# PROGRAM BOOKLET
## REHAB WEEK ZURICH 2011

Rehab Week Zurich 2011 - One week. Three conferences.
INRS 2011 - International Neurorehabilitation Symposium 2011
ICVR 2011 - International Conference on Virtual Rehabilitation 2011
ICORR 2011 - IEEE International Conference on Rehabilitation Robotics 2011

June 27 to July 1, 2011
ETH Zurich, Science City
Zurich, Switzerland

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## Dear Delegates,

It is with great pleasure that we would like to welcome you to Rehab Week Zurich. For the first time ever three leading international rehabilitation conferences are uniting to create what is probably the largest ever interdisciplinary gathering of experts in clinical and technological aspects of rehabilitation.

The combination of several factors made this unique concept of Rehab Week Zurich possible. The organizing committee enjoys significant support from many research groups within the University of Zurich and the ETH Zurich, from funding bodies such as the Swiss National Science Foundation and the Swiss National Center for Competence in Research in Neural Plasticity and Repair, as well as from an extensive clinical network with leading hospitals in Zurich and the region. In addition, Zurich has an active rehabilitation industry with companies such as Hocoma that are committed to apply the results of our research to clinical practice with high-quality products. The activities in research, education, patient care and industry are coordinated via the Neuroscience Center Zurich (ZNZ) and the Rehabilitation Initiative and Technology Platform Zurich (RITZ) in order to exploit synergies, optimize knowledge transfer and stimulate interaction. These elements have all made it possible for us to collectively take on the extremely challenging but also rewarding task of creating Rehab Week Zurich.

During your time in Zurich, we hope that apart from the congress you will experience and enjoy the lifestyle that regularly places Zurich at the top of rankings of the world's most liveable cities. In particular, the Gala Dinner taking place directly at the beautiful lake of Zurich promises to be an unforgettable event. If you are coming from abroad, we highly recommend that you take the opportunity to visit some of Switzerland's famous mountains and lakes.

We would like to thank you for participating in Rehab Week Zurich and for contributing to the atmosphere of collegial, lively and rewarding interactions that we feel certain will unfold during the event. We are looking forward to sharing an exciting, intellectually stimulating and enjoyable week with you.

Gery Colombo
General Chair
International Neurorehabilitation Symposium 2011

Kynan Eng
General Chair
International Conference on Virtual Rehabilitation 2011

Robert Riener
General Chair
International Conference on Rehabilitation Robotics 2011

## One Week, Three Conferences

### INRS 2011 - International Neurorehabilitation Symposium 2011

The INRS is an international conference organized in Zurich since 2004. World class clinicians present and discuss the progress in the field of neurorehabilitation. The focus of the conference will be on new technologies in neurorehabilitation, the latest evidence based research and hands-on workshops.

www.inrs2011.com

### ICVR 2011 - International Conference on Virtual Rehabilitation 2011

The ICVR is a biennual international conference that provides an overview of novel technological and clinical developments in the field of virtual reality and augmented reality applied to rehabilitation. This conference will focus in particular on clinical validation studies, low-cost systems, avatars and Internet-enabled tele-rehabilitation.

www.virtual-rehab.org

### ICORR 2011 - 2011 IEEE International Conference on Rehabilitation Robotics

The ICORR is a biennial international IEEE conference that highlights the latest results from world leading research labs and clinics in the fields of rehabilitation robotics. A special focus will be on clinical evaluation and promotion of interaction between engineers, clinicians and therapists. The conference will also include patient and caregiver testimonials as well as sessions about standardization of technology, technology transfer, and assessment tools.

www.icorr2011.com

# Comittees

## INRS

*Executive Committee*

- Gery Colombo, General Chair
- Andreas Luft, Co-Chair and Scientific Chair
- Silvestro Micera, Co-Chair and Scientific Chair
- Zev Rymer, Scientific Co-Chair
- Irin Maier, Scientific Co-Chair

## ICVR

*Executive Committee*

- Karin Bruetsch, Workshop & Tutorials Chairs
- Rena De Zanet, Exhibits Chair
- Kynan Eng, General Chair
- Emily Keshner, Program Chair
- Daniel Kiper, Local Organizing Committee
- Hristiyan Kourtev, Web Chair
- Belinda Lange, Workshop & Tutorials Chairs
- David Lawrence, Finance Chair
- Mindy Levin, Awards Committee Chair
- Pawel Pyk, Local Organizing Committee
- Daniel Thalmann, Program & Proceedings Chair
- Michael Villiger, Local Organizing Committee
- Patrice (Tamar) Weiss, General Co-Chair

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- Sue Cobb, Nottingham University, UK
- Rosa Costa, Rio de Janeiro State University, Brazil
- Joyce Fung, McGill University, Canada
- Emily Keshner, Temple University, USA
- Albert (Skip) Rizzo, University of Southern California, USA
- Daniel Thalmann, Ecole Polytechnique Federale de Lausanne, Switzerland
- Patrice (Tamar) Weiss, University of Haifa, Israel

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- Katherine August
- Sergi Bermudez i Badia
- Jürgen Broeren
- Karin Brütsch
- Grigore (Greg) Burdea
- Yiyu Cai
- Monica Cameirao
- Rosa Costa
- Judith Deutsch
- Ruty Dickstein
- Assaf Dvorkin
- Kynan Eng

- Joyce Fung
- Roger Gassert
- Jerome Grapinet
- Marie-Claude Hepp-Reymond
- Bruno Herbelin
- Maureen Holden
- Lisa Holper
- Michelle Johnson
- Hannes Kaufmann
- Robert Kenyon
- Emily Keshner
- Daniel Kiper
- Rachel Kizony
- Evelyne Klinger
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- Belinda Lange
- Mindy Levin
- Lars Luenenburger
- Andreas Luft
- Liliane Machado
- Alma Merians
- Francesca Morganti
- James Patton
- Pawel Pyk
- Debbie Rand
- Robert Riener
- Albert (Skip) Rizzo
- Patrick Sparto
- James Sulzer
- Heidi Sveistrup
- Daniel Thalmann
- Frederic Vexo
- Patrice (Tamar) Weiss
- Sue Whitney
- Peter Wilson
- W. Geoffrey Wright

*Award Sponsors*

Conference awards will be given to the best submissions in the categories listed below. These awards have been made possible by the generous support of our award sponsors.

Hocoma

Best Paper

YouRehab

Best Poster

ISVR
International Society for Virtual Rehabilitation

Best Student Paper
Best Student Poster

*ICVR Event Support*

ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

University of Zurich[UZH]

RITZ

Neural Plasticity and Repair
National Center of Competence in Research

ISVR
International Society for Virtual Rehabilitation

**ICORR**

*Executive Committee*

- Roger Gassert, Co-Chair and Scientific Chair
- Just Herder, Scientific Co-Chair
- Silvestro Micera, Award Chair
- Robert Riener, General Chair
- Peter Wolf, Local Arrangement Chair & Finance Chair

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- Bart Driessen, TNO, The Netherlands
- Roger Gassert, ETH Zurich, Switzerland
- Gert Jan Gelderblom, iRv, The Netherlands
- Axel Graeser, University of Bremen, Germany
- William Harwin, University of Reading, UK
- Just Herder, TU Delft, The Netherlands
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- Yoky Matsuoka, University of Washington, USA
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- Kiyoshi Nagai, Ritsumeikan University, Japan
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- Dimitar Stefanov, Coventry University, UK
- Noriyuki Tejima, Ritsumeikan University, Japan
- Machiel Van der Loos, University of British Columbia, Canada

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- Marc Bolliger, Balgrist University Hospital, Switzerland

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- Charles G Burgar, Rice University, USA
- Jane Burridge, University of Southampton, UK
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- Armin Curt, Balgrist University Hospital, Switzerland
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- Jules P. Dewald, Northwestern University, USA
- Yasin Dhaher, RIC, USA
- Volker Dietz, Balgrist University Hospital, Switzerland
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- Xiaodong Zhang, Xi'an Jiaotong University, China

*ICORR event support*

IEEE EMB

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

University of Zurich[UZH]

robotics

Swiss National Centre of Competence in Research

tecnalia Inspiring Business

RITZ

Neural Plasticity and Repair
National Center of Competence in Research

**Rehab Week Volunteer Support Staff**

- Kit August, Institut of Neuroinformatics, ETH Zurich and University of Zurich
- Maria Laura Blefari, RELAB, ETH Zurich
- Johannes Brand, Institut of Neuroinformatics, ETH Zurich and University of Zurich
- Julia Bühlmeier, Hocoma
- Edith Chevrier, Institut of Neuroinformatics, ETH Zurich and University of Zurich
- Arash Dodge, Hocoma
- Alex Duschau-Wicke, Hocoma
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- Annegret Elmsheuser, Hocoma
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- Michael Villiger, Institut of Neuroinformatics, ETH Zurich and University of Zurich
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- Martin Wieser, SMS-Lab, ETH Zurich and University of Zurich
- Dario Wyss, SMS-Lab, ETH Zurich and University of Zurich
- Lukas Zimmerli, Hocoma
- Raphael Zimmermann, RELAB, ETH Zurich

# Conference Location

## About Zurich

Zurich is a cosmopolitan city in the heart of Europe and is located on a clear lake surrounded by beautiful mountains. It embraces history, heritage, culture and art with rich cultural influences and diversity. Zurich offers culinary highlights, unlimited shopping pleasure, over 50 museums and more than 100 art galleries and Switzerland's liveliest nightlife.

Being the home of many leading research and development centers, Zurich has world-class expertise in different scientific communities, such as the RITZ (Rehabilitation Initiative and Technology Platform Zurich). The RITZ is a Zurich-wide platform supporting research and knowledge exchange in the patient's best interest. The platform aims to find and exploit synergies, optimize knowledge transfer and stimulate the interaction of basic neuroscience, engineering and clinical sciences in research, education and patient care.

## Further Information

*Weather*
Zurich has a humid continental climate with four distinct seasons. One of the best times of the year for visiting Zurich is between June and September. During these summer months the average daytime temperature is around 22°C. Rainfall is spread throughout the year, with slightly higher levels of rainfall during summer than during winter.

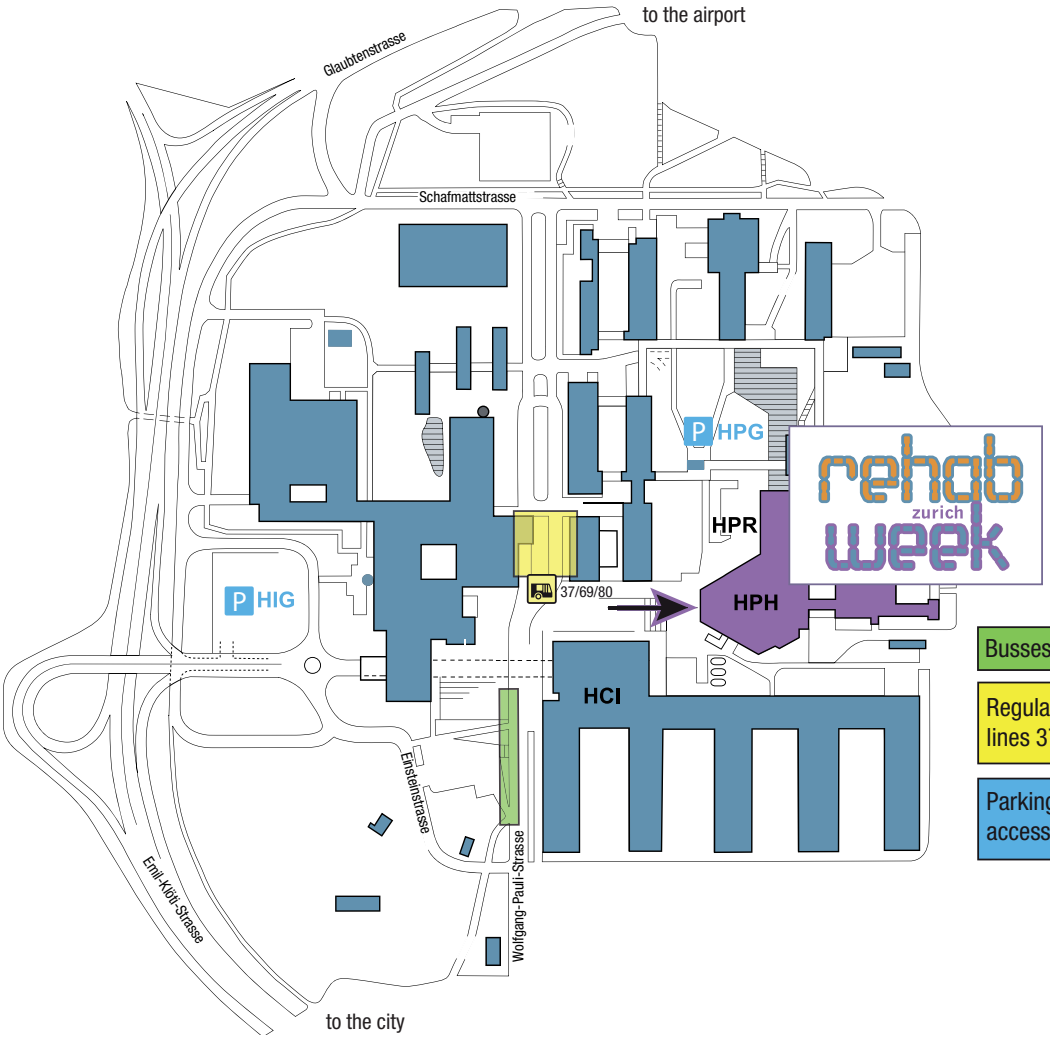
*Currency*
The official currency is the Swiss Franc (CHF). Most banks are open from Monday to Friday between 09h00 and 16h30. On Saturdays and Sundays banks are closed.

