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Guest Editorial

Functional Electrical Stimulation

Christine Azevedo Coste¹, Milos Popovic², and Winfried Mayr³

In 2016, the International Functional Electrical Stimulation Society (IFESS) celebrated its 20th anniversary. IFESS is promoting research, applications, and understanding of electrical stimulation. This special issue is based on a selection of extended versions of articles that have been presented during the anniversary annual conference in June 2016 in Montpellier/La Grande-Motte, France. They are intended to illustrate the multiple facets of

functional electrical stimulation (FES) and recent advances in the domain. Engineers and clinicians demonstrate here the importance and potential of this very active research field. We have also invited Prof. Dejan Popovic and Dr. Thierry Keller to contribute with an article about IFESS history. The clinical applications presented in this issue cover various contexts: post-stroke hemiplegic upper limb therapy (Malesevic et al. (1), Irimia et al. (2)), complete spinal cord injuries (SCI) assisted cycling (Fonseca et al. (3), Tefertiller and Gerber (4), Andrews et al. (5)), obesity treatment (Lonys et al. (6)), Parkinson's disease (PD) gait assistance (Sijobert et al. (7)), and cerebral palsy (CP) gait assistance (Rose et al. (8)).

In their article, Tefertiller and Gerber present a walking rehabilitation program dedicated to SCI patients. This very comprehensive protocol associates electrical stimulation and ergometry to enhance neurological recovery. Rose et al. discuss the use of multichannel electrical stimulation as a very promising assistive technology to help children with spastic CP achieve a more upright and functional gait. Andrews et al. present their long experience of FES-rowing in SCI patients. The article from Malesevic et al., investigates surface motor activation zones using a multi-pad functional electrical stimulation system to produce selective wrist, finger, and thumb extension movements in therapy sessions involving hemiplegic stroke patients. In their article, Fonseca et al. present an approach for cadence tracking and disturbance rejection in FES cycling in complete paraplegic subjects. Sijobert et al. report a new strategy to assist PD gait through somatosensory cueing based on electrical stimulation of the arch foot in PD gait. Irimia et al., introduce a brain-computer interface to monitor movement imagery to real-time control FES and bar feedback during post stroke hemiplegic patients upper limb training.

Some articles of this issue are concerned with invasive approaches of FES. Lonys et al. present an in vivo validation of a less invasive procedure to stimulate the stomach with a gastrointestinal stimulator implant to activate the loss of weight in obese patients.

Overall the contributions to this special issue demonstrate how versatile FES can act as a beneficial tool for a variety of clinical applications. We are confident that this collection will be interesting for a wide community of researchers and practitioners and hope it will promote awareness for the numerous beneficial options the use of FES in diagnostic and therapeutic applications can provide.

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