



PhD in INGEGNERIA STRUTTURALE, SISMICA, GEOTECNICA / STRUCTURAL SEISMIC AND GEOTECHNICAL ENGINEERING - 39th cycle

THEMATIC Research Field: PIEZOELECTRIC MICRO-RESONATORS

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

Microsystems or Micro Electro Mechanical Systems (MEMS) are highly sophisticated devices, where electronics is coupled with mechanical parts to create micro sensors, micro actuators, as well as micro-fluidic devices. MEMS are today commonly used in automotive, aerospace and consumer-oriented engineering. Other fields are now taking advantage of these devices, like biomedical engineering and structural engineering, where MEMS start being used for monitoring and self-actuation. Multi-disciplinary research is strongly needed to improve the performances and reliability of MEMS and to create new devices which will enable the Internet of Things and Industry 4.0 revolutions. The project is related to piezoelectric MEMS resonators, with a particular focus on piezo-resonators having frequencies in the range 30 kHz – 20 MHz and on the study of all dissipative phenomena related to their behaviour in the linear and nonlinear regime.

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

MEMS-oriented research needs a highly multi-disciplinary approach and a deep knowledge of the fundamentals of physics, mechanics and electronics, as well as a certain familiarity with today's sophisticated techniques for numerical modelling and simulations.

Educational objectives

The proposed research project is related to the Joint Research Center between Politecnico di Milano and



	Research Center between Politecnico di Milano and STMicroelectronics "Research Center on Sensor sysTEms with Advanced Materials - STEAM" which involves various Departments and research groups of Politecnico di Milano with which the candidate will have the opportunity to collaborate. A strict collaboration with the industrial partner STMicroelectronics will also characterize the PhD experience of the candidate who will acquire specialized knowledge on MEMS and their related research fields, like micromechanics and microfabrication.
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, micro-mechanics, testing and computational methods, advanced structural monitoring are requested.
Composition of the research group	4 Full Professors 2 Associated Professors 2 Assistant Professors 6 PhD Students
Name of the research directors	Alberto Corigliano, Attilio Frangi

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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
List of Universities, Companies, Agencies and National or International Institutions that are cooperating in the research:



- STMicroelectronics - www.st.com
- Partners of the FET project: Metaveh, <https://www.metaveh.com/>
- Prof. Alper Erturk, <https://www.me.gatech.edu/faculty/erturk>
- Prof. Matteo Rinaldi, <https://coe.northeastern.edu/people/rinaldi-matteo/>

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 assistanship (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.