*Time zone*
Zurich is located in the Central European Time Zone (GMT + 1 during wintertime, GMT +2 during summertime)

*Shopping*
Most shops are open from Monday to Friday between 9h00 and 20h00 and on Saturday between 9h00 and 17h00. International and luxury brands are located on the Bahnhofsstrasse and trendy and traditional stores are located in the Old Town, on both sides of the Limmat river.

## Congress Venue: Science City

ETH Zurich is one of the most prestigious scientific and technical universities in the world. It provides an ideal environment for education and research. Since 2003, ETH has been steadily developing its Science City university campus on the Hönggerberg site. Science City is a model university for the 21st century and sees itself as a place where science, business and the general public come together. A city district for a “Thinkers’ Culture” is being created, where students, researchers and visitors can meet and realise new ideas. The congress will take place in the building HPH of Science City, ETH campus Hönggerberg.




Busses to social event

Regular bus stop, „ETH Hönggerberg“, lines 37 69 80

Parking garages HIG and HPG accessible via „Emil-Klöti-Strasse“

## Address

ETH Science City Hönggerberg
Building HPH
Wolfgang-Pauli Strasse 14
8093 Zürich

## Getting Around

*From Zurich main station to the congress venue*
There are several options to get from the Zurich main station to the congress venue:

- S-Bahn (lines 2, 5, 6, 7, 8, 14, 16) to “Bahnhof Oerlikon”; bus 80 (direction “Triemlispital”) from “Bahnhof Oerlikon Nord” to bus stop “ETH Hönggerberg”. Journey time: about 25 minutes.
- Tram 11 (direction “Auzelg”) to “Bucheggplatz”, from there by bus 69 (direction “ETH Hönggerberg”) to the terminal stop. Journey time: about 25 minutes.
- Tram 14 (direction “Seebach”) to “Milchbuck”, from there by bus 69 (direction “ETH Hönggerberg”) to the terminal stop. Journey time: about 25 minutes.

You need a valid ticket for Zone 10 (“Stadt Zürich”). Depending on your needs, you can buy a day ticket (“Tageskarte”) valid for 24 hours for all trams and buses.

*From station “ETH Zentrum” to the congress venue*
- Tram 9 (direction “Hirzenbach”) or Tram 10 (direction “Zürich Flughafen”) to “Milchbuck”, from there by to the terminal stop. Journey time: about 25 minutes.

You need a valid ticket for zone 10 (“Stadt Zürich”). Depending on your needs, you can buy a day ticket (“Tageskarte”) valid for 24 hours for all trams and buses.

*From Zurich airport to the congress venue*
- S-Bahn S2 (direction “Ziegelbrücke”) or S16 (direction “Meilen”) to “Bahnhof Oerlikon”, from “Bahnhof Oerlikon Nord” by bus 80 (direction “Triemlispital”) to the bus stop “ETH Hönggerberg”. Journey time: about 20 minutes.

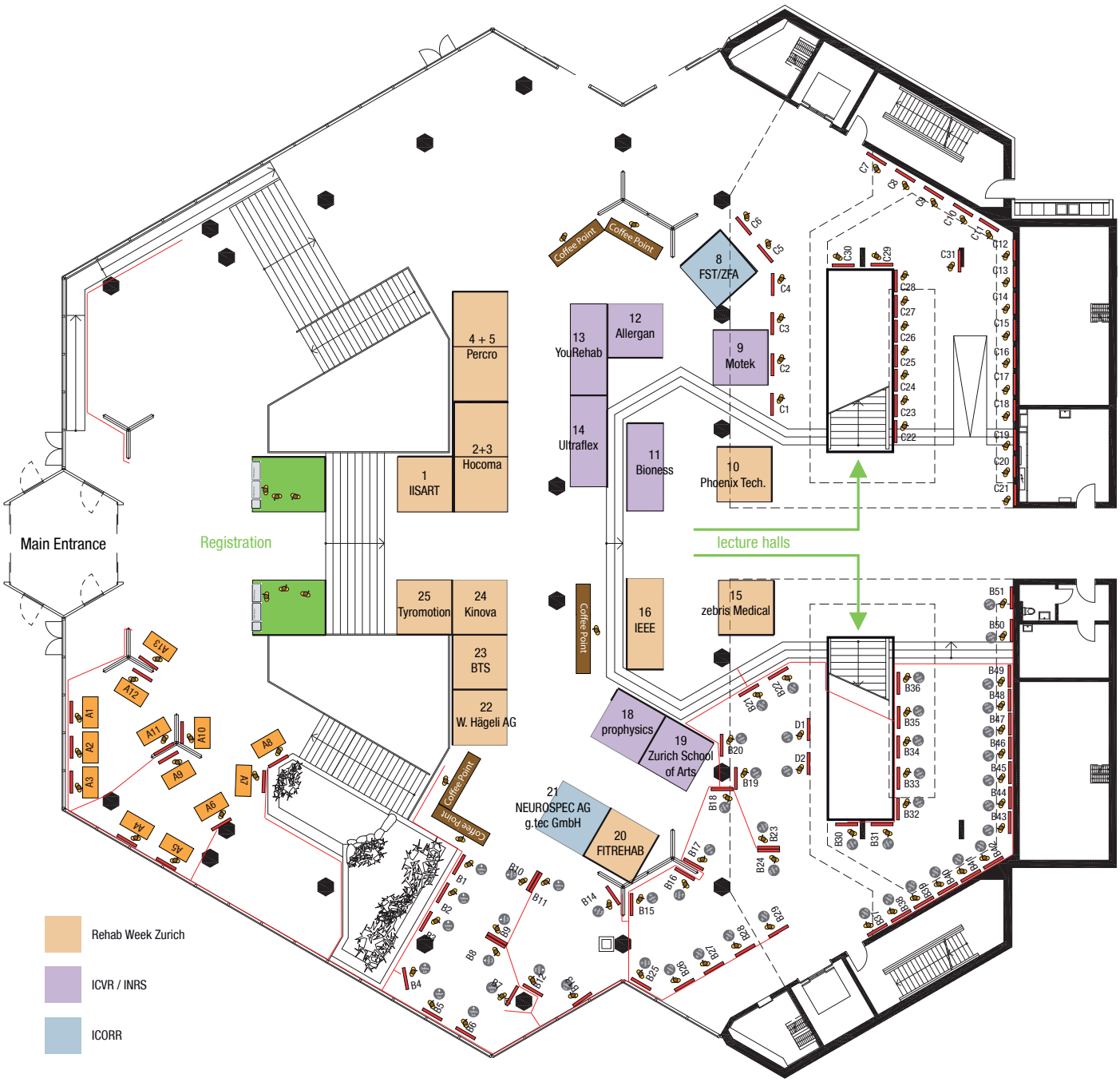
You need a valid ticket for 3 zones. Depending on your needs, you can buy a day ticket (“Tageskarte”) valid for 24 hours for all trams and buses.

*Selection of Zurich taxis*
Züritaxi: +41 (0)44 222 22 22
Taxi 444: +41 (0)44 444 44 44
Alpha Taxi: +41 (0)44 777 77 77

Please note that travelling by taxi is very expensive in Zurich. A taxi from the congress venue to the main station costs between CHF 40-50 depending on the traffic situation.

# Congress Information

## Exhibition Area and Posters Plan



## Exhibitor List

*Rehab Week Zurich 2011 (June 27 – July 1, 2011)*

| | | |
|---|---|---|
| BTS S.A. | Booth 23 | www.btsbioengineering.com |
| FITREHAB project | Booth 20 | www.innovation4welfare.eu |
| W. Hägeli AG | Booth 22 | www.haegeli-orthopaedie.ch |
| Hocoma | Booth 2 & 3 | www.hocoma.com |
| IEEE | Booth 16 | www.embs.org |
| IISART | Booth 1 | www.iisartonline.org |
| Kinova | Booth 24 | www.kinovatechnology.com |
| PERCRO - Scuola Superiore Sant'Anna | Booth 4 & 5 | www.percro.org |
| Phoenix Technologies Inc. | Booth 10 | www.ptiphoenix.com |
| Tyromotion GmbH | Booth 25 | www.tyromotion.com |
| zebris Medical GmbH | Booth 15 | www.zebris.de |

*INRS / ICVR 2011 (June 27 – June 29, 2011)*

| | | |
|---|---|---|
| Allergan AG | Booth 12 | www.allergan.com |
| Bioness | Booth 11 | www.bioness.com |
| Motek Medical B.V | Booth 9 | www.motekmedical.com |
| prophysics AG | Booth 18 | www.prophysics.ch |
| Ultraflex Europe by Dirame | Booth 14 | www.dirame.be |
| YouRehab AG | Booth 13 | www.yourehab.com |
| Zurich School of Arts | Booth 19 | www.zhdk.ch |

*ICORR 2011 (June 29 – July 1, 2011)*

| | | |
|---|---|---|
| FST / ZFA | Booth 8 | www.fst.ch / www.access-for-all.ch |
| NEUROSPEC AG / g.tec GmbH | Booth 21 | www.neurospec.com / www.gtec.at |

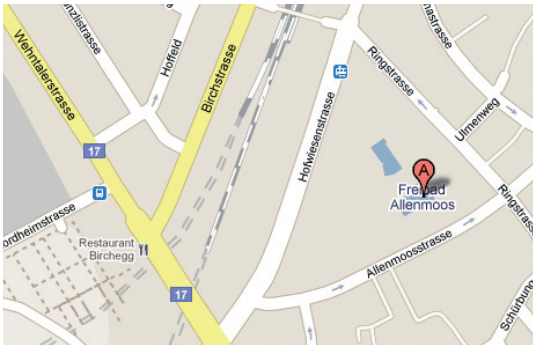
## Important to know

- Presentations: All speakers are kindly requested to upload and check their presentations in the Speaker Ready Room, which is next to the room G5. Please do so one day before your talk or, at the latest, two breaks before the session of your talk. All talks have to be uploaded - presentations on own laptops will NOT be supported.
- Refreshments: Lunch and break refreshments are included with the registration. They will be provided in the breaks at the exhibition hall. Water is available all day.
- Room entrance: Please keep your badge visible while entering the room of the session. Eating in the rooms is not allowed.
- Toilets: Take the stairs downwards next to the reception.
- Wardrobe: A guarded wardrobe is available below the exhibition hall; take the stairs downwards next to the reception.
- WLAN: Wireless internet access is provided for free within the building. Login: rehabweek; Password: rehazh2011
- Assistance for people with disabilities: Handicapped persons should not hesitate to contact the registration desk if they need any assistance.

# Social Events Rehab Week Zurich

### INRS 2011 Social Event hosted by Hocoma

Move from the networks in the brain to your networks of friends and colleagues at the INRS social event! The INRS 2011 social event will take place at the famous "Bad Allenmoos" (one of Zurich's traditional outdoor swimming facilities) on Monday, June 27th, after the INRS workshop program. We will leave the closed congress rooms behind for a short hike through the greener parts of Zurich and enjoy the evening at the outdoor facility. Food & drinks will be served.




| | |
|---|---|
| Address | Freibad Allenmoos<br>Ringstrasse 79<br>8057 Zürich |
| Date and time | Monday, June 27th, 2011 |
| Start hike | Meet at 3:45 p.m. at the registration desk in HPH D Hall. Afterwards, 1 hour hike through the forest with a beautiful view over Zurich to Bad Allenmoos. Please wear robust shoes (suited for uneven terrain, no high heels!) and comfortable clothing appropriate to weather conditions. |
| Start get-together | 5:00 p.m. at Bad Allenmoos. Please show your social event voucher at the entrance. |
| Swimming | Bring your swimming gear and a towel if you want to refresh yourself in the outdoor pool. We recommend appropriate clothing to spend most of the evening outside (it is possible to change your clothing at Bad Allenmoos). |

As an alternative to walking, individual transfer to Bad Allenmoos by public transportation. Some options are:

| | |
|---|---|
| Congress site | Bus 69 (direction "Milchbuck") from station "ETH Hönggerberg" to "Bucheggplatz" (e.g. 4:39 p.m. or 4:46 p.m., 10 minutes) then transfer to Tram 11 (direction "Auzelg") from "Bucheggplatz" to "Bad Allenmoos" (e.g. 4:50 p.m. or 4:57 p.m., 3 minutes). |
| Zurich main station | Tram 11 from "Bahnhofquai/HB" (direction "Auzelg") to "Bad Allenmoos" (e.g. 4:40 p.m. or 4:48 p.m., 12 minutes). |
| Way back (Bad Allenmoos to Zurich main station) | Tram 11 (direction „Rehalp") to „Bahnhofquai/HB" (every 15 minutes).<br>Selection of Zurich taxis:<br>Züritaxi: +41 (0)44 222 22 22<br>Taxi 444: +41 (0)44 444 44 44<br>Alpha Taxi: +41 (0)44 777 77 77 |
| Emergency contact | Please contact our staff at the registration desk, HPH D Hall (entrance hall ETH science city) for further information or call +41 (0)78 688 40 08 in case of a delay. |

