



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

**THEMATIC Research Field: DESIGN AND MULTI-PHYSICS SIMULATION OF INNOVATIVE
MEMS DEVICES FOR NEW FABRICATION PROCESSES**

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**

A few years ago, the spread of more than 20 billions of Micro-Electro-Mechanical Systems (MEMS) in the consumer world triggered a revolution of user interfaces in gaming, mobile phones and navigation. Similarly, in the near future, new generations of sensors and actuators will dramatically impact our lives and will enable a sustainable evolution of the Internet of Things in its different declinations such as Smart City, Home, Farming, Objects and Driving.

MEMS devices are also addressing increasing attention from the medical world thanks to their promising applications as micro-grippers, drug delivery systems, implantable sensors and so on.

Innovative MEMS designs and new working principles are then strongly required to fulfil the increasing requests of improved performances, versatility and reduced dimensions coming from the market.

The aim of the project is to design, fabricate and test innovative MEMS devices exploiting the new features of the recently developed STMicroelectronics fabrication process "Thelma-Double". The "Thelma-Double" thanks to its double layer of polysilicon is able to overcome the main limitations of the standard MEMS fabrication processes (i.e. planarity), thus opening the way to a new generation of MEMS devices.

The scientific challenge is then twofold: to overcome the



	intrinsic planarity of MEMS devices exploiting the "Thelma-Double" features and obtain extraordinary performances not achievable so far through standard MEMS fabrication processes.
Methods and techniques that will be developed and used to carry out the research	<p>MEMS-oriented research needs a highly multi-disciplinary approach and a deep knowledge of the fundamentals of physics, mechanics and material science, as well as a familiarity with innovative techniques for numerical modelling and simulations.</p> <p>During the design process, commercial multiphysics codes and custom routines will be employed. The Candidate will also conceptualize and perform experimental tests to validate the proposed designs. The activity will be carried out in the framework of the Joint Research Center STMicroelectronics-Politecnico di Milano (STEAM) and will require a strong interaction of the Candidate with STMicroelectronics, company leader in the MEMS field.</p>
Educational objectives	Thanks to the high multidisciplinary of the project, the Candidate will have the opportunity to collaborate with a number of laboratories and research groups in various Departments of Politecnico di Milano, in MEMS companies (i.e. STMicroelectronics) and in international research centers. He/she will acquire specialized knowledge on the design, simulation and test of new generation MEMS devices.
Job opportunities	Direct employment in MEMS- and NEMS- research centers and industries in Europe and all-over the world. Job opportunities in other fields, where experts in multiphysics problems, testing and computational methods are requested.
Composition of the research group	3 Full Professors 4 Associated Professors 2 Assistant Professors 6 PhD Students
Name of the research directors	Dr. Valentina ZEGA

Contacts

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MEMS modelling and design group [<https://mems.polimi.it/>]

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): 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): 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.