



## Thesis Project Form

**Title (tentative):** Powered exoskeleton for workers: performance evaluation

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### Description

#### Motivation and application domain

Many workers suffer from low-back pain caused by physically demanding work in many sectors. We design and validate exoskeletons to mitigate the risk of injury. (<https://advr.iit.it/projects/inail-scc/esoscheletro>)

#### General objectives and main activities

The student will join the multi-disciplinary research group XoLab, part of Advanced Robotics at Istituto Italiano di Tecnologia (IIT). Ongoing projects at this group include further developments on our exoskeletons and their validation for various application sectors.

The research for this thesis will aim at the evaluation of the effect of our powered back-support exoskeleton during manual material handling activities. This device contributes to the extension of the back, thereby reducing the musculoskeletal loading on the lumbar spine associated with injuries.

As part of this research, laboratory experiments with healthy subjects will replicate the physical conditions of the intended use. Specifically our main goal is to assess and quantify the physical benefits experienced by the workers thanks to the use of the exoskeleton building up the theory of the equivalent weight for a wide range of static and dynamic postures (<https://doi.org/10.3390/ijerph18052677>). The evaluation, based on a variety of measurements such as movements, muscle activation, metabolic energy expenditure, will allow to lay the foundations necessary for wide-spread adoption by companies.

This work will allow the student to master relevant techniques and methods used in state-of-the-art research and development in robotics, exoskeletons, human-robot interaction. It will also provide opportunities to develop skills in experimental design and real-time exoskeleton control, contributing to future research.

#### Training Objectives (technical/analytical tools, experimental methodologies)

- Capturing and analyzing data on motion capture, muscular activation and metabolic consumption;
- Conducting laboratory experiments on healthy subjects replicating operative conditions;
- Analyzing the effectiveness of possible assistive strategies and different manual material handling activities (e.g. lifting, carrying).

**Place(s) where the thesis work will be carried out:** Istituto Italiano di Tecnologia (Advanced Robotics)

### Additional information

**Pre-requisite abilities/skills:** Conoscenza di Matlab e tecniche di base di analisi di dati e segnali

**Maximum number of students:** 2