Program

13th Vienna International Workshop on Functional Electrical Stimulation

Vienna, Austria, September 23rd-25th, 2019

fesworkshop.org
The triennial “Vienna International Workshop on Functional Electrical Stimulation” provides a platform for researchers to present and discuss their recent work whilst visitors can expect a representative and actual overview of the state of the art of FES.

Conference venue

Haus der Ingenieure
Eschenbachgasse 9, 1010 Vienna
https://www.palais-eschenbach.at/

National organizers

Austrian Society for Biomedical Engineering
"FES group of the Austrian Society for Biomedical Engineering"
W. Mayr, M. Bijak, M. Pichler, H. Lanmüller, D. Rafolt

Contact address

Medical University of Vienna
Center for Medical Physics and Biomedical Engineering
Secretary M. Pichler Phone: +43-1-40400/19840
Waehringer Guertel 18-20/4L, Fax: +43-1-40400/3988
A-1090 Vienna, Austria e-Mail: office@fesworkshop.org

Conference language

The official language of the conference is English

Dates

Come together Coffee 23. Sept. 2019 08:30 - 09:30
Scientific program 23. Sept. 2019 09:30 - 18:00
Scientific program 24. Sept. 2019 08:00 - 18:00
Conference Dinner 24. Sept. 2019 18:00 - 23:00
Post Conference Course 25. Sept. 2019 09:00 - 16:00

Registration fee

Conference € 350,00 / 320,00*
Day Ticket** € 140,00
Post Conference Course € 120,00
* Members of ÖGBMT or IFESS in good standing,
Participants of the “2. Fachtag Elektrotherapie”
** Does not include social activities in the evening
GENERAL INFORMATION

Accompanying persons

| Conference Dinner | € 90,00 | 24. Sept. 2019 |

Methods of payment

Bank transfer, Credit card transfer
or directly at the registration desk (credit card – NO CASH)

The registration fee for the whole conference includes

- Come together coffee
- Coffee breaks, Lunch
- Conference dinner
- Conference proceedings

Day tickets include: Scientific program, coffee breaks, lunch and conference proceedings

Registration Desk

Open throughout the conference:
Monday, 23. Sept. 2019 08:00 - 17:00
Tuesday 24. Sept. 2019 08:00 - 18:00
Wednesday 25. Sept. 2019 08:30 - 14:00

Conference Dinner

24. Sept. 2019
Berghotel Tulbinger Kogel
Tulbingerkogel 1, 3001 Tulbing
www.tulbingerkogel.at

Commercial exhibition

Facilities for exhibition and commercial product presentations are available - interested companies please contact the secretary.
GENERAL INFORMATION

Oral presentation

*Time: 15 minutes*
*(10 minutes presentation and 5 minutes discussion)*

Presentation media

*Beamer and PC for PowerPoint presentations*
*(USB memory stick)*

*Speakers should submit their media 30 minutes prior to the start of their session at the slide desk.*

Poster presentation

*The posters should be exhibited at the assigned poster board during the whole conference. All participants are encouraged to contact the authors during the coffee breaks.*
*Paper size A0, portrait.*

Proceedings of the conference

*The proceedings with full-length papers will be available at the beginning of the workshop.*

Detailed information

*Please find further information at the official conference homepage: fesworkshop.org/13th-workshop-2019*
Scientific Committee

Gad Alon
Brian Andrews
Christine Azevedo Coste
Manfred Bijak
Radu Ciupa
Mihaela Cretu
Glen Davis
Thordur Helgason
Ursula Hofstoetter
Klaus Peter Koch
Hermann Lanmüller
Johannes Martinek
Karen Minassian
Dejan Popović
Frank Rattay
Martin Reichel
Matthias Krenn
Janez Rozman
Stefan Sauermann
Thomas Schauer
Martin Schmoll
Erika G. Spaich
Thomas Stieglitz
Paul Taylor
José Luis Vargas Luna
Michael Willand
Keynote Lecture:
Chairperson: Gad Alon (Maryland, USA)

09:30 – 10:00
Ines Bersch-Porada (Lucern, Switzerland)
APPLICATIONS OF FES IN MOVEMENT REHABILITATION IN SCI

Session 1

Chairpersons: Milan Dimitrijevic (Houston, USA)
              Justin Brown (Harvard, USA)

