



PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 40th cycle

THEMATIC Research Field: ON RESIDUAL STRESS DETERMINATION IN MICROELECTROMECHANICAL SYSTEMS

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	As microelectromechanical systems integrate stacks of many different materials, reliability and performance are affected by residual stresses, which often depend on the process sequence. As miniaturization progresses, these effects can significantly hamper the predictions made under the assumption of a material free of intrinsic stresses. Consequently, the identification of the sources of residual stresses and their characterization and determination, including a quantification of the uncertainty, poses a relevant issue. By combining analytical, experimental and numerical methods, the research aims to provide insights into their role in layered thin films obtained through microfabrication using existing and possibly new technology.
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 intrinsic and extrinsic stresses as a consequence of the microfabrication process of real MEMS devices. Experimental mechanics: tests of available on-chip testing devices or wafers to assess the effects of residual stresses on curvature and/or out-of-plane displacements; 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	A. Corigliano, A. Ghisi

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

Educational activities (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year. 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.

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 is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: each Ph.D. student has his/her own computer for individual use.

Desk availability: each Ph.D. student has his/her own desk, cabinet and locker.