

# PhD in Mechanical Engineering

## Research Title: Novel methods for the evaluation and benchmarking of gait patterns in lower limb amputees

Lower limb amputees gait evaluation

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<b>Context of the research activity</b>	<p>Currently, the clinical method to evaluate the biomechanical setup for a lower limb prosthesis patient is based on qualitative feedback of clinical experts. This method is exposed to subjectivity and may result in poor repeatability. On the other hand, adopting specific clinical scales for the evaluation of the gait pattern ‘goodness’ may also present limitations as the outcome would again be affected by the amputee subjectivity.</p> <p>This analysis could get more quantitative and less susceptible to the human evaluation with a scientific and standardized protocol, based on biomechanical measurements concerning what the human body is doing in terms of kinematics, balance and related muscular activity.</p> <p>This method, based on biomechanical analysis and modeling, will be the result of a collaboration with physiatrists, physiotherapists, orthopedic technicians and tested in a clinical trial meant to clinically evaluate both transfemoral and transtibial novel prostheses recently developed at the Rehab Technologies Lab of Istituto Italiano di Tecnologia (IIT).</p> <p>The experimental setup will be based on Motion Capture systems (Vicon), a sensorised treadmill and a wireless EMG acquisition system (Cometa).</p> <p>A secondary goal of this PhD will be to carry out a biomechanical comparison between the devices developed at Rehab Technologies, IIT and those made by the main players in the field of lower limb prosthetics. This will allow the evaluation of the devices to understand which are the real benefits we can bring to the patient with our own technology, in his daily life.</p>
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<p><b>Objectives</b></p>	<ol style="list-style-type: none"> <li>1. The main goal of this research activity will be hence focused on validating a new scientific method to evaluate the biomechanical 'goodness' of lower limb prosthetic patients gait patterns. To fulfill this goal, the researcher will make large use of motion capture systems, EMG sensing and force sensors for human interaction. The results of the gait analysis will also lead to the creation of biomechanical models of the "patient-prosthesis" ensemble.</li> <li>2. Integrate clinical experience with the quantitative analysis offered by the new technologies. This will be carried out through collaboration with clinical personnel at INAIL Centro Protesi.</li> <li>3. Use the developed method to contribute to benchmark the performance of Rehab/IIT new prostheses (Knee, Foot), in comparison with the main commercial devices</li> <li>4. Based on the previous objectives, the final goal is hence the Validation of a novel method to evaluate the gait patterns in lower limb amputees, which is going to be used to evaluate the biomechanical benefits brought by the new Rehab/IIT Knee and Foot prostheses.</li> </ol>
<p><b>Skills and competencies for the development of the activity</b></p>	<ul style="list-style-type: none"> <li>• MSc in Biomechanical Engineering or Mechanical Engineering</li> <li>• Matlab &amp; Simulink;</li> <li>• Knowledge of Motion Capture systems;</li> <li>• Big Data processing;</li> </ul>