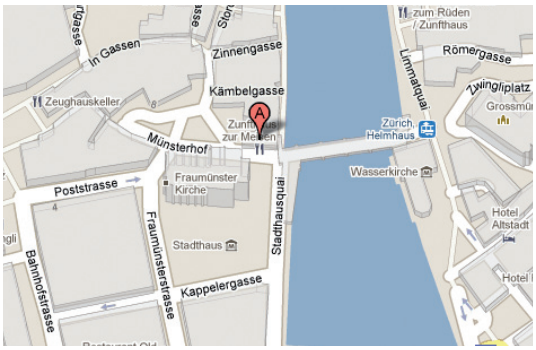
## ICVR 2011 Welcome Event

The ICVR committee is pleased to invite you to the welcome event at the famous Zunfthaus zur Meisen. Built in the French baroque style in 1757, it represented the cultural blossoming of the city at the time. It is the home of the “Meisen” guild representing winemakers, saddlers and painters, which has existed since 1336. Over the years the house has hosted many prominent persons, including Queen Elizabeth II, King Gustav of Sweden, Jimmy Carter and Winston Churchill. Come and experience the unique ambiance of one of the most famous and historic buildings in Zurich, with fine finger food and drinks, in a relaxed and welcoming atmosphere

| | |
|---|---|
| Address | Zunfthaus zur Meisen, Münsterhof 20, 8001 Zurich<br>+41 (0)44 211 21 44<br>www.zunfthaus-zur-meisen.ch |
| Date and time | Monday, June 27, 2011<br>start at 6.30 p.m. |
| How to get there | Public transport:<br>Tram 2, 6, 7, 8, 9, 11 or 13 to “Paradeplatz”,<br>or tram 4 or 15 to “Helmhaus”. |

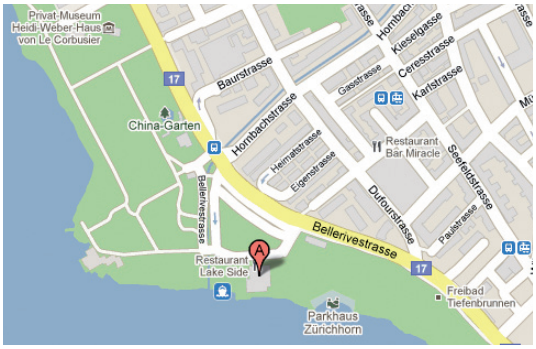
Selection of Zurich taxis:

| | |
|---|---|
| Züritaxi: | +41 (0)44 222 22 22 |
| Taxi 444: | +41 (0)44 444 44 44 |
| Alpha Taxi: | +41 (0)44 777 77 77 |



## Gala Dinner Restaurant Lake Side Zurich

The Organizing Committees are pleased to welcoming you in the beautifully located restaurant Lake Side Zurich. Due to its excellent food and its perfect location the restaurant is one of the most popular venues in town. The cocktail reception starts at 6:00 p.m. in the restaurant's summer lounge and is followed by a standing 3-course dinner on the upper floor of the venue. Throughout the evening the Swiss cover band Mr. Ray's Class will entertain you with background and dance music. The dinner is the ideal platform to meet up with other Rehab Week Zurich 2011 participants and industry partners from all over the world.



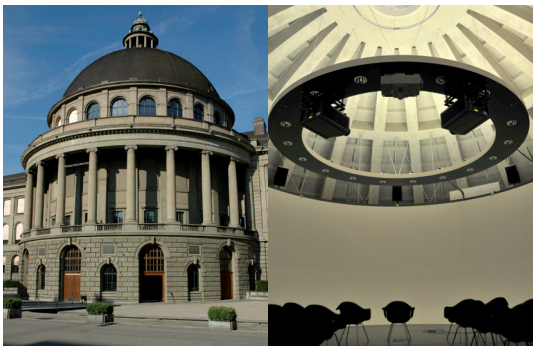

| | |
|---|---|
| Address | Lake Side, Bellerivestrasse 170, Zurich<br>www.lake-side.ch |
| Date and time | Wednesday, June 29, 2011 |
| Start cocktail reception | 6 p.m., Summer Lounge |
| Start 3-course standing dinner | 7 p.m., 1st floor<br>Please show your dinner voucher at the registration desk located on the restaurant's ground floor. |
| How to get there | Bus:<br>There are shuttle buses organized leaving the congress venue, ETH Science City, from 6 p.m. until 6.30 p.m.<br><br>Public transport:<br>From Zurich "Bellevue" tram station (located close to the train station Zurich "Stadelhofen"):<br>Take Bus 912 or 916 from "Bellevue" to the bus stop "Chinagarten".<br><br>From Zurich main station:<br>Take Tram 11 to "Bellevue" change here for Bus 912 or 916 to bus stop "Chinagarten".<br><br>Selection of Zurich taxis:<br>Taxi 444: +41 (0)44 444 44 44<br>Züritaxi: +41 (0)44 222 22 22<br>Alphataxi: +41 (0)44 777 77 77 |

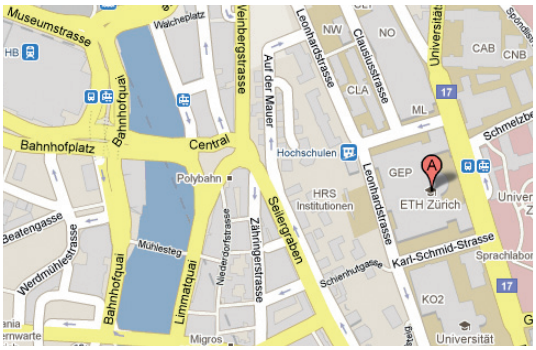
Please contact our staff at the registration desk, HPH D Hall (entrance hall ETH science city) for further information.

## ICORR Welcome Reception and Research Demos

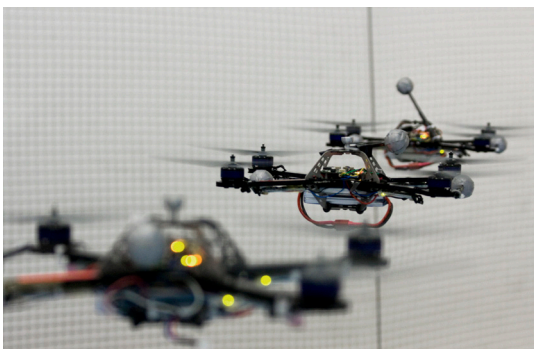
The ICORR 2011 social event will take place at the ETH Dome and the roof terrace of the main building on the city campus, with its beautiful view of the Alps. You will be welcomed by the ETH Zurich Vice President of Research and Corporate Relations and director of the Autonomous Systems Lab, Prof. Roland Siegwart. There you may enjoy delicious snacks and drinks and explore many current research projects from ETH Zurich labs working in the field of robotics.

| | |
|---|---|
| Address | ETH Zurich (Dome and roof terrace of main building), Rämistrasse 101, 8092 Zurich |
| Date and time | Thursday, June 30, start at 6.15 p.m. |
| How to get there | Bus:<br>Shuttle buses depart ETH Science City from 6 p.m.<br><br>Public transport:<br>Tram 6, 9, 10 to ETH / Unispital<br><br>Selection of Zurich taxis:<br>Züritaxi: +41 (0)44 222 22 22<br>Taxi 444: +41 (0)44 444 44 44<br>Alpha Taxi: +41 (0)44 777 77 77 |






*ETH Zurich Research Demos*



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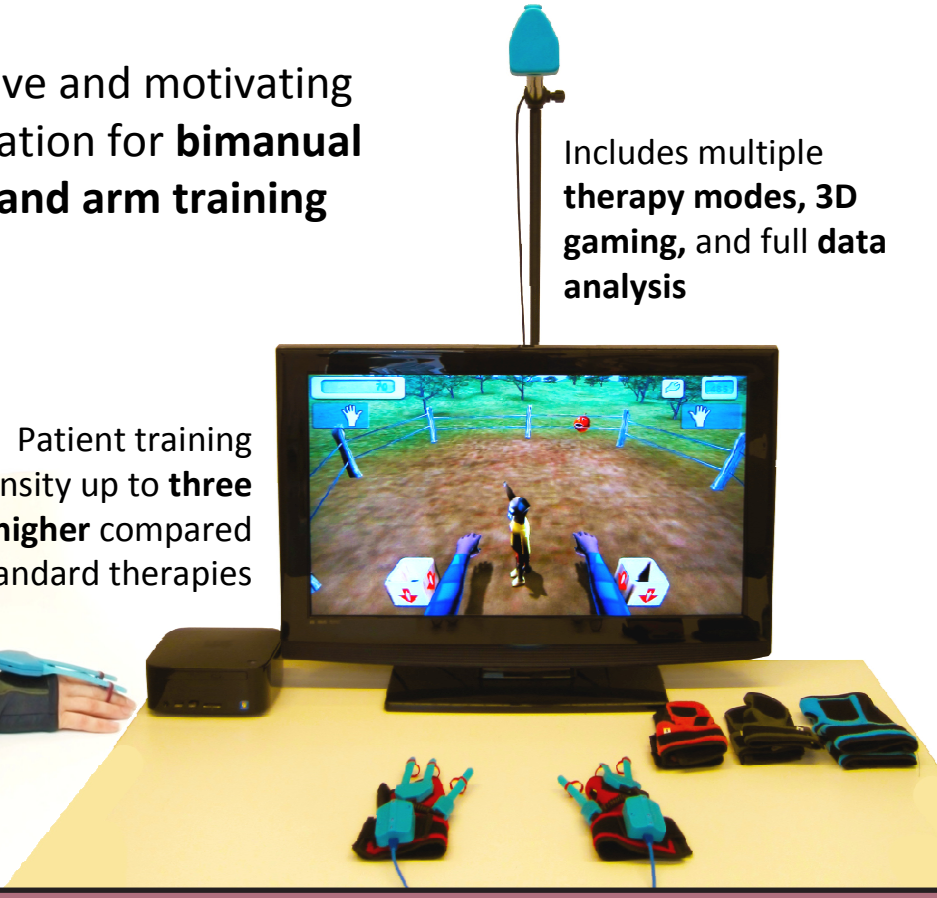

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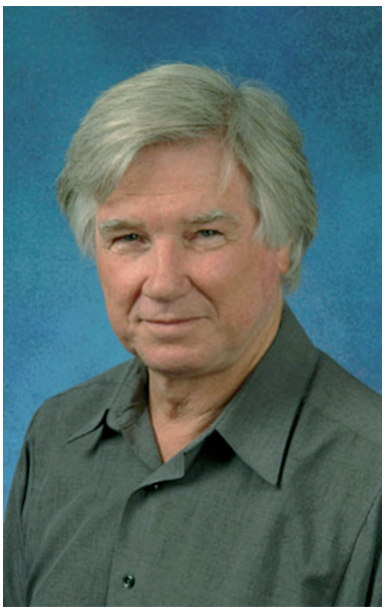
## Keynote speakers

**Edgerton, V. Reggie**

*Tuesday, June 28, 09:10 - 09:45, Physiological rational for Assist-as-Needed control in facilitation of recovery of stepping*



*Distinguished Professor*
*Department of Integrative Biology & Physiology*
*University of California, Los Angeles*
*www.ibp.ucla.edu/research/edgerton*

Dr. V. Reggie Edgerton received his Ph.D. in Exercise Physiology from Michigan State University and has been at the University of California, Los Angeles, since 1968. Dr. Edgertons laboratory focuses on two main research questions. One is, how, and to what extent, does the nervous system control protein expression in skeletal muscle fibers? Whole muscle, single motor units and single muscle fibers are studies physiologically and biochemically. Light and confocal microscopy including quantitative enzyme analyses and immunofluorescent microscopy are some of the experimental methods used to study motor unit plasticity. The principal animal models used are spinal cord injury, spaceflight and surgically induced compensatory hypertrophy. These studies have shown that although the nervous system has a significant influence on the kind and amount of specific proteins synthesized, there are factors intrinsic to individual fibers that also define these properties. The results show also that the neural influence that is associated with muscle fiber types is probably not mediated via the amount or pattern of activity of the motor units. The second is how the neural networks in the lumbar spinal cord of mammals, including humans, control stepping and how this stepping pattern becomes modified by chronically imposing specific motor tasks on the limbs after complete spinal cord injury. Limb motion, electromyographic and kinetic data are recorded to define locomotor characteristics. These studies have shown that the mammalian spinal cord can learn specific complex motor tasks such as standing and stepping. Considerable effort is focused on integrating neural models of locomotion with actual musculoskeletal properties that are subject specific. Another component of the modeling tasks is to develop robotic devices that can quantify and assist laboratory animals and humans with neuromuscular deficits to walk. A similar device is being developed for use by crewmembers in maintaining a critical level of control of locomotion in variable gravitational environments.

**Rizzo, Skip**

*Tuesday, June 28, 09:45 - 10:20, Virtual Rehabilitation: Emerging opportunities and challenges for promoting access*

*Associate Director, The Institute for Creative Technologies*
*Research Professor, Dept. of Psychiatry and the School of Gerontology*
*University of Southern California, Los Angeles, CA., USA*
*http://vrpsych.ict.usc.edu*

Albert “Skip” Rizzo is a Clinical and Neuro- Psychologist, Associate Director of the University of Southern California Institute for Creative Technologies and a Research Professor in Psychiatry and in Gerontology. Skip conducts research on the design, development and evaluation of VR systems targeting the areas of clinical assessment, treatment and rehabilitation. His cognitive work has addressed the use of VR applications to test and train attention, memory, visuospatial abilities and executive function. In the motor domain, he develops VR game-based applications to promote rehabilitation in persons with CNS dysfunction (e.g., stroke and TBI). And in the psychological domain, he has directed the development / implementation of the Virtual Iraq/Afghanistan VR exposure therapy system for combat-related PTSD and is involved in translating these simulation assets for PTSD assessment and prevention (stress resilience). He is also involved with ICT collaborators in the creation of artificially intelligent virtual human patients that clinicians can use to practice skills required for

challenging clinical interviews and diagnostic assessments (sexual assault, resistant patients, etc.) and for creating online virtual human healthcare guides for breaking down barriers to care in psychological health and TBI. In his spare time, Skip enjoys playing rugby, riding motorcycles, listening to music and dreaming about ways that VR will improve clinical care and research.

