**Category:** Clinical Application of Technology, Lower Limb

**Workshop Title:** Automated Gait Pattern Facilitation with Advanced Closed-Loop Control Algorithm - Opportunities and Challenges in Clinical Practice

**Workshop Organizer(s):** Juan Pablo Gonzalez Appelgren

**In person Speaker(s):**

- Giffhorn, Matt, Max Näder Lab for Rehabilitation Technologies and Outcomes Research Shirley Ryan AbilityLab, Chicago, IL, USA
- Gonzalez-Appelgren, Juan Pablo, Translational Research Unit, Trainfes Center, Santiago, Chile
- Breen, Kelly, Max Näder Lab for Rehabilitation Technologies and Outcomes Research, Shirley Ryan AbilityLab, Chicago, IL, USA
- Hossiason, Matias, TRAINFES Center, Santiago, Chile
- Covarrubias, Felipe, Translational Research Unit, Trainfes Center, Santiago, Chile; Kesar, Trisha, Division of Physical Therapy, Emory University, Atlanta, GA, USA

**Workshop Time:** 13:45 - 15:15

**Attendee Engagement:**

The basis of this workshop is the practice and resolution of challenges around neurological cases through testing different FES activation patterns up to six channels, for the integration of both, lower and upper extremity, in order to facilitate the gait pattern in diverse conditions. Also we will explore the current evidence about FES home based dosage and therapeutic strategies to improve the adoption of self delivered care.

**Abstract:**

FES systems have been used as neuroprosthetic devices in rehabilitative interventions such as gait training for several years. Stimulator triggers, implemented to control stimulation delivery, range from open-to closed-loop controllers. Finite-state controllers trigger stimulators when specific conditions are met and utilize preset sequences of stimulation. Thus, wearable sensors provide the necessary input to differentiate gait phases during walking and trigger stimulation to specific muscles. This technology has been largely used to improve gait parameters in different populations.

Home based rehabilitation using FES is an option which can help reduce the sequelae of sensorimotor disorders and lends itself as an exciting way for people suffering from various conditions to exercise their muscles and achieve functional goals. Some of the most complex issues to wider adoption of home-based FES use are its ease of use in the home context, the versatility to adopt different intended uses and the activation of different muscles related to the progression of the treatment.

Softwares able to include easy training programs based on well established therapeutic protocols may reduce the gap between laboratory and ecological environments and benefit the use of this kind of devices in a non-supervised training plus the conventional therapies.



In this workshop we will discuss and test different activation patterns for lower extremity, upper extremity and trunk with the purpose of facilitating the gait pattern of individuals with diverse neurological conditions. For this, we will use an FES device that uses a kinematic sensor (IMU based) to trigger patterns of up to six contraction channels simultaneously using automatic algorithms. These algorithms can also adapt the intensity of the stimuli according to the actual pattern, speed and ground slope to obtain the best approximation of a normal gait pattern.

These characteristics lead us to new therapeutic possibilities but also open up more questions that still do not have a definitive answer, which muscles I have to target in different functional stages, what kind of patients benefit the most, what dosage is appropriate for unsupervised activity, among others. We want to discuss the current experiences about FES home based dosage and therapeutic strategies to improve the adoption of self delivered care.

Join us in this challenging and evolving topic!