POLITECNICO DI MILANO

PhD in INGEGNERIA MECCANICA / MECHANICAL ENGINEERING - 41st cycle

INTERDISCIPLINARY Research Field: OBJECTIVE ABILITY ASSESSMENT IN PARALYMPIC ATHLETES

Monthly net income of PhDscholarship (max 36 months)
1800.0 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	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**BIOENGINEERING**". See https://www.dottorato.polimi.it/?id=422&L=1 for further information. This PhD project aims to develop an innovative, objective, and multifactorial system for assessing functional ability in Paralympic athletes, leveraging advanced motion analysis and muscle activation monitoring techniques. Thus, the starting point is an in-depth scientific understanding of biomechanics in the context of disability, with the dual purpose of improving classification standards in Paralympic sport and optimizing personalized training strategies.The research is organized into three key phases: (1) modeling and simulating sport-specific movements, (2) designing and validating a robust measurement system, and (3) applying the methodology in real-world experimental settings with athletes. This structured approach will ensure both scientific rigor and practical relevance.The project holds strong relevance for both the scientific and applied domains—particularly within sports science, assistive technology, and rehabilitation. It addresses critical gaps in current evaluation practices by introducing quantitative, reproducible, and scalable assessment tools.The anticipated impact includes fostering greater inclusion in

	competitive and recreational sports for individuals with disabilities, while also enabling more effective, data-driven rehabilitation programs tailored to individual needs.
Methods and techniques that will be developed and used to carry out the research	The PhD will develop an interdisciplinary methodology to develop a comprehensive system for functional assessment. Motion analysis will allow for the continuous monitoring of athletes' movements in both controlled and real-world settings. A multifactorial approach will be employed to extract biomechanical data, including kinematics, kinetics, energy expenditure, and muscle activation patterns.Advanced data analysis techniques, particularly machine learning algorithms, will be used to identify meaningful patterns in motor behaviour and to enable objective classification of functional ability and disability levels. These models will be trained to evaluate movement efficiency, muscular coordination, and compensatory strategies.Computational modelling tools will simulate idealized motor functions, serving as a reference framework to assess deviations in real performance and to identify areas for targeted intervention. The research will also explore individualized, adaptive training strategies aimed at enhancing neuromuscular responses and maximizing athletic performance. Collaboration with sports scientists, rehabilitation experts, and clinicians will ensure the scientific validity and real-world applicability of the methodologies, facilitating the translation of research outcomes into both competitive and therapeutic contexts.
Educational objectives	Through this research, the candidate will acquire in-depth knowledge of human movement analysis, gaining practical skills in the use of motion capture systems, wearable sensors, and surface electromyography (sEMG) for assessing motor performance in real-world and laboratory settings.A key objective of this PhD is to master computational modelling techniques to simulate optimal motor functions and compare them to actual athlete performance, enabling evidence-based assessments. The candidate will also build strong competencies in data science, including machine learning and signal processing, to interpret complex biomechanical and

	physiological datasets. This analytical capacity will support the development of objective classification tools for functional ability in Paralympic athletes.Throughout the program, the doctoral candidate will learn to design and validate experimental protocols involving human participants, while ensuring ethical and methodological rigor. Communication skills will be developed through scientific publications, conference presentations, and interdisciplinary collaboration. The PhD will also enhance the candidate's ability to translate research into practical applications in rehabilitation and athletic training.By critically engaging with existing classification systems and promoting the development of more objective and inclusive models, the PhD will prepare the candidate to contribute meaningfully to both scientific advancement and societal impact.
Job opportunities	This PhD will prepare the candidate for career opportunities in academia, research institutions, and applied fields such as sports science, biomedical engineering, and rehabilitation technology. Potential roles include research scientist, R&D engineer, clinical technologist, or consultant in organizations focused on human performance, assistive devices, or inclusive athletic development.The research could involve collaboration with a range of universities, companies, and institutions that contribute expertise in biomechanics, motion analysis, rehabilitation, and Paralympic sports. Academic partners include the University of Padova's Department of Neurosciences, ETH Zurich's Institute of Biomechanics, Loughborough University's School of Sport, Exercise and Health Sciences, KU Leuven's Department of Movement Sciences, and the Biomechatronics Group at the Massachusetts Institute of Technology. Industrial collaboration is expected with companies such as BTS Bioengineering, Cometa Systems, Motek Medical, and Technogym. Institutional support and potential end-user engagement are foreseen through partnerships with the International Paralympic Committee, the Comitato Italiano Paralimpico (Italian Paralympic Committee), INAIL – Centro Protesi, the Italian National Olympic Committee (CONI), and possibly

	the World Health Organization’s Disability and Rehabilitation team.
Composition of the research group	2 Full Professors 1 Associated Professors 0 Assistant Professors 2 PhD Students
Name of the research directors	Prof. Francesco Braghin, Prof.Manuela Galli

Contacts
For questions about scholarship/support francesco.braghin@polimi.it, manuela.galli@polimi.it, phd-dmec@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
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, fundingfor participation in courses, summer schools, workshops and conferences) for a total amount of € 6.114,50. 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. 750 euro/month- net amount). Additionally, PhD candidates who spend at least 3 months abroad are eligible for an extra reimbursement of €3,000 to cover travel expenses. 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 theteaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.