**Allum, John HJ**

*Tuesday, June 28, 14:00 - 14:45, Improving impaired balance function for posture and gait: on-line versus carry-over effects of prosthetic feedback*

*Head of Audiology and Neurootology*
*ORL University Clinic, Basel, Switzerland*
*Cochlear Implant Clinic Centre: www.unibas.ch/hno/audio and*
*Neurootology Research: www.unibas.ch/hno/neurooto*

Prof. Allum obtained his first degree (BSc) in mechanical engineering at Birmingham University, England. He held one of the first Kennedy Scholarship awards for study at the MIT. After receiving a MSc and DSc in Biomedical Engineering at MIT, he worked for several years as a neurophysiologist and developer of medical diagnostic equipment, first at the University Neurology Clinic in Freiburg/Germany, and later at the Brain Research Institute in Zurich/Switzerland. He has been Head of the Department of Audiology and Neurootology at the University ORL Clinic in Basel/Switzerland for several years where his main clinical duties include managing diagnostic and rehabilitation programs for patients with hearing and balance disorders. His scientific interests are concentrated on understanding neurophysiological mechanisms underlying balance control in man and on developing balance prostheses for persons with poor balance control. He has published over 200 peer-reviewed papers and holds several patents. Prof Allum speaks English, Spanish, and German.

**Blanke, Olaf**

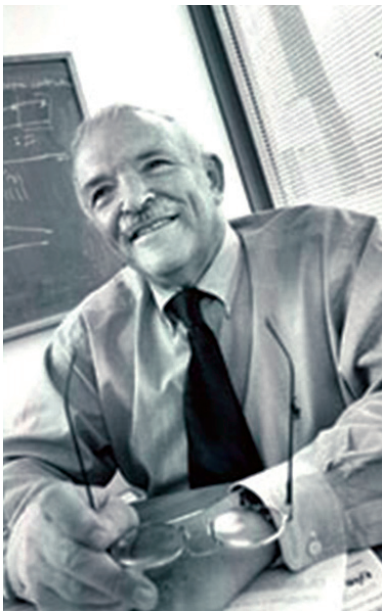
*Wednesday, June 29, 08:20 - 09:00, Cognitive Neuro-Prosthetics: From virtual limbs and avatars to robotic chairs*

*Professor, Director of the Laboratory of Cognitive Neuroscience at the Swiss Federal Institute of Technology (Ecole Polytechnique Fédérale de Lausanne), Switzerland*
*Consultant neurologist at the Department of Neurology (University Hospital of Geneva), Switzerland*

Olaf Blanke pioneered the neuroscientific study of human self-consciousness and subjectivity by using a broad range of methods such as the neuropsychology and electrophysiology of self-consciousness in neurological disease as well as brain imaging in healthy subjects. His main interest at present is the development of a data-driven neuroscientific theory of self-consciousness and subjectivity. Another main line of research concerns balance and body perception, and their application to engineering-based technologies such as virtual reality, robotics, and neuro-rehabilitation.

**Rymer, W. Zev**

*Wednesday, June 29, 09:00 - 09:40, Rehabilitation robotics - closing the gap between expectation and current clinical performance*



*John G. Searle Chair in Rehabilitation Research*
*Vice President for Research*
*Director, Sensory Motor Performance Program*
*Rehabilitation Institute of Chicago, USA*
*Professor, Departments of Physical Medicine & Rehabilitation,*
*Physiology, and Biomedical Engineering*
*Northwestern University*
*www.ric.org/aboutus/people/doctors/detail.aspx?doctorID=15*

W. Zev Rymer (M'94) received the M.B.B.S. degree from Melbourne University, Australia, in 1962. After residency training in internal medicine and neurology, he returned to graduate training and received the Ph.D. degree in neurophysiology from Monash University, Australia. After postdoctoral training at the National Institutes of Health and Johns Hopkins University Medical School, Baltimore, MD, he became an Assistant Professor of Neurosurgery and Physiology at the State University of New York, Syracuse. In 1978, he became an Assistant Professor of Physiology at Northwestern University Medical School, Chicago, IL. He now holds the John G. Searle Chair in Rehabilitation Research and is Vice President for Research at the Rehabilitation Institute of Chicago, while also holding appointments as Professor of Physiology and Biomedical Engineering at Northwestern University and at Hines VA, Hines, IL. He is also Director of the Medical Biomechanics Program at Northwestern University Medical School. His laboratory receives support from the National Institutes of Health, the Department of Education (NIDRR), and the Veterans Administration.

**Winstein, Carolee**

*Wednesday, June 29, 14:00 - 14:40, The future of neurorehabilitation: best practice is theoretically inspired, grounded in science and patient-centered*

*Professor, Director of Research and Motor Behavior and Neurorehabilitation Laboratory*
*Biokinesiology and Physical Therapy*
*University of Southern California, Los Angeles, California, USA*
*http://pt2.usc.edu/labs/mbnl/*

Carolee J. Winstein, PhD, PT, FAPTA is professor of Biokinesiology and Physical Therapy and directs the Motor Behavior and Neurorehabilitation Laboratory, University of Southern California, Los Angeles, CA, USA. She holds a joint appointment in the Department of Neurology, USC Keck School of Medicine. She is best known for work concerned with the functional neural and behavioral basis of motor control and learning and its relationship to neurorehabilitation. She has published extensively on scientifically derived neurorehabilitation approaches to enhance recovery and repair after adult onset stroke. Winstein is principal investigator (PI) for the first clinical research network, PTClinResNet, funded by the Foundation for Physical Therapy; she is Co-PI of the first National Institutes of Health (NIH) phase III Multi-site Randomized Control Trial of a rehabilitation intervention for upper extremity recovery in stroke, Extremity Constraint-Induced Therapy Evaluation (EXCITE); she is PI for an individual investigator NIH funded grant, Brain and Behavioral Correlates of Arm Rehabilitation after Stroke, a companion to EXCITE; and Co-PI of a NIH roadmap planning and exploratory project, the Interdisciplinary Study of Neuroplasticity and Stroke Rehabilitation (ISNSR). In 2005, she was appointed to the National Advisory Board on Medical Rehabilitation Research (NABMRR) of the National Institute of Child Health and Human Development (NICHD) of the NIH. Recent research efforts that provide critical background and experience for the development of innovative approaches in neurorehabilitation include: 1) feasibility of Novel Virtual Environments and Constraint-Induced

Movement Therapy (NIH Phase I STTR), 2) Safety and Effectiveness of Cortical Stimulation in the Treatment of Upper Extremity Hemiparesis (Northstar Neuroscience, Inc.). Two ongoing large-scale funded collaborations include the National Institute on Disability and Rehabilitation Research's Rehabilitation Engineering Research Center - "Optimizing Participation through Technology (OPTT)" and NIH (NINDS, NICHD) Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE) Stroke Initiative, a Multi-Center phase III Randomized control Trial, Interdisciplinary Comprehensive Arm Rehabilitation Evaluation (ICARE).

**Lüth, Tim**

*Wednesday, June 29, 14:40 - 15:20, TUM Agetech: A framework for pervasive medical devices for elderly*

*Professor and director Institute for Micro Technology and Medical Device Technology*
*Managing director*
*Institute for Mechatronics*
*Technical University of Munich, Germany*
*www.mw.tum.de/index.php?cid=939*

Tim C. Lüth was born in Hamburg, Germany, in 1965. He received his degree in electrical engineering from the Darmstadt University of Technology, Darmstadt, Germany in 1989. Afterwards, he received the Ph.D. degree in robotics and habilitation in computer science from the University of Karlsruhe in 1993 and 1997, respectively. In 1994-1995, he was a Visiting Researcher at the MITI-AIST Electrotechnical Laboratory in Tsukuba, Japan. In 1997, Lüth became Professor for surgical navigation and robotics at the medical school Charité-Universitätsmedizin Berlin of the Humboldt University at Berlin. In 2001, he became the Director for Mechatronic Medical Technology at the Fraunhofer-Institute for Production Systems and Design Technology IPK. Since 2005, Lüth works as Professor, Chair, and Director of the Institute of Micro Technology and Medical Device Technology of the University of Technology, Munich. In 2006, he received a professor status at the University of Toronto, Canada. The European Patent Office elected him in 2007 as TOP-3 inventor in the category "lifetime achievement" for his patent activities in the area of surgical robotics and navigation. He received several national and international awards for his research on medical devices. In 2010, Lüth became elected Member of "acatech," by the German National Academy for Science and Technology. Current research topics are Assistant Systems for an Aging Society, Robotics, Automation, Navigation for Surgery, and Rapid Prototyping of Mechatronics Systems.

**Herr, Hugh**

*Thursday, June 30, 09:00 - 09:40, Neuromuscular model of human walking: implication on prosthetic leg design*

*Associate Professor, Media Arts and Sciences*
*Associate Professor, MIT-Harvard Division of Health Sciences and Technology*
*Director of the Biomechatronics Group*
*Massachusetts Institute of Technology*
*http://biomech.media.mit.edu/people/herr.htm*

Hugh Herr is pioneering new research directions for a new class of biohybrid, "smart" prostheses; these devices are accelerating the merging of body and machine, improving the lives of amputees and other physically challenged individuals, and amplifying the endurance and strength of everyone. Herr has employed cross-bridge models of skeletal muscle to the design and optimization of a new class of human-powered mechanisms that amplify endurance for cyclic anaerobic activities. He has also built elastic shoes that increase aerobic endurance in walking and running. In the field of human rehabilitation, Herr's group has developed gait adaptive knee prostheses for transfemoral amputees and variable impedance ankle-foot orthoses for patients suffering from drop foot, a gait pathology caused by stroke, cerebral palsy, and multiple sclerosis. Herr received his BA in physics from Millersville University of Pennsylvania, an MS in mechanical engineering from MIT, and a PhD in biophysics from Harvard University. Prior to coming to the Media Lab, Herr was assistant professor at the Harvard-MIT Division of Health Sciences and Technology and the Department of Physical Medicine and Rehabilitation, Harvard Medical School.

**Courtine, Grégoire**

*Friday, July 1, 09:00 - 09:40, Robotic and neuroprosthetic systems for neurorehabilitation after spinal cord injury*

*Experimental Neurorehabilitation laboratory*
*Faculty of Medicine*
*August Forel-Strasse 7*
*8008 Zürich*
*www.neuroscience.uzh.ch/research/motor_systems/courtine*

Prof. Dr. Grégoire Courtine was originally trained in Mathematics and Physics, but received his PhD degree in Experimental Medicine from the University of Pavia, Italy, in 2003. From 2004-2007, he held a Post-doctoral Fellow position at the Brain Research Institute, University of California, Los Angeles (UCLA), USA, under the supervision of Dr. Reggie Edgerton. In 2008, he established his own research laboratory at the Faculty of Medicine, University of Zurich, Switzerland, where he also is a member of the Rehabilitation Initiative and Technology Platform Zurich (RITZ). The main focus of the lab includes the development and use of neuroprosthetic systems, robotic interfaces, pharmacological cocktails, neuroregenerative therapies, and neurorehabilitation interventions to promote the recovery of motor functions after neurological impairments such as spinal cord injury or stroke. His laboratory addresses a remarkably diversified range of research paradigms in mice, rats, cats, monkeys, and humans. In the past four years, he published several articles in Nature Neuroscience and Nature Medicine, which were discussed in national and international press extensively. He received numerous honors and awards such as the 2007 Chancellor's award for excellence in post-doctoral research from UCLA and the 2009 Schellenberg Prize for Research that was awarded by the International Foundation of Research in Paraplegia.

