Scientific/Clinical Workshop

Workshop Title

Modelling and Control Strategies in Lower Limb Exoskeletons for Gait Rehabilitation After Brain Injury

Workshop Responsible

Josep M. Font-Llagunes (Universitat Politècnica de Catalunya, ES)
Joan Lobo-Prat (Able Human Motion, ES)
Laura Marchal-Crespo (TU Delft, NL)
Massimo Sartori (University of Twente, NL)

Speakers

Damiano Zanotto (Stevens Institute of Technology, USA)
Zachary Lerner (Northern Arizona University, USA)
Jaime Duarte (MyoSwiss, CH)
Karen J. Nolan (Kessler Foundation, USA)
Conor Walsh (Harvard University, USA)
Cristina Bayón (University of Twente, NL)
Noel Keijsers (Sint Maartenskliniek, NL)
Mohamed Bouri (EPFL, CH)
Michael Goldfarb (Vanderbilt University, USA)
Jesús de Miguel

Attendee Engagement

Oral presentations

We will organize real-time quizzes through smartphone app (e.g., Kahoot!) during the talks. We will ask each presenter to provide two multiple-choice questions about their presentation. This way, we will keep the attention of the audience.

We will organize discussion rounds combining speakers from different fields (industry, clinical, academia/research). Bringing together all stakeholders is crucial to further develop the field and really bring the technology to people.

Technology showcase

We will showcase real exoskeleton prototypes and related technologies, e.g., wearable sensors. We will set up different desks, one per demonstrator. Workshop participants will be able to move freely across desks and try the different technologies. Each booth will also host some explanatory posters giving more info on the demonstrated technology.

Abstract

Brain injuries, e.g., stroke, cerebral palsy (CP), and traumatic brain injury, are one of the major causes of death and disability worldwide. The global incidence of stroke alone increases by more than 13.7 million new cases each year, being the third leading cause of disability worldwide. Robotics plays a promising role in gait rehabilitation, because it promotes highly intensive and

repetitive training, together with active participation and engagement. Particularly, lower-limb exoskeletons promote task-oriented repetitive movements, muscle strengthening, and movement coordination, which positively impact energy efficiency, gait speed and balance control. The use of data-driven modelling further allows individualized motor function monitoring and clinical decision making. Moreover, such models can be employed for personalizing exoskeleton design and control through neuromusculoskeletal simulations.

The aim of this workshop is to present state-of-the-art works on novel modelling and control approaches for lower-limb exoskeletons for gait neurorehabilitation after brain injury, and studies on their clinical effectiveness. To this end, we plan to bring together different stakeholders, covering clinics, industry and academia, to further develop this field of application. The main topics of the workshop cover:

- Assistive, challenge-based and adaptive control strategies.

- Methodologies for human-robot synchronization.

- Trajectory-tracking and compliant control.

- Neuromuscular control.

- Neuromusculoskeletal modelling and simulation of assisted walking.

- Experimental protocols and metrics used in clinical validation.

- Clinical effectiveness of lower-limb exoskeletons in gait neurorehabilitation.