10:00
Milan Dimitrijevic (Houston, USA)
INTRODUCTION TO THE TOPIC

10:05
Andreas Schicketmueller et al (Magdeburg, Germany)
SENSOR BASED MOVEMENT DETECTION FOR FUNCTIONAL ELECTRICAL STIMULATION DURING END-EFFECTOR GAIT REHABILITATION

10:20
Dejan Popović et al (Belgrade, Serbia)
The Finite State Control of Stimulation Synergy Based on Data From the Instrumented Shoe Insole

10:35
Marion Gosperrin et al (Lausanne, Switzerland)
AN EMG-CONTROLLED SYSTEM COMBINING FES AND A SOFT EXOSKELETON GLOVE FOR HAND REHABILITATION OF STROKE PATIENTS

10:50
Ursula Hofstoetter et al (Vienna, Austria)
NONINVASIVE SPINAL CORD STIMULATION IMPROVES WALKING PERFORMANCE IN AN INDIVIDUAL WITH MULTIPLE SCLEROSIS

11:05
Max Haberbusch et al (Vienna, Austria)
INVESTIGATION ON THE INTERACTION OF MONOSYNAPTIC AND POLYSYNAPTIC ACTIVITY UNDERLYING POSTERIOR ROOT REFLEXES

11:20
Guðrún Magnúsdóttir et al (Reykjavík, Iceland)
COMPARISON OF RESULTS FROM A SPASTICITY ASSESSMENT OF THE ANKLE JOINT USING THE TARDIEU SCALE AND EMG ACTIVITY RECORDED SIMULTANEOUSLY IN STROKE PATIENTS
11:35  Katsuhiro Nishino (Akita, Japan)
SPINAL CORD STIMULATION FOR ENHANCING MOTOR RECOVERY
AFTER STROKE AND IMPROVING CHRONIC PAIN: IDENTIFYING
RESPONDERS USING KETAMINE AND MAGNETIC STIMULATION

11:50  Justin Brown (Harvard, USA)
RECONSTRUCTIVE NEUROSURGERY FOR RESTORATION OF FUNCTION
FOLLOWING SCI

12:05  Milan Dimitrijevic (Houston, USA)
SUMMARY

12:15-13:30  Lunch

**Special Session 2**

**WEARPLEX: European multidisciplinary Research and Innovation Action on WEARable multiPLEXed biomedical electrodes**

Chairpersons:  Thierry Keller (San Sebastian, Spain)
               Russel Torah (Southampton, UK)

13:30  Milos Kostic et al (Belgrade, Serbia)
INTRODUCTION OF EU-H2020 PROJECT WEARPLEX - WEARABLE
MULTIPLEXED BIOMEDICAL ELECTRODES

13:42  Russel Torah (Southampton, UK)
PRINTED ELECTRODE STRUCTURES FOR BIO-POTENTIAL MONITORING
IN WEARABLE E-TEXTILE GARMENTS

13:54  Erik Hernandez Jimenez (San Sebastian, Spain)
CLASS: PLATFORM FOR STIMULATION AND RECORDING VIA
WEARABLE MULTIPLEXED ELECTRODES

14:06  Matija Strbac (Belgrade, Serbia)
CUSTOM DESIGN OF MULTI-ELECTRODE ARRAYS FOR STIMULATION
AND RECORDING APPLICATIONS

14:18  Peter Andersson Ersman (Norrköping, Sweden)
SCREEN PRINTED ORGANIC ELECTROCHEMICAL TRANSISTORS FOR
RECORDING AND STIMULATION APPLICATIONS

14:30  Luis Pelaez Murciego (Aalborg, Denmark)
MUSCLE PATTERNS IN HIGH-DENSITY EMG RECORDED DURING
GRASPING IN DIFFERENT ARM POSITIONS
<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker</th>
<th>Topic</th>
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<tbody>
<tr>
<td>14:42</td>
<td>Nikola Perinka (Leioa, Spain)</td>
<td>DEVELOPMENT OF NEW FUNCTIONAL INKS FOR BIO-MONITORING APPLICATIONS</td>
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<tr>
<td>14:54</td>
<td>Abiodun Komolafe (Southampton, UK)</td>
<td>INTEGRATION OF FLEXIBLE CIRCUITS IN TEXTILES FOR WEARABLE HEALTH MONITORING</td>
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<tr>
<td>15:06</td>
<td>Jenni Isotalo (Oulu, Finland)</td>
<td>EXPERIENCES IN SCALE-UP MANUFACTURING OF PRINTED MEDICAL DEVICES</td>
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<tr>
<td>15:18</td>
<td>Russel Torah (Southampton, UK)</td>
<td>INTEGRATION OF WEARPLEX TECHNOLOGY AND DEVELOPMENT OF ALPHA PROTOTYPES OF WEARPLEX ELECTRODES</td>
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<td>15:30-16:00</td>
<td>Coffee Break</td>
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Session 3