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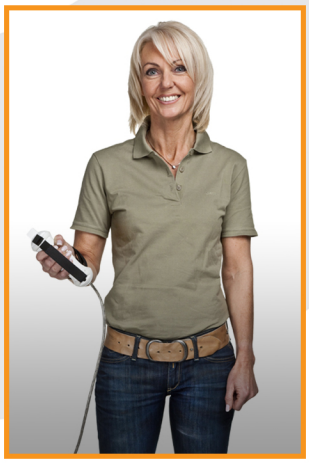

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## Program at a glance

### Monday - June 27, 2011

<table>
<tr><th colspan="4">INRS</th><th>ICVR</th></tr>
<tr><td colspan="4">08:00 – 09:30<br>Coffee and registration</td><td>08:00 – 08:30<br>Coffee and registration</td></tr>
<tr><td rowspan="2">09:30 – 12:00 (HPH, G1)<br>Robotics in the rehabilitation of upper limb function in SCI<br>Armin Curt</td><td>09:30 – 11:30 (HPH, G2)<br>Very early rehabilitation<br>Andreas Luft</td><td>09:30 – 10:30 (HPV, G4)<br>Implementation of robotics in clinical settings<br>Leslie VanHiel<br>Kerstin Baldauf<br>Chan Kay Fei</td><td>09:30 – 10:30 (HPV, G4)<br>Non invasive spinal assessment<br>Cesare Mannhart</td><td rowspan="2">08:30-12:00 (HCI, J3)<br>Virtual Reality Technology for the Therapist<br>Greg Burdea, Albert Rizzo, Patrice Weiss<br>09:30-12:00 (HCI, J4)<br>Virtual Reality for Arm Therapy<br>Andreas Luft<br>08:30-12:00 (HCI, J6)<br>Microsoft Kinect/Primesense Sensing Systems for Virtual Rehabilitation<br>Belinda Lange & Albert Rizzo<br>08:30-12:00 (HCI, J7)<br>Successful operational deployment of telerehabilitation<br>Henry Mulder et al.</td></tr>
<tr><td colspan="2">10:30 – 11:00<br>Coffee break/poster/exhibition</td></tr>
<tr><td>11:30 – 12:30 (HPH, G1)<br>Erigo basic<br>Arash Dodge</td><td>11:00 – 12:00 (HPH, G3)<br>Lokomat basic<br>Julia Bühlmeier</td><td>11:00 – 12:00 (HPV, G4)<br>Virtual reality-based rehabilitation with YouGrabber and YouKicker<br>Oliver Ullmann<br>Daniel Kiper</td></tr>
<tr><td>12:00 – 13:00<br>Lunch/poster/exhibition</td><td>12:30 – 13:00<br>Lunch/poster/exhibition</td><td colspan="2">12:00 – 13:00<br>Lunch/poster/exhibition</td></tr>
<tr><td rowspan="4">13:00 – 15:15 (HPH, G1)<br>Robot-supported locomotor training in pediatric neurorehabilitation: application, assessment and achievements<br>Huub van Hedel</td><td>13:00 – 14:00 (HPH, G2)<br>ArmeoPower basic<br>Alexander Duschau-Wicke</td><td>13:00 – 14:00 (HPH, G3)<br>Lokomat advanced<br>Julia Bühlmeier</td><td>13:00 – 14:00 (HPV, G4)<br>Pablo Plus - upper limb rehabilitation<br>Maik Hartwig</td><td>13:00 – 13:15 (G5)<br>Conference welcome<br>Kynan Eng, Daniel Thalmann</td></tr>
<tr><td></td><td></td><td></td><td>13:15 – 14:00 (G5)<br>Podium session 1<br>Sensory impairment</td></tr>
<tr><td colspan="3">14:00 – 14:15<br>Coffee break/poster/exhibition</td><td>14:00 – 15:15 (G5)<br>Podium session 2<br>Posture and balance</td></tr>
<tr><td>14:15 – 15:15 (HPH, G2)<br>ArmeoSpring basic<br>Peter Schenk</td><td>14:15 – 15:15 (HPH, G3)<br>Valedo basic<br>Jan Kool<br>Eelco Sengers</td><td>14:15 – 15:15 (HPV, G4)<br>Amadeo - advanced fingerrehabilitation<br>Goncalo Goncalves</td><td>15:15 – 15:45<br>Coffee break/poster/exhibition</td></tr>
<tr><td colspan="4">15:15<br>End of workshops</td><td>15:45 – 17:00 (G5)<br>Podium session 3<br>Post-stroke rehabilitation</td></tr>
<tr><td colspan="4">15:45<br>Start social event INRS 2011 hosted by Hocoma</td><td>18:30 – 20:00<br>Welcome drink<br>Zunfthaus zur Meisen</td></tr>
</table>

## Tuesday - June 28, 2011

| INRS | ICVR |
|---|---|
| **08:30 – 09:00**<br>Welcome coffee and registration | |
| **09:00 – 09:10** (G1)<br>Welcome address | |
| **09:10 – 09:45 Keynote lecture** (G1)<br>Physiological rational for Assist-as-Needed control in facilitation of recovery of stepping<br>*Reggie Edgerton* | |
| **09:45 – 10:20 Keynote lecture** (G1)<br>Virtual Rehabilitation: Emerging opportunities and challenges for promoting access<br>*Skip Rizzo* | |
| **10:20 – 10:50**<br>Coffee break/poster/exhibition | **10:20 – 10:50**<br>Coffee break/poster/exhibition |
| **10:50 – 11:15** (G2)<br>Clinical application of neuroscientifically based interventions for the neurologically disabled patient<br>*Susan Woll, Jan Utley* | **10:50 – 11:50** (G3)<br>Podium session 4<br>Games for rehabilitation |
| **11:15 – 11:40** (G2)<br>fNIRS monitoring of neurorehabilitation<br>*Ichiro Miyai* | |
| **11:40 – 12:05** (G2)<br>What should we really be doing? Lessons from 15 years of chronic stroke rehabilitation research<br>*Jill Whitall* | **11:50 – 12:35** (G3)<br>Podium session 5<br>Upper limb rehabilitation |
| **12:05 – 12:30** (G2)<br>Strategies for neuromuscular recovery after spinal cord injury<br>*Susan Harkema* | |
| **12:30 – 14:00**<br>Lunch/poster/exhibition | |
| **14:00 – 14:25** (G2)<br>Acceptance of impairment based rehabilitation robotics in the clinic and at home, what is required?<br>*Jules Dewald* | **14:00 – 14:45** (G3)<br>Improving impaired balance function for posture and gait: on-line versus carry-over effects of prosthetic feedback<br>*John Allum* |
| **14:25 – 14:50** (G2)<br>Clinical use of Rehabilitation Robotics: Getting to best practices<br>*Michael Boninger* | |
| **14:50 – 15:15** (G2)<br>Translating upper limb rehabilitation technologies into clinical practice: what are the critical determinants?<br>*Jane Burridge* | **14:45 – 16:00** (G3)<br>Podium session 6<br>Gait, locomotion, navigation |

| | |
|---|---|
| **15:15 – 15:35** (G2)<br>Physiological basis of an effective training after a stroke or spinal cord injury<br>*Volker Dietz* | |
| **15:35 – 16:30**<br>Coffee break/poster/exhibition | **16:00 – 16:30**<br>Coffee break/poster/exhibition |
| **16:30 – 16:35** (G2)<br>Evidence versus experience – Introduction<br>*Andreas Luft* | **16:30 – 17:30** (G3)<br>Podium session 7<br>Rehabilitation for brain injuries |
| **16:35 – 16:50** (G2)<br>The evidence so far and what should we do next<br>*John Krakauer* | |
| **16:50 – 17:00** (G2)<br>Clinical trial methodology<br>*Michael Weller* | |
| **17:00 – 17:20** (G2)<br>Practical Considerations in Formulating Stroke Rehabilitation Clinical Trials<br>*Steve Wolf* | |
| **17:20 – 18:00** (G2)<br>Roundtable discussion: Evidence versus experience | **17:30 – 18:30** (G3)<br>ISVR members meeting |

## Wednesday - June 29, 2011

<table>
<tr><th>INRS</th><th>ICVR</th><th>ICORR</th></tr>
<tr><td colspan="3">07:30 – 08:00<br>Welcome coffee and registration</td></tr>
<tr><td colspan="3">08:00 – 08:20 (G1, G2)<br>Welcome address</td></tr>
<tr><td colspan="3">08:20 – 09:00 Keynote lecture (G1, G2)<br>Cognitive Neuro-Prosthetics: From virtual limbs and avatars to robotic chairs<br>Olaf Blanke</td></tr>
<tr><td colspan="3">09:00 – 09:40 Keynote lecture (G1, G2)<br>Rehabilitation robotics – closing the gap between expectation and current clinical performance<br>Zev Rymer</td></tr>
<tr><td colspan="3">09:40 – 10:20 (G1, G2)<br>Interactive podium presentation, fast forward (45s each)</td></tr>
<tr><td>10:20 – 10:50<br>Coffee break/poster/exhibition</td><td>10:20 – 10:50<br>Coffee break/poster/exhibition</td><td>10:20 – 11:15<br>Poster session 1/exhibition/coffee break</td></tr>
<tr><td>10:50 – 11:15 (G2)<br>Robot-assisted neurorehabilitation for children: some non-evidence based considerations<br>Andreas Meyer-Heim</td><td rowspan="4">10:50 – 12:35 (G3)<br>Podium session 8<br>VR training for pain and disability</td><td rowspan="2"></td></tr>
<tr><td>11:15 – 11:40 (G2)<br>Robotic locomotor training: More than going through the motions<br>Carolynn Patten</td></tr>
<tr><td>11:40 – 12:05 (G2)<br>Clinical evidence for upper-extremity rehabilitation in chronic stroke and implications for use of robotic technology: results of VA ROBOTIC clinical trial<br>Albert Lo</td><td rowspan="2">11:15 – 12:30 (G1)<br>Podium session 1<br>5 x 15 min (12 + 3 min)<br><br>Orthotics and prosthetics</td></tr>
<tr><td>12:05 – 12:30 (G2)<br>Measuring and augmenting Locomotor recovery after SCI with spinal cord stimulation<br>Keith Tansey</td></tr>
<tr><td colspan="3">12:30 – 14:00<br>Lunch/poster/exhibition</td></tr>
</table>

**14:00 – 14:40 Keynote lecture** (G1, G2)
The future of neurorehabilitaiton: best practice is theoretically inspired, grounded in science and patient-centered
*Carolee Winstein*

**14:40 – 15:20 Keynote lecture** (G1, G2)
TUM Agetech: A framework for pervasive medical devices for elderly
*Tim Lüth*

**15:20 – 16:00** (G1, G2)
Interactive podium presentation, fast forward (45s each)

**16:00 – 16:30**
Coffee break/poster/exhibition

**16:00 – 17:00**
Poster session 2/exhibition/coffee break

**16:30 – 16:50** (G2)
The impact of robotic technologies in neurorehabilitation and for assistive devices: lesson learnt and perspectives
*Franco Molteni*

**16:30 – 17:30** (G3)
Podium session 9
Rehabilitation for children

**16:50 – 17:10** (G2)
Biomimetic upper limb NMES integrated with eye tracking in hybrid assistive exoskeletons
*Giancarlo Ferrigno*

**17:00 – 18:00** (G1)
Podium session 2
4 x 15 min (12 + 3 min)

Neuroprosthetics & Brain Machine Interfaces

**17:10 – 17:30** (G2)
EMG-controlled functional electrical stimulation: devices and methods
*Thomas Schauer*

**17:30 – 17:50** (G2)
Robotic technologies for multiple sclerosis
*Vittorio Sanguinetti*

**17:30 – 18:00** (G3)
Awards and farewell

**17:50 - 18:10**
Transfer to gala dinner location at the venue Lake Side Zurich (www.lake-side.ch).
Several buses at different times will be organized.

## Thursday - June 30, 2011

| ICORR |
|---|
| **08:30 – 09:00**<br>Welcome coffee |
| **09:00 – 09:40 Keynote lecture** (G1)<br>Neuromuscular model of human walking: implication on prosthetic leg design<br>*Hugh Herr* |
| **09:40 – 10:20** (G1)<br>Fast-forward session (45s each) |
| **10:20 – 11:15**<br>Poster session 3 and exhibition/coffee break |
| **11:15 – 12:30** (G1)<br>Podium session 3<br>5 x 15 min (12 + 3 min)<br><br>Evaluation & clinical experience |
| **12:30 – 13:45**<br>Lunch |
| **13:45 – 14:30** (G1)<br>User involvement session<br><br>The loss of independence is a major point of concern after disease or accident. Five people, who experienced physical constraints as a result of accidents, stroke, or blindness, will talk about the challenges they face in daily life. They will share with us their experiences with robotics as therapeutic tools and daily life aids, how these robotics facilitate their independence, and which technical changes could further improve their activities and participation in daily life. |
| **14:30 – 15:30** (G1)<br>Podium session 4<br>4 x 15 min (12 + 3 min)<br><br>Upper limb robotics |
| **15:30 – 16:00** (G1)<br>Fast-forward session (45s each) |
| **16:00 – 17:00**<br>Poster session 4 and exhibition/coffee break |
| **17:00 – 18:00** (G1)<br>Podium session 5<br>4 x 15 min (12 + 3 min)<br><br>Orthotics |
| **18:00**<br>Welcome reception and lab visits at ETH Dome |

## Friday - July 1, 2011

### ICORR

**07:30 – 09:00**
Welcome coffee

**07:45 – 08:50** (G1)
ICORR society kick-off
*J. Patton, R. Loureiro, W. Harwin*

**09:00 – 09:40 Keynote lecture** (G1)
Robotic and neuroprosthetic systems for neurorehabilitation after spinal cord injury
*Grégoire Courtine*

**09:40 – 10:20** (G1)
Fast-forward session (45s each)

**10:20 – 11:15**
Poster session 5 and exhibition/coffee break

**11:15 – 12:15** (G1)
Podium session 6
4 x 15 min (12 + 3 min)

Neuroscience robotics

**12:30 – 13:45** (G1)
Awards & closing ceremony
Lunch/exhibition

### ICORR workshops

| | | | |
|---|---|---|---|
| **13:45 – 15:45** (G1)<br>Implementation of impairment based rehabilitation robotics<br>*J. P. A. Dewald* | **13:45 – 15:45** (G2)<br>Detecting motor intention in rehabilitation<br>*K. Ito, K. Nagai* | **13:45 – 18:15** (G5)<br>Clinical insights for rehabilitation engineers<br>*J. Burridge, A.-M. Hughes, P. Feys, A. Timmermans, G. Prange, J. Buurke* | **13:45 – 18:15** (G4)<br>Physiological principles of locomotion required for robot design<br>*V. Dietz, A. König, H. Vallery, R. Ronsse* |
| **15:45 – 16:15**<br>Coffee break | | | |
| **16:15 – 18:15** (G1)<br>Motor skill learning and neurorehabilitation<br>*V. Sanguineti, E. Burdet* | **16:15 – 18:15** (G2)<br>Brain-computer interfaces for communication and control<br>*M. Zeintlinger* | | |

## Session Chairs

### INRS

*Tuesday, 28 June 2011*
Principles of CNS reorganisation (09:10 - 10:20)
Gery Colombo and Patrice (Tamar) Weiss

Classical approaches (10:15 - 12:30)
Andreas Luft

Clinical potential of new technologies (14:00 - 15:35)
Giancarlo Ferrigno

Evidence versus experience (16:30 - 17:20)
Andreas Luft

*Wednesday, 29 June 2011*
Rehab Week (08:20 - 10:20)
Gery Colombo, Robert Riener, Kynan Eng

