



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

**THEMATIC Research Field: ADVANCED REGISTRATION METHODS FOR X-RAY
TOMOGRAPHY MEDICAL IMAGES**

Monthly net income of PhDscholarship (max 36 months)

€ 1180.0

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

The project: "Advanced registration methods for X-ray tomography medical images" concerns the topic "industry 4.0" and several priorities of National Strategy (technologies for Health and Life Environment). In fact, each improvement of the imaging quality and processing exhibits a strong industrial interest and possesses a great impact on the network of firms developing biomedical equipment and on public and private entities engaged in the healthcare. The main objectives to be pursued are: (i) comparing diverse tomographic reconstructions along time, e.g. before and after surgery interventions (teeth implants) or for monitoring a specific disease (like osteoporosis) estimating possible variations of local elastic properties; (ii) to correct low quality images or artifacts as a consequence of patient motions, assuming as a reference partial reconstructions along time.

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

The core of the project is the development of advanced Digital Volume Correlation (DVC) techniques resting on the estimation of the optical flux, regularized with mechanical models to improve the effectiveness of registration procedures. Such methods will be based on the finite element discretization of the displacement field, enriched by multiscale and multiresolution approaches. The expected results will consist in an improved quality of tomographic reconstructions but also in the possibility to



	estimate mechanical properties and local stresses from a sequence of digital images. In this research also experimental activities are planned, concerning not only small samples of soft tissue and bone, subjected to in situ mechanical tests monitored by X-ray tomography, but also patients.
Educational objectives	The project activities involving diverse subjects at an international level will favour in the candidate the development of a huge expertise for the research and development of computational methodologies oriented to biomedical images, with a special sensitivity for the design of novel products and the healthcare activities.
Job opportunities	The collaboration with the Italian firm active in the field of biomedical equipment and with the research center abroad will put the candidate in contact with the international network of the research and innovation oriented both to research and to the development of new products for the market, and with the clients to which such products are provided, namely the private and public entities promoting activities for the healthcare.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Eng. Roberto Fedele

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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	566.36 €
By number of months	6



Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

The PhD position is funded by the Italian National Social Security Institution (INPS): the candidate must be an Italian citizen and must satisfy peculiar requirements. Please check carefully such requirements before applying.

The candidate will be provided of a desk and a personal pc required for his/her work. He/she will interact with the community of PhD students active in the same Department for fruitful help and exchange at a personal and scientific level. Numerous educational activity are organized at Politecnico di Milano and offered in particular to PhD students, of which only a few are mandatory.

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 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.