumentation and facilities to allow the mass production of tiny, cheap devices.
Composition of the research group	3 Full Professors 4 Associated Professors 2 Assistant Professors 5 PhD Students
Name of the research directors	S. Mariani, A. Ghisi, A. Corigliano, A. Frangi

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

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p><u>Educational activities</u> (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 first year.</p> <p><u>Teaching assistantship</u> (availability of funding in recognition of support to teaching activities by the</p>



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.