Clinical application of new technologies (current achievements) (10:50 - 12:30)
Armin Curt

Rehab Week (14:00 - 16:00)
Gery Colombo, Robert Riener, Kynan Eng

Clinical application of new technologies (supportive and combined therapy) (16:30 - 17:50)
Silvestro Micera

### ICVR

*Monday, 27 June 2011*
General Welcome
Kynan Eng, Daniel Thalmann

Sensory Impairment (13:15 - 14:00)
Mindy Levin, Greg Burdea

Posture and Balance (14:00 - 15:15)
Evelyne Klinger, Anat Mirelman

Post-stroke Rehabilitation (15:45 - 17:00)
Mariano Alcanez, Peter Wilson

*Tuesday, 28 June 2011*
Physiological rational for Assist-as-Needed control in facilitation of recovery of stepping - Reggie Edgerton (09:10 - 09:45)
Gery Colombo

Virtual Rehabilitation: Emerging opportunities and challenges for promoting access - Skip Rizzo (09:45 - 10:20)
Patrice (Tamar) Weiss

Games for Rehabilitation (10:50 - 11:50)
Hannes Kaufman, Paul Sharkey

Upper Limb Rehabilitation (11:50 - 12:35)
Geoff Wright, Dario Liebermann

Keynote lecture – John Allum (14:00 - 14:45)
Emily Keshner

Gait, Locomotion and Navigation (14:45 - 16:00)
Judy Deutsch, Pawel Pyk

Rehabilitation for Brain Injuries (16:30 - 17:30)
Philippe Archambault, Jim Patton

*Wednesday, 29 June 2011*
Rehab Week (08:20 - 10:20)
Gery Colombo, Robert Riener, Kynan Eng

Virtual Reality Training for Pain and Disability (10:50 - 12:35)
Joyce Fung, Belinda Lange

Rehabilitation for Children (16:45 - 17:30)
Marlene Sandlund, Ouriel Grynzpan

Closing ceremony
Emily Keshner (announcement of next conference), Mindy Levin (announcement of awards)

**ICORR**

*Wednesday, 29 June 2011*
Rehab Week (08:20 - 10:20)
Gery Colombo, Robert Riener, Kynan Eng

Orthotics and Prosthetics (11:15 - 12:30)
Kevin Fite, Clarkson University, NY, USA

Neuroprosthetics and Brain Machine Interfaces (17:00 - 18:00)
Alejandro Hernandez Arieta, University of Zurich, Switzerland

*Thursday, 30 June 2011*
Evaluation and Clinical Experience (11:15 - 12:30)
Peter Feys, University of Hasselt, Belgium

Upper Limb Robotics (14:30 - 15:30)
Farshid Amirabdollahian, University of Hertfordshire, England

Lower Limb Robotics (17:00 - 18:00)
Yasin Dhaher, Northwestern University, IL, USA

*Friday, 1 July 2011*
Neuroscience Robotics (11:15 - 12:15)
Rieko Osu, Advanced Telecommunications Research Institute, Japan

# Workshops

## INRS Workshops

| **Robotics in the rehabilitation of upper limb function in SCI** | **Monday 09:30 - 12:00** |
|---|---|
| Armin Curt, MD, Spinal Cord Injury Center, Balgrist University Hospital, University of Zurich, Switzerland<br>Inge-Marie Velstra, MSc, Swiss Paraplegics Centre, Nottwil, Switzerland<br>Milos Popovic, PhD, Rehabilitation Engineering Laboratory, Toronto, Canada<br>Annick Timmermans, PhD;,Maastricht University, Netherland<br>Michael L. Boninger, MD, University of Pittsburgh school of Medicine, Pittsburgh, USA<br>José Zariffa, MSc, ICORD, University of British Columbia, Canada<br>Doris Maier, MD; Trauma Center Murnau, Germany<br>Deborah Backus, PhD, Spinal Cord Injury Research, Sheperd, Atlanta, USA<br>John Steeves, PhD, ICORD, University of British Columbia, Canada | HPH, G1 |
| Organizer: A. Curt, MD, Spinal Cord Injury Center, Balgrist University Hospital, University of Zurich, Switzerland | |

*Objective*
The field of rehabilitation robotics has seen increasing interest over the last decades. Robotic devices are a promising solution to complement conventional therapy, and provide a unique platform for more objective and sensitive assessment. This workshop focuses on robotics in upper limb rehabilitation.

**Workshop Program**

- 09:30 - 09:40
  Welcome (Armin Curt)
- 09:40 - 09:55
  The advanced assessment of upper limb function (Inge-Marie Velstra)
- 09:55 - 10:15
  Advanced approaches in upper limb rehab (Milos Popovic)
- 10:15 - 10:30
  Task-oriented training of the upper extremity in SCI: Concepts and methods for rehabilitation technologies (Annick Timmermans, Annemie Spooren)
- 10:30 - 10:50
  How to identify targets and tools in upper limb SCI rehab (Michael L. Boninger)
- 10:50 - 11:05
  First insights into the Armeo application in tetraplegia (José Zariffa)
- 11:05 - 11:25
  Clinical standards: European perspective (Doris Maier)
- 11:25 - 11:45
  Clinical standards: North America perspective (Deborah Backus)
- 11:45 - 12:00
  Wrap up and lessons learned (John Steeves)

| Very early rehabilitation | Monday 09:30 - 11:30 |
|---|---|
| Andreas Luft, UniversitätsSpital Zurich, Zurich, Switzerland<br>Joachim Liepert, Kliniken Schmieder Allensbach , Germany<br>Lyudmila Chernikova, RAMS, Russia<br>Margret Hund, Wald, Switzerland<br>Dr. Friedemann Müller, Bad Aibling, Germany<br>Dr. Karin Diserens, CHUV, Switzerland | HPH, G2 |
| Organizer: Andreas Luft, Universitätsspital Zurich, Zurich, Switzerland | |

*Objective*
The aim of this workshop is to provide an overview on standards and guidelines for very early mobilization in different pathologies like Stroke, TBI and SCI and to discuss recent and future developments within the field. Furthermore to provide an insight on how new technologies are currently integrated and applied into the clinical setting and their future potential.

- 09:30 - 09:50
  Background: Very early rehab, how early is early, main problems and future prospective (Andreas Luft)
- 09:50 - 10:10
  Early rehabilitation: What is proven, what is new (Joachim Liepert)
- 10:10 - 10:30
  Efficacy of very early mobilization in stroke, potential of new technologies (Lyudmilla Chernikova)
- 10:30 - 10:50
  An example of early rehab in post intensive care (Margret Hund)
- 10:50 - 11:10
  The German classification system for early rehab and its clinical implications (Friedemann Müller)
- 11:10 - 11:30
  Ischemic stroke management in the intensive care setting (Karin Diserens)

| Implementation of robotics in clinical settings – best practice examples | Monday 09:30 - 10:30 |
|---|---|
| Dr CHAN Kay Fei, Tan Tock Seng, Singapore<br>Dr. Kerstin Baldauf, Helios Klinik, Switzerland Leslie VanHiel, BME, MSPT, Shepherd Center, USA | HPV, G4 |
| Organizer: Hocoma, Switzerland | |

*Objective*
In this workshop speakers from leading rehabiliation centers from over the world will present their experience with the implementation of robotics into their clinical settings.

The speakers will introduce their centers and robotic devices with their target patients treated with robotics. Furthermore they will present the new working environment of their therapists, talk about their experience with reimbursement, and report from problems they were confronted with when they started with robotics and how they solved them.
There will be three talks a 15 minutes.

During the last 15 minutes of this workshop, all speakers are available for answering your questions.

| Non invasive spinal assessment | Monday 09:30 - 10:30 |
|---|---|
| Cesare Mannhart (MSc ETH HMS) | HPV, G4 |
| Organizer: idiag, Switzerland | |

*Objective*
This workshop will provide an overwiew on different non invasive spinal assessment methods with an emphasis on the SpinalMouse®.

The SpinalMouse® is an assessment device to determine shape and mobility of the spinal column (Th1 - S3) in the sagittal and frontal planes in a non invasive way. The device is rolled over the skin down the back as the mobile sensors independently follow the shapes and angles of the vertebrae. Based upon a scientifically valid and reliable computing method, the following clinically relevant parameters are computed:

- Mobility and posture of individual motion segments, anatomical regions and the overall spine in the sagittal and frontal planes
- Postural competence and sufficiency
- Sacral-hip joint positioning
- Length of the back

Understanding the position and mobility of vertebral segments helps to identify back specific findings, to define an individually tailored therapy and eventually to evaluate and report on the therapeutic progess. The participants will have the opportunity to use the SpinalMouse®.

| Early mobilization: current standards enhanced using Erigo® advanced robotic movement therapy | Monday 11:30 - 12:30 |
|---|---|
| Harald Kinzner<br>Arash Dodge, PhD | HPH, G1 |
| Organizer: Hocoma, Switzerland | |

*Objective*
In recent years early mobilization of patients in acute care has proven to be an effective therapy for stroke and intensive care patients. For example helping stroke patients moving and loading their legs when in the upright position as early as 24h after onset has proven to be a safe procedure where patients can faster regain the ability to walk in a significant way. However this type of treatment requires 2-3 physiotherapists and is difficult to sustain for longer periods of training. The purpose of Erigo® therapy is to use an advanced robotic device to support this type of treatment by combining verticalization, mobilization of the hip, knee and ankle joints in a physiological manner, and cyclic loading of the legs in order to support therapists when performing early mobilization of moderate to severely affected patients as early as possible. The Erigo has proven to be an effective therapy for bringing patients faster in the upright position by keeping patients' cardiovascular system stable during verticalization.

In this workshop we will
- Give a brief overview of early mobilization standards in the scientific and clinical community today
- Demonstrate the Erigo product with an overview of its features and benefits
- Present Erigo therapy implementation in different acute care clinical settings such as a neurointensive ward for spinal chord injured patients, and in a stroke unit
- Discuss scientific results using Erigo in acute and post acute care for neurological patients

This workshop is targeted to physiotherapists and physicians working in acute care settings such as stroke units, intensive care units, or rehabilitation facilities where early rehabilitation is a mindset. We will help you take your early rehabilitation therapy concepts to the next level!

| **Enhanced functional locomotion therapy with the Lokomat®** | **Monday 11:00 - 12:00** |
|---|---|
| Annick Schmartz, MSc<br>Julia Buehlmeier, PhD | HPH, G3 |
| Organizer: Hocoma, Switzerland | |

*Objective*
Locomotion therapy supported by an automated gait orthosis on a treadmill has shown to be an effective intervention for improving over-ground walking function caused by neurological diseases and injuries in many cases. The Lokomat® system assists walking movements of gait-impaired patients and is used to improve mobility in individuals following stroke, spinal cord injury, cerebral palsy and multiple sclerosis as well as other neurological diseases and injuries. The LokomatPro has been on the market since 2001 and has been a crucial improvement in the art and science of locomotion therapy.

In this workshop, we will
- perform a product demonstration
- explain the advantages of Lokomat therapy compared to conventional gait training, such as longer and more intensive training, real time feedback for a higher motivation and compliance, physiological gait pattern provided by individually adjustable orthoses, assessment and reporting functionality
- present the field of application of the Lokomat
- give insight into current scientific evidence

Clinical application specialists will be present to discuss and answer your questions.
This workshop targets therapists as well as medical doctors interested in bringing gait therapy to the next level using novel technologies, and it will provide an overview over the clinical benefits and the field of application of the Lokomat.

No experience with the device necessary.

| **Virtual reality-based rehabilitation with YouGrabber and YouKicker** | **Monday 11:00 - 12:00** |
|---|---|
| PD Dr. Daniel Kiper, Co-Founder, YouRehab AG<br>Oliver Ullmann, Co-Founder & CEO, YouRehab AG | HPV, G4 |
| Organizer: YouRehab, Switzerland | |

*Objective*
YouGrabber is a new virtual reality-based tool for upper limb rehabilitation. It is unique in its ability to measure bimanual reaching and grasping in 18 degrees of freedom, combined with class-leading gaming software. Using YouGrabber, therapists can implement several therapy forms with one system, e.g. functional training, constraint-induced therapy, virtual mirror therapy. This workshop will demonstrate the clinical use of YouGrabber and its companion YouKicker for lower-limb rehabilitation.

| **Robot-supported locomotor training in pediatric neurorehabilitation: application, assessment and achievements** | **Monday 13:00 - 15:15** |
|---|---|
| Huub van Hedel, PhD, PT<br>Karin Brütsch, PhD,<br>Corinne Ammann, MPTSc<br>Tabea Schuler MSc | HPH, G1 |
| Organizer: Huub van Hedel, Childrens Hospital, University of Zurich, Affoltern, Switzerland | |

*Objective*
The goal of this workshop is to provide an insight into our approach at the Rehabilitation Center Affoltern am Albis to train children with neurological disorders with the pediatric driven gait orthosis Lokomat. In addition, we present the tests we use to evaluate changes in walking ability and we will present an up-to-date overview about the scientific achievements in this field.

The target audience we aim for are therapists who are working in a pediatric setting and (are interested in working) with the pediatric Lokomat

Your hosts for this workshop are Corinne Amman, physiotherapist, Karin Brütsch, psychologist, Tabea Schuler, movement scientist and Huub van Hedel, physiotherapist and movement scientist.

This workshop will consist of several presentations, as well as some practical exercises.