**Aging, dystrophic and denervated Muscle**

Chairpersons: Stanley Salmons (Liverpool, UK)  
Markus Gugatschka (Graz, Austria)

16:00  Ugo Carraro et al (Padova, Italy)
HOME BASED FUNCTIONAL ELECTRICAL STIMULATION FOR EARLY-AGING AND AGING, A NARRATIVE REVIEW

16:15  Markus Gugatschka (Graz, Austria)
FES FOR TREATMENT OF AGE RELATED LARYNGEAL MUSCLE ATROPHY

16:30  Feliciano Protasi (Chieti, Italy)
TREATMENT OF CENTRAL CORE DISEASE WITH FUNCTIONAL ELECTRICAL STIMULATION: A CASE REPORT.

16:45  Berit Schneider-Stickler, et al (Vienna, Austria)
SELECTIVE SURFACE STIMULATION IN UNILATERAL VOCAL FOLD PARALYSIS (UVFP)

17:00  Gerd Fabian Volk et al (Jena, Germany)
LONG-TERM HOME-BASED SURFACE ELECTROSTIMULATION IS USEFUL TO PREVENT ATROPHY IN DENERVATED FACIAL MUSCLES.

17:15  Gad Alon (Maryland, USA)
OBSTETRIC BRACHIAL PLEXUS INJURY (OBPI): IS FUNCTIONAL ELECTRICAL STIMULATION (FES) A VIABLE INTERVENTION OPTION?

**ÖGBMT**

**Talk of Stefan-Schuy prize winner**

**General Assembly**

18:00  Mathias Tschaikner (Graz, Austria)
Development of a Single-Site Device for Conjoined Glucose Sensing and Insulin Delivery in Type 1 Diabetes Patients

followed by  General assembly ÖGBMT
Tuesday 24.09.2019

**Keynote Lecture**

Chairperson: Thomas Schauer (Berlin, Germany)

08:00 – 08:30 Francesco Moscato (Vienna, Austria)

PERPECTIVES OF ADDITIVE MANUFACTURING FOR PROSTHETIC INSTRUMENTATION

**Advanced Biosignal Analysis**

Chairpersons: Paolo Gargiulo (Reykjavík, Iceland)
Martin Schmoll (Vienna, Austria)

08:30 Lukas Wiedemann et al (Auckland, New Zealand)

DECOMPOSITION OF HDEMG DATA OF A CHILD WITH SPASTIC CEREBRAL PALSY: A CASE STUDY PRE AND POST BONT-A TREATMENT

08:45 Paolo Gargiulo et al (Reykjavík, Iceland)

USE OF HIGH DENSITY EEG TO ASSESS SCHIZOPHRENIC PATIENTS UNDERGOING TMS TREATMENT: N100-P300 ERP COMPLEX

09:00 Manfred Bijak et al (Vienna Austria)

SKIN IMPEDANCE IS A RELIABLE PARAMETER FOR AROUSAL MONITORING (STRESS MONITORING)

09:15 Halldór Kárason et al (Reykjavík, Iceland)

FREQUENCY ANALYSIS OF EMG SIGNALS FROM THE TRICEPS SURAE MUSCLE IN ACHILLES TENDON TESTS BY STROKE PATIENTS IN TCS TREATMENT.

09:30 Martin Baumgartner et al (Vienna, Austria)

EFFECTS OF MUSCLE FATIGUING SEMG DATA ON THE CLASSIFICATION ACCURACY OF A NONLINEAR MYOELECTRIC CONTROL CLASSIFIER

09:45 Weerayot Aramphanlert et al (Vienna, Austria)

SURFACE EMG BASED MUSCLE FATIGUE LEVEL ESTIMATION

10:00-10:30 Coffee Break
Session 5

Early Career Panel Discussion
Chairperson: Johannes Martinek (Vienna, Austria)

10:30 – 12:00 Organised by
Alexandra Gülich (Vienna, Austria)
Hunor Kertesz (Vienna, Austria)
Matthias Scherer (Vienna, Austria)

