POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 38th cycle

Research Area n. 1 - Advanced Materials and Smart Structures

PNRR_352 Research Field: TRIBOLOGICAL ASPECTS IN MICROGRIPPERS

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	In a lot of industrial sectors, the reduction of the dimension of devices is a very important feature but definitely not easy to achieve. Microgrippers are MEMS devices used for handling objects at the micro and nano scale and are designed to fulfil specific tasks, e.g. picking objects at the micro/nano scale, moving them at desired locations, and placing them without damaging the substrate and with an extremely high accuracy. Other requirements are a very low minimum gripping force, simple and robust control interface, short gripping and releasing time along with small dimensions and light weight. They are currently used in the semi-conductor industry for assembling tiny parts on wafer substrates, to manipulate biological nano-materials, to provide minimally invasive surgery, but could be really useful also in other applications where micro fabrication, micro assembly and micro manipulation are needed. For a wider spread of the use of microgrippers, several challenges have still to be solved among which an easy release (adhesion forces typically prevent simple and fast release) and a self-cleaning procedure (since microgrippers usually operate in dirty environment). The research is coherent with missions M6C2: INNOVAZIONE, RICERCA E DIGITALIZZAZIONE DEL SERVIZIO SANITARIO NAZIONALE and M4C2: DALLA RICERCA ALL'IMPRESA of PNRR.

Methods and techniques that will be developed and used to carry out the research	The research carried out within this PhD focuses on the analysis of the tribological aspects of microgrippers to facilitate the grip and especially the release, as well as the possibility of self-cleaning (self-cleaning) of the gripper itself. The topics that will be faced are the following: design and optimization of microgripper geometries to allow the grip and release of solid microcomponents; design and optimization of microgripper geometries to allow the gripping and release of soft microcomponents; experimental verification of the tribological characteristics of end effector for microgrippers; analysis of the surface conditions of microgrippers to facilitate self-cleaning actions induced by electrical potentials.
Educational objectives	At the end of the PhD cycle the candidate will be able to define, design and carry out original research programs by working in a team or leading a research group in the field of MEMS.
Job opportunities	All project activities are strongly connected to industrial needs and industrial partners are directly participating to project tasks. In this specific project, STMicroelectronics is directly involved in the research. Our last survey on MecPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary compared to Master of Science students in the same field.
Composition of the research group	4 Full Professors 3 Associated Professors 2 Assistant Professors 4 PhD Students
Name of the research directors	Prof. Francesco Braghin, Prof. Alberto Corigliano

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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	STMicroelectronics
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	Georgia Institute of Technology
By number of months abroad	6

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

Financial aid is available for all PhD candidates (purchase of study books and materials, fundingfor participation in courses, summer schools, workshops and conferences) for a total amount of euro 5.707, 13.

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