The programm looks as follows:
- Introduction to our center and expectations of the workshop participants
- Robotic Body Weight Supported Treadmill Training (BWSTT) in children from a practical point of view: Target population, inclusion/exclusion criteria, adjusting training parameters
- Biofeedback and virtual reality for robotic BWSTT in children
- Clinical results of robotic BWSTT in children
- Standardized Assessments: Timed walking tests and feasibility of the electronic walkway system “GaitRite”
- 3D Gait Analysis to monitor improvement in quality of walking – A clinical example

| **Introducing the Armeo®Power: Guiding severely affected patients towards clinical success** | **Monday 13:00 - 14:00** |
|---|---|
| Nicole Schüpfer, MSc<br>Alexander Duschau-Wicke, PhD | HPH, G2 |
| Organizer: Hocoma, Switzerland | |

*Objective*
In this workshop, we will present the Armeo®Power to an international public for the first time. The ArmeoPower completes Hocoma’s established Armeo Therapy Concept and was specifically designed for patients with severe movement impairment who have no voluntary activation of their arm muscles yet. In addition to the Arm Weight Support, those severely affected patients specifically require assist-as-needed support for goal-directed movements. The motors of the ArmeoPower arm exoskeleton fulfill these needs by supporting and guiding patients as needed during the training of functional movements in a large 3D workspace.

Get to know the ArmeoPower in a hands-on seminar, and learn about experiences and best practices with the ArmeoPower research prototype (ARMin III, ETH Zurich) during a stroke multicenter trial in 4 Swiss rehabilitation hospitals

No experience with the device necessary.

| **Lokomat® advanced: Provoking best therapy efficiency in every therapy period** | **Monday 13:00 - 14:00** |
|---|---|
| Candy Tefertiller, Director of Physical Therapy<br>Julia Buehlmeier, PhD | HPH, G3 |
| Organizer: Hocoma, Switzerland | |

*Objective*
This workshop targets therapists as well as medical doctors who are already familiar with the basics of the Lokomat.
In this workshop, we will provide best practice examples with the Lokomat.

Furthermore we will focus on the following:
- how to challenge the patients with their specific needs during the course of the disease
- how to adapt and modulate training parameters in order to provoke best possible outcomes

Experience with device essential.

| **Pablo®Plus - upper limb rehabilitation** | **Monday 13:00 - 14:00** |
|---|---|
| Msc. Maik Hartwig, OT | HPV, G4 |
| Organizer: Tyromotion, Austria | |

*Objective*
Introducing the evidence-based therapy system Pablo®Plus for patients with sub-acute and chronic arm-paresis with plegic, paretic and spastic handicaps.

The practice oriented workshop shows a great variety of training methods with both the Pablo®Multiball and Pablo®Multiboard, which not only allow to train upper limb movements, strength and tonus-control but also record each and every assessment for documentation and evaluation.

| **Enhancing arm and hand rehabilitation with Armeo®Spring** | **Monday 14:15 - 15:15** |
|---|---|
| Tom Vanderhenst, MSc<br>Peter Schenk, PhD | HPH, G2 |
| Organizer: Hocoma, Switzerland | |

*Objective*
Since its introduction in 2007, the Armeo®Spring has gained a lot of attention and has been introduced successfully into leading centres worldwide. Through the combination of the passive Arm Weight Support and Augmented Feedback, it facilitates intensive, repetitive, self-initiated movement exercies even for patients with severe motor impairments. The Augmented Feedback provides game-like exercies and functional tasks, but also Assessment Tools.
In this workshop, we will
- introduce the rationale for the ArmeoSpring therapy,
- present the Armeo Therapy Concept,
- present current scientific evidence,
- perform a live demonstration.

Clinical application specialists will be present to discuss and answer your questions.

This workshop targets therapists as well as medical doctors interested in bringing upper extremity therapy to the next level using novel technologies, and it will provide an overview over the clinical benefits and the field of application of the ArmeoSpring.

No experience with the device necessary.

| Valedo™ Therapy Concept - Low back pain treatment with motivating functional movement therapy | Monday 14:15 - 15:15 |
|---|---|
| Jan Kool, PhD<br>Eelco Sengers, PT | HPH, G3 |
| Organizer: Hocoma, Switzerland | |

*Objective*
Chronic low back pain is a major and occupational public health problem, which is associated with high medical costs mainly through the loss of productivity due to sick leave. Research suggests that many back injuries and incidences of low back pain can be improved by active functional movement therapy. Nevertheless, the main problems in low back pain therapy are insufficient patient motivation as well as the patient's difficulty to exercise independently.

The ValedoMotion is a medical back training device for professional hospital and clinical use. It consists of three lightweight orientation and motion sensors and a tablet PC providing the Augmented Feedback software as well as audio and visual feedback. Therapeutic exercises mainly focuses on three areas: Stabilization, Mobilization and Movement awareness.
With the ValedoMotion we offer clinical relevant exercises to patients, engaging them in a self guided therapy program and improve the therapy and assessment for compliances.

Within the workshop we will give you an overview of the features and benefits of the Valedo Therapy Concept. The difference the ValedoMotion makes in daily practice with patients will be addressed by Eelco Sengers of the Sophia Rehabilitation Centre, The Hague, Netherlands

There will be the opportunity to experience the ValedoMotion yourself.

| Amadeo® - Advanced fingerrehabilitation | Monday 14:15 - 15:15 |
|---|---|
| Goncalo Goncalves, PT | HPV, G4 |
| Organizer: Tyromotion, Austria | |

*Objective*
There are just as many different hands as there are people. The Amadeo® creates a system for all phases of neurologic rehabilitation.

Target oriented exercises on the device help to improve motor functions of patients with restricted movement in individual fingers or in the whole hand.

The varied training and the clear feedback evaluations are very motivating for the patient. The therapy progress is made measurable and can be explained easily when discussing the effect of the therapy.

## ICVR Workshops

| Virtual Reality Technology for the Therapist | Monday 08:30 - 12:00 |
|---|---|
| Grigore C. Burdea, Rutgers University Tele-Rehabilitation Institute | HCI, J3 |
| Organizer: Grigoire C. Burdea, Rutgers University | |

*Objective*
The tutorial aims at educating the clinician on current VR technology intended or adapted for clinical use, including advantages and drawbacks.

Virtual reality technology has progressed substantially in recent years, with system costs diminishing. Adoption has been mixed, and sometimes without a strong body of research, which certainly poses safety risks for the patient and professional challenges for the clinician. While building a strong body of data that would lead to "best practices" will take time, this Tutorial can assist by giving a broad and unbiased coverage of the technology and predicting trends for the future.

*Intended Audience*
Clinicians (PTs, OTs, neuro-psychologists, psychiatrists) who contemplate getting involved in virtual rehabilitation research or clinical adoption but are held back by the technology unknown.

| Virtual Reality for Arm Therapy | Monday 09:30 - 12:00 |
|---|---|
| Andreas Luft,University Hospital Zurich<br>John Krakauer, Johns Hopkins Hospital<br>Daphne Bevalier, University of Rochester<br>Eling de Bruin, ETH Zurich<br>Robert Riener, ETH Zurich | HCI, J4 |
| Organizer: Andreas Luft, University Hospital Zurich | |

*Objective*
Behavioral results in healthy volunteers suggest that virtual reality video gaming not only trains reaction time, selective attention and vision, but also improves one's implicit learning ability. Stroke survivors can likely utilize the implicit learning capabilities of the motor system to improve movement deficits. The purpose of this workshop is to explore how to translate virtual reality-based training models that improve healthy learning to rehabilitation. The first two lectures are devoted to the characteristics of healthy movement learning and VR augmentation of healthy learning. The last two lectures then present virtual reality approaches to rehabilitation of elderly individuals and stroke survivors. The workshop will conclude with a round table discussion that aims at defining the necessary characteristics of virtual reality robotic gaming for stroke survivors with motor deficits.

- Why we need VR in rehabilitation, lessons from motor learning studies (15+5 min)
  *John Krakauer, Johns Hopkins Hospital*
- Learning from VR games (30+10 min)
  *Daphne Bevalier, University of Rochester*
- VR in rehabilitation (20+5 min)
  *Eling de Bruin, ETH Zurich*
- VR and robotics (20+5 min)
  *Robert Riener, ETH Zurich*
- Round Table Discussion: Developing VR games for stroke survivors with motor deficits (30 min)
  *All*

| Microsoft Kinect/Primesense Sensing Systems for Virtual Rehabilitation | Monday 08:30 - 12:00 |
|---|---|
| Belinda Lange and Albert (Skip) Rizzo, University of Southern California<br>Patrice (Tamar) Weiss, University of Haifa | HCI, J7 |
| Organizers: Belinda Lange and Albert (Skip) Rizzo, University of Southern California | |

*Objective*

One of the exciting new developments in the field of Virtual Rehabilitation involves the release of the new Xbox Kinect system by Microsoft. This revolutionary game platform uses an infrared "depth-sensing" camera (produced by an Israeli company, Primesense) to capture users' full body movement in 3D space for interaction within game activities. This system does not require the user to hold an interface device or move on a pad as the source of interaction within the game. Instead, the user's body is the game controller operating in 3D space and multiple users can be tracked in this fashion for both cooperative and competitive interactive activities. This technology is a significant advance over previously available 2D video capture systems.

Such low cost sensing systems for tracking human movement could revolutionize how virtual rehabilitation will be done in the future. Following a stroke, brain injury or other form of neurological disorder, a patient using this system can naturally interact with game content as part of their physical, occupational and cognitive therapy and they may be more motivated to do therapy when it is embedded in a game context. An attractive feature is the fact that while the Primesense camera provides the tracking functionality for the Kinect, it will soon be available as a low-cost stand-alone USB depth-sensing camera. This option will allow homegrown developers and researchers to produce game software and content that is specifically designed to promote rehabilitation, and perhaps "exergaming" activities beyond what the Xbox console games may offer.

Researchers have thus far integrated the MS Kinect/Primesense movement tracking system with custom-built rehab games and with associated software that allows it to drive any PC-based computer game by emulating standard mouse and keyboard commands, all based on the designated physical activity of the user. This will provide a new dimension for interactive rehabilitation and exergaming in many ways by opening up a multitude of existing game content for full body interaction. These advances could stand to promote healthcare research and application development that could be widely disseminated at a low cost in user's homes.

The objective of this workshop is to provide participants with an introduction to the technology and illustrate how it has thus far been applied in application development and evaluation. Participants will have an opportunity to try out the system and take part in a discussion regarding future research and clinical developments.

| Successful operational deployment of telerehabilitation. Organizational and operational issues in implementing Hip/knee rehabilitation using the Evocare telerehabiliation concept; the Solis case | Monday 08:30 - 12:00 |
|---|---|
| Hans van Zeist, Manager Nursing home Zorggroep Solis<br>Stefan Kok, Manager Paramedic Services Zorggroep Solis<br>Henry Mulder, Director Evocare BV<br>Achim Hein, Dr. Hein Healthservices GmbH | HCI, J6 |
| Organizer: Henry Mulder, Evocare BV | |

*Objective*

The ability to deploy telerehab successfully is a requirement to make telerehab mainstream. During 2010 Zorggroep Solis in Deventer, The Netherlands, implemented successfully the Evocare telerehabilitation concept. The workshop is using the experiences of the Evocare implementation. It will address the issues of implementing telerehab services in care provider organizations. Issues like required pre-requisites on infrastructure, procedures and protocols, job descriptions and other human resource issues, strategy, policies, communication and project management. Successful implementation of telerehab requires a tenacious team dealing with every detail to ensure broad acceptance within the organization and quality assurance.

## ICORR Workshops

| Implementation of impairment based rehabilitation robotics | Friday 13:45 - 15:45 |
|---|---|
| Jules Dewald, Northwestern University, Chicago<br>Jacob MacPherson, Northwestern University, Chicago<br>Arno Stienen, University of Twente, The Netherlands<br>Ana Maria Acosta, Northwestern University, Chicago | HPH, G1 |
| Organizers:<br>Jules Dewald, Northwestern University, Chicago, USA<br>Ana Maria Acosta, Northwestern University, Chicago, USA | |

*Objective*
This workshop will demonstrate the ideal attributes of various robotic technologies necessary for the quantification of motor impairments, such as stereotypical muscle synergies, spasticity and paralysis, that appear following stroke-induced brain injury. Deeper understanding of how these impairments impact movement will be shown to lead to the successful development of novel robot-mediated interventions. The discussion will include how impairment-based robotic interventions differ from conventional rehabilitation not only in quantitative control and level of intensity, but in the fundamental approach or strategy employed to achieve functional gains. Furthermore, considerations for successful transition to clinical practice will be highlighted including methods to increase acceptance by the therapist and patient such as merging entertainment with impairment-based rehabilitation robotics through the implementation of virtual gaming environments.

| Motor Intention and Sensory Feedbacks in Rehabilitation | Friday 13:45 - 15:45 |
|---|---|
| Koji Ito, Ritsumeikan University<br>Rieko Osu, ATR<br>Yasuharu Koike, Tokyo Institute of Technology<br>Etienne Burdet, Imperial College London<br>Pietro G. Morasso, Italian Institute of Technology | HPH, G2 |
| Organizers:<br>Koji Ito, Research Organization of Science and Engineering, Ritsumeikan University, Japan<br>Kiyoshi Nagai, Department of Robotics, College of Science and Engineering, Ritsumeikan University, Japan | |

*Objective*
Functional injuries in motor control are induced by various causes, such as stroke, traffic accidents, etc. Especially, stroke is a leading cause of adult disability. Though many rehabilitation methods are proposed for motor recovery, motor learning underlying the acquisition of motor skills is considered as a basic principle for functional recovery. It is then known that proprioceptive feedbacks to the somatosensory area reinforce the motor control in the damaged area and its surroundings. Specifically, synchronous activation of neurons along the motor and sensory pathways is essential to facilitate the synaptic reconnection.