12:00-13:30 Lunch

Key Keynote Lecture
Chairperson: Nico Rijkhoff (Aalborg, Denmark)

13:30 Sean Doherty (London, UK)
NEUROMODULATION OF NEUROGENIC BLADDER DYSFUNCTION

Session 6

Parameters and Technology
Chairpersons: Jonathan Jarvis (Liverpool, UK)
Hermann Lanmüller (Vienna, Austria)

14:00 Nico Rijkhoff et al (Aalborg, Denmark)
A PERCUTANEOUS ELECTRODE FOR DORSAL GENITAL NERVE STIMULATION; COMPARISON WITH A SURFACE ELECTRODE

14:15 Janez Rozman et al (Ljubljana, Slovenia)
MULTI-CHANNEL TRANSCUTANEOUS AURICULAR NERVE STIMULATION

14:30 Steffen Eickhoff et al (Liverpool, UK)
INFLUENCE OF ELECTRODE CONFIGURATION ON THE EFFECT OF SUBTHRESHOLD PRE-PULSES: AN EXPLANATION FOR TWO DECADES OF CONFLICTING DATA
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<tr>
<th>Time</th>
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<th>Title</th>
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<tr>
<td>14:45</td>
<td>Narrendar Ravichandran et al (Auckland, NZ)</td>
<td>A COMPUTATIONAL MODEL FOR NEUROMUSCULAR ELECTRICAL STIMULATION - FEATURING EXCITATION CONTRACTION DYNAMICS</td>
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<tr>
<td>15:00</td>
<td>Markus Valtin et al (Berlin, Germany)</td>
<td>FES TESTBED FOR MULTI-CHANNEL TRANSCUTANEOUS STIMULATION SYSTEMS</td>
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<tr>
<td>15:15</td>
<td>Constantin Wiesener et al (Berlin, Germany)</td>
<td>CURRENT-CONTROLLED STIMULATOR WITH VARIABLE HIGH VOLTAGE GENERATION</td>
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<td>15:30</td>
<td>Eduardo Villar Ortega et al (Bern, Switzerland)</td>
<td>HIGH-FREQUENCY TRANSCUTANEOUS CERVICAL ELECTRICAL STIMULATION: A PILOT STUDY</td>
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<td>15:45</td>
<td>Christoph Kast et al (Vienna, Austria)</td>
<td>SHORT IMPULSE STIMULATION FOR PREDOMINANT ACTIVATION OF PROPRIORCEPTIVE AFFERENTS</td>
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<td>16:00 – 16:30</td>
<td>Coffee Break</td>
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**Hybrid systems for exercising cyclic functional movements**

Chairpersons: Dejan Popović (Belgrade, Serbia)  
Jozsef Laczko (Budapest, Hungary)

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<tr>
<td>16:30</td>
<td>Dejan Popović (Belgrade, Serbia)</td>
<td>THE ROLE OF FUNCTIONAL ELECTRICAL STIMULATION IN HYBRID SYSTEMS FOR REHABILITATION</td>
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<tr>
<td>16:45</td>
<td>Mayr Winfried (Vienna, Austria)</td>
<td>STIMULATION PARAMETERS FOR CYCLING IN PERSONS WITH DENERVATED AND ATROPHIED MUSCLES DUE TO THE INJURY OF THE CENTRAL NERVOUS SYSTEM</td>
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<td>17:00</td>
<td>Laczko Jozsef (Budapest, Hungary)</td>
<td>THE IMPORTANCE OF MODELING FOR CONTROL OF ELECTRICAL STIMULATION FOR CYCLING</td>
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<td>17:15</td>
<td>Lana Popović Maneski et al (Belgrade, Serbia)</td>
<td>FES CYCLING IN PERSONS WITH PARALYZED LEGS: FORCE FEEDBACK FOR SETUP AND CONTROL</td>
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<td>17:30</td>
<td>Alexander Kohlreider (Austria)</td>
<td>THE DEVELOPMENT OF ROBOTIC PLATFORMS FOR SUPPORTING THE EXERCISE OF PARALYZED LEGS</td>
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<tr>
<td>17:45</td>
<td>Mariann Percze-Mravcsik et al (Pecs, Hungary)</td>
<td>TRICYCLING BY FES OF QUADRICEPS MUSCLES LEADS TO INCREASED CYCLING SPEED OVER SERIES OF TRAININGS OF PERSONS WITH FLACCID PARAPLEGIA</td>
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<td>18:00</td>
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<td>Conference Dinner</td>
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Wednesday 25.09.2019

**PCC 1**

*Post-Conference Courses*

09:00 - 10:30  **Introduction the Workshops**

10:30 – 11:00  **Coffee Break**

11:00 - 12:00  **Introduction to Exhibition**

12:00-13:00  **Lunch**

13:00 – 16:00  **Workshops**

are in the same room, you switch any time according to your interest

**PCC 2a**

*Additive Manufacturing: In the scope of FES and Rehabilitation*

Ewald Unger, Francesco Moscato

Additive Manufacturing (AM), colloquially known as 3D-Printing, has been established in our hospital in the past years. By definition this technology can produce three-dimensional parts by deposition and binding of multiple materials on a layer-by-layer basis. AM technology can be categorized in different processes depending on the material used, ranging from polymers, ceramics as well as metals and biological materials, and on the binding method, ranging from gluing, to photopolymerization and laser melting. Within our post-conference workshop we will give you an overview about our 3d-printing infrastructure, which is based on the project "Additive Manufacturing for Medical Research, M3dRES", founded by the Austrian Research Promotion Agency (FFG).
You will have a backstage view to our work, running projects and hurdles to establish a 3D-Laboratory inside a hospital. You will have the possibility to get an overview about the typical workflow to create medical models based on any medical imaging during an hands on training by using our rendering software USL-Mimics (Materialise).

We will be pleased to help you designing your own patient-specific application in FES.
Looking forward to see you at the workshop!

**FES in Spinal Cord Injury**

Ines Bersch-Porada, Jose Luis Vargas Luna, Winfried Mayr

FES provides a whole spectrum of options for support of movement rehabilitation in spinal cord injury. Due to individualization of the residual profile of motor control after injury and functional changes over time personalization, based on regular assessment, is essential ofr intervention planning and follow-up monitoring. Further, available and affordable equipment is to be selected and applied in best possible compliance with daily activities of the user.

The course focuses on non-invasive options and will discuss and demonstrate examples for amelioration of spasticity, support of restoration of movement, maintenance of cardiovascular fitness, and prevention of pressure sores and osteoporosis. Technical, physiological and clinical aspects of stimulation of afferent and efferent nerves as well as direct stimulation of denervated muscles will be addressed in view of realistic benefit, safety and limitations. A theoretical introduction part and subsequent application oriented hands-on demonstrations will convey basic practice and have room for continuous interactive discussion.
The workshop is structured to have a theoretical introduction and subsequent application oriented hands-on demonstrations. The workshop is planned to include continuous interactive discussion.

The workshop will focus on non-invasive options for the control of paralyzed arm-hand complex after the central nervous system lesion (brain lesion, cervical lesion of the spinal cord, and similar).

The workshop starts with theory describing the principle of the operation of functional activation of paralyzed muscles by means of electrical field and differences between the use of transcutaneous and implantable technologies. The results on the efficacy of FES augmented manipulation and grasping, with the emphasis on what were the limitations of the systems applied, will follow. The main questions that will be answered deal with methods to provide sufficient selectivity, minimize muscle fatigue, and have the control that matches the needs of users.

The practical part will be a demonstration of the strategies and limitations of the surface activation of arm muscles to support the exercise, manipulation and exercise. The presentation will include the activation of sensory pathways for possible feedback applications. An interesting example will be described where the FES technology can be used for the reduction of tremor.

The practical part will be with the new stimulators MOTIMOVE (https://www.3-x-f.com/products.php) and UNAFET stimulators used in clinical trials for therapy persons after stroke and spinal cord lesion at the cervical level.
Electrode suit for afferent multi-channel nerve-stimulation for augmentation of movement in children with CP

Fredrik Lundquist

The aim of the course is to give insight and knowledge in how multi-channel afferent nerve stimulation can be a helpful tool in augmenting and improving movement and body position in children suffering from cerebral palsy. The whole-body system Mollii gives the rehabilitation specialists the possibility to pinpoint, and work with, specific steps in the complex process of pediatric neurorehabilitation. Pre/post stimulation videos of children using the Mollii-electrode suit system will be presented and discussed during the course.
We acknowledge the support by:

Edited by:
Paul S. Malchesky, D. Eng.

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