



PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: DEVELOPMENT OF AN INTELLIGENT ACTUATED SECOND
SKIN FOR HUMAN EMPOWERMENT**

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

When coming to human empowerment in different fields, such as assistance during workdays, to frail or motor impaired persons, we are witnessing a technological push starting from more classical rigid wearable exoskeletons to hybrid or soft solutions. None of the current solutions disappear under the cloths towards an ecological and transparent assistance. With this project, we want to study and develop an intelligent actuated second skin which is able to assist human movement.

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

The methods implemented in the research will be theoretical (numerical and analytical) and experimental. The research will develop along 3 main research lines closely related to each other and which will concern:

- i) the development of a perception and a monitoring layer able to interact with the wearer, which implements a proper sensor network and human-machine interaction methodologies;
- ii) an actuation layer to support the intended motion, which will be developed building on current solutions based on cables or hydraulic units, but developing a solution able to actuate a second skin;
- iii) a brain layer to supervise and control the whole process.

The strong interdependence of the research lines is evident, which will be adequately supported by experimental activities at the basis of the validation



	experimental activities at the basis of the validation procedures of the models created and will allow a robust development of the identified technical solutions. The main result of the PhD activity will consist in the creation of a prototype of an intelligent actuated second skin able to assist human movement.
Educational objectives	PhD graduate will be able to have a interdisciplinary knowledge of technologies and processes related to new paradigms in human assistance and empowerment, with a focus on soft robotics, control, and sensor network.
Job opportunities	Skills and competences in the field are extremely interesting for all the companies involved in manual working and for the whole society in terms of assistance of disabled or frail people. Our last survey on MeccPhD Doctorates highlighted a 100% employment rate within the first year and a 35% higher salary , compared to Master of Science holders in the same field.
Composition of the research group	1 Full Professors 0 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Prof. Francesco Braghin, Dr. Marta Gandolla

Contacts
Email: francesco.braghin@polimi.it; marta.gandolla@polimi.it
For questions about scholarship/support phd-dmec@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



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

Our candidates are strongly encouraged to spend a research period abroad, joining high-level research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month - net amount).

Teaching assistantship: availability of funding in recognition of supporting teaching activities by the PhD candidate. 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.