The objectives of this workshop are to discuss the following topics related to motor intention and sensory feedbacks in rehabilitation.
- Novel methods detecting motor intention by EEG, EMG, NIRS etc.
- Proprioceptive sensory feedbacks by FES (Functional Electrical Stimulation), haptic interfaces of robots, and variable compliance/impedance robotic devices.

*Intended Audience*
The workshop is open to all the delegates.

| Clinical insights for rehabilitation engineers | Friday 13:45 - 18:15 |
|---|---|
| Jane Burridge, University of Southampton (UK)<br>Peter Feys, Hasselt University & PHL (BE)<br>Annick Timmermans, Adelante Centre of Expertise in Rehabilitation (NL)<br>Gerdienke Prange, Roessingh Research & Development Research Institute (NL)<br>Ann-Marie Hughes, University of Southampton (UK) | HPV, G5 |
| Organizers:<br>Jane Burridge & Ann-Marie Hughes, University of Southampton, UK<br>Peter Feys, Hasselt University & PHL, Belgium<br>Annick Timmermans, Adelante Centre of Expertise in Rehabilitation, The Netherlands<br>Gerdienke Prange, Roessingh Research & Development Research Institute, The Netherlands | |

*Objective*

This workshop aims to bridge the gap between robot designers and robot users. It addresses the question 'how do we design robots that will be used in clinical practice for different types of impairments?' Robotic devices are increasingly sophisticated and have many applications in supporting neuro-rehabilitation. Recent evidence from neurophysiological research and clinical studies has influenced rehabilitation robotic interventions for the arm, providing valuable knowledge about how to apply technology-based therapy for people with neurological disorders, such as stroke and multiple sclerosis. However, clinical use of such devices remains limited. Should the robots have to be re-designed?

The workshop will provide a comprehensive view from neurophysiology to users' needs and expectations. It will involve the audience in a lively debate stimulated by video presentations of patient case studies.

*Intended Audience*

The intended audience is primarily designers, engineers, and developers of arm rehabilitation technologies for neurological patients. The session will also be of interest to therapists, researchers, medical practitioners, neurophysiologists etc. involved in the application of rehabilitation robotics in clinical practice, as well as to any people interested in this field of study from a professional or personal background.

| Physiological Principles of Locomotion required for Robot Design | Friday 13:45 - 18:15 |
|---|---|
| Volker Dietz, University of Zurich<br>Gregoire Courtine, University of Zurich<br>Alexander König, ETH Zurich<br>Rüdiger Rupp, Universitätsklinik Heidelberg<br>Hartmut Geyer, Carnegie Mellon University<br>Erin Vasudevan, Moss Rehabilitation Research Institute<br>Jacques Duysens, KULeuven<br>Renaud Ronsse, UCLouvain<br>Jonas Buchli, Italian Institute of Technology | HPV, G4 |
| Organizers:<br>Volker Dietz, University of Zurich, Switzerland<br>Alexander König, ETH Zurich, Switzerland<br>Heike Vallery, ETH Zurich, Switzerland<br>Renaud Ronsse, UCLouvain, Belgium | |

*Objective*
This workshop aims at transferring physiological knowledge on the principles underlying neuro-plasticity after CNS damage in animals and humans to the efficient design of rehabilitation robotics and prosthetics. We will describe experiments in which neuroscientific knowledge has already been transferred into pre-clinical and clinical robots, and will provide neuroscience-based guidelines to design novel gait rehabilitation robots and prostheses. Collectively, the presented results will define a conceptual and practical framework to elaborate novel robotic systems that have the potential to further enhance the efficacy of robotically assisted neuro-rehabilitation to improve function after neurological impairments. A point of discussion will be the combination of the advantages from both sensory feedback and feed-forward controllers in rehabilitation robotics and prosthetics designs, as established by control theory principles.

| Brain-Computer Interfaces for communication and control | Friday 16:15 - 18:15 |
|---|---|
| Rupert Ortner, g.tec Guger Technologies<br>Nathan Evans, Laboratory of Cognitive Neuroscience, École Polytechnique Fédérale de Lausanne<br>Robert Leeb, Chair in Non-Invasive Brain-Machine Interface, École Polytechnique Fédérale de Lausanne | HPH, G2 |
| Organizer: Rupert Ortner, g.tec Guger Technologies, Austria | |

*Objective*
An EEG based Brain-Computer Interface (BCI) measures and analyzes the electrical brain activity (electroencephalogram, EEG) in order to convert the EEG into control commands. These commands are used to control external devices like wheelchairs or robots, spelling applications or smart environment like smart homes. BCIs are based - depending on the type of application - on slow cortical potentials, EEG oscillations in the alpha and beta band, the P300 response or steady-state visual evoked potentials (SSVEP). For example, BCI systems based on slow cortical potentials or oscillatory EEG components with 1-5 degrees of freedom were realized up to now. However, high information transfer rates were reached based on 2 degrees of freedom as otherwise the accuracy of the BCI systems dropped down. SSVEP based systems allow selecting up to 48 different targets and are limited by the number of distinct frequency responses that can be analyzed in the EEG. With P300 response based BCIs users can select commands from a rather large command set reliably. Recent advances in usability and reliability of BCI systems made it possible to demonstrate its usefulness for persons with disabilities without significant training effort. In this session different approaches based on demonstrators shall be introduced and vividly discussed.

*Intended Audience*
People working in the area of brain-machine interface, neuro-rehabilitation, working with handicapped people, innovative human computer interaction.

| Motor skill learning and neuro-rehabilitation | Friday 16:15 - 18:15 |
|---|---|
| Vittorio Sanguineti, University of Genoa and Italian Institute of Technology (ITALY)<br>Herbert Heuer, IfADo - Leibniz Research Centre for Working Environment and Human Factors (GERMANY)<br>Etienne Burdet, Imperial College, London (UNITED KINGDOM)<br>Roberto Colombo, Fondazione 'Salvatore Maugeri', Pavia (ITALY)<br>Dejan Popovic, Aalborg University, Aalborg (DENMARK) and University of Belgrade (SERBIA)<br>Ander Ramos, Eberhard-Karls-Universitat, Tübingen (GERMANY) | HPH, G1 |
| Organizers:<br>Vittorio Sanguineti, University of Genoa and Italian Institute of Technology, Italy<br>Etienne Burdet, Imperial College of Science, Technology and Medicine, UK | |

*Objective*

In recent years, motor learning theories and experiments have been used as a tool to investigate neurorehabilitation. In fact, neuro-rehabilitation can be analyzed as a particular form of motor skill learning.

Studying how humans acquire novel motor skills (and how robots can be used to facilitate such learning) may suggest or test neurorehabilitation therapies and novel ways to use robots for rehabilitation. For example, it has been suggested that the acquisition of a novel motor skill can be facilitated by allowing trainees to experiment the correct movements (the 'guidance' hypothesis), possibly using robots. However, guidance seems effective for some tasks but not for others. In addition, guidance may result in a reduced voluntary contribution, which may be detrimental to learning (the slacking effect).

And, after all, is guidance the only way robots could facilitate the acquisition of a motor skill? The effect of guidance and its opposite, lateral destabilisation, as well as other control strategies, have been experienced and analyzed by the speakers and other groups, and enabled to derive efficient strategies for neurorehabilitation.

The proposed workshop builds on the results of the EU-FP7 project HUMOUR, and has the following specific objectives:

- To provide an overview of the major theoretical issues in motor skill learning: guidance hypothesis, slacking, force field learning, role of redundancy
- To discuss how robots can facilitate the acquisition of a novel motor skill
- To discuss how robots could support the transfer of a motor skill from an expert to a naïve performer, and to support the acquisition of cooperative behaviors

The workshop will include tutorials, case studies and video demonstrations. The speakers are using robots and control theory, as well as psychophysical experiments, with healthy and impaired subjects, to investigate novel rehabilitation strategies.
At the end of the workshop, participants will be able to:

- Design an appropriate scheme of assistance for a specific motor task.
- Develop schemes for regulation of assistance, specifically aimed at preventing the slacking effect.
- Define appropriate performance measures for those particular tasks.

*Intended Audience*

Robot-therapy experts willing to identify novel and more principled approaches, based on knowledge of the mechanisms of motor skill learning.

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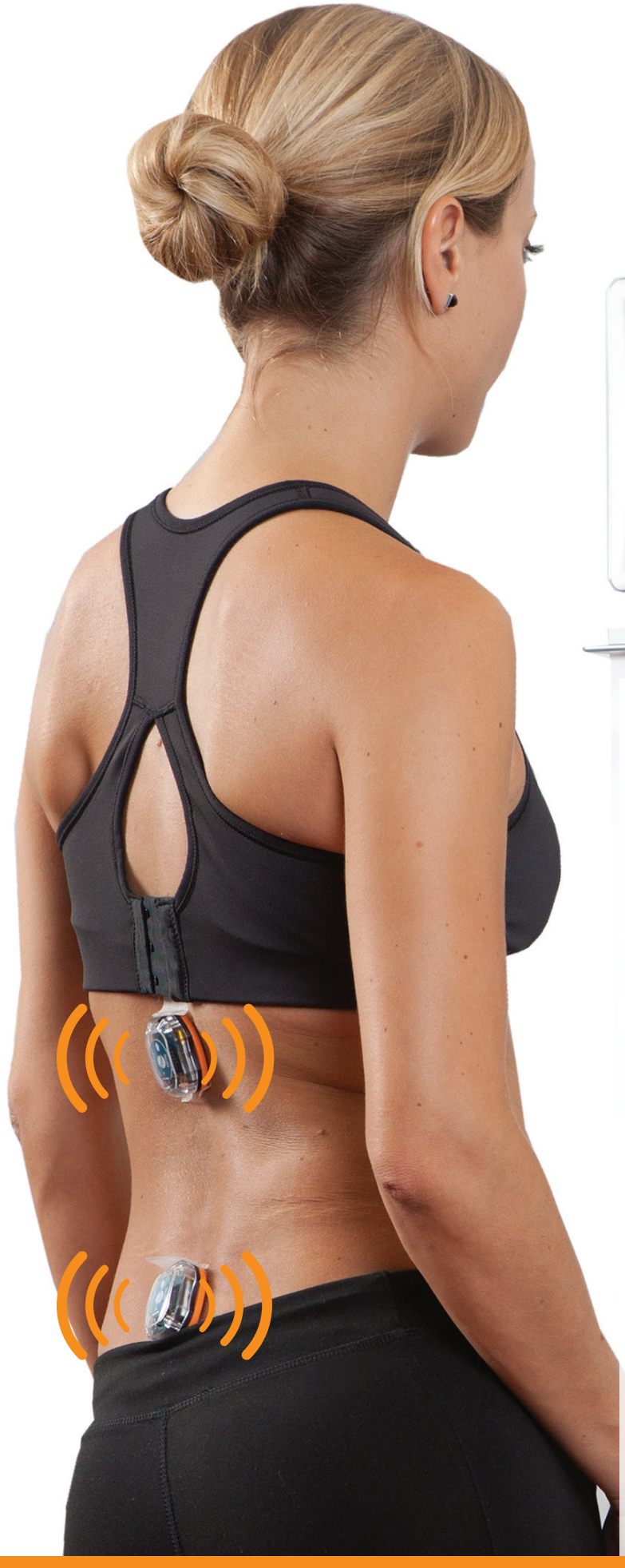


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**Motivating functional movement therapy for your clinic:**

- Offer clinically relevant exercises specifically designed for low back pain therapy.
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- Improve your patients' body movement awareness through precise real-time feedback.
- Capture your patients' training activity and progress with accurate therapy software.

The ValedoMotion, a medical back pain therapy system offers your patients functional and motivating exercises for an improved therapy outcome. Available in combination with the ValedoMotion, the ValedoShape supports your clinical decision making with innovative computer assisted assessment and display of the spinal shape and mobility.

**Are you interested to learn more about the clinical usage of ValedoMotion and ValedoShape? Please contact us at +41 43 444 22 00 or at info@hocoma.com.**

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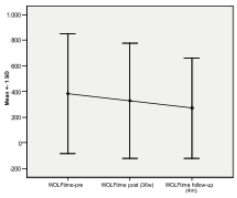
# INRS Poster / Speaker Sessions

Upper limb rehabilitation in hemiparetic subjects with the Armeo System

*C. Colomer, S. Torromé, A. Baldovi, L. Pérez, P. Morera, C. Mascaros, I. Verdecho, J. Cases, B. Moliner, J.Ferri, E. Noé*



- Upper limb rehabilitation program using Armeo
- 28 hemiparetic patients after a brain injury
- 36 sessions of 45-minutes
- Initial, final and a 4-month follow-up assessment
- Significant improvement in upper limb-function

Poster Session - B30

The use of virtual task parameter scaling and robotically simulated global forces to shape motor adaptations in persons with mild to moderate hemiparesis.

*G.G. Fluet, Q. Qiu, I. Lafond, S. Saleh, Alma S. Merians, S.V. Adamovich*

- The provision of robotic assistive forces changes a task.
- Hammer Task is a robotic activity with no assistive forces.
- Weakness is accommodated with haptic anti-gravity.
- Work-spaces are scaled to match user to abilities.
- User to avatar movement ratio is scaled

Poster Session - B31

Modular Arm Orthosis with Weight Support: Mechanical Concept

*W. Reichenfelser, J. Karner, M. Gföhler*

- Four electronically lockable degrees of freedom
- Modular device, assembled according to users needs
- Worn with a body harness or mounted on wheelchair
- Weight compensation via a spring mechanics
- Easily adjustable to different anthro-pologic sizes

Poster Session - B32

Reorganization of spinal neuronal networks after locomotor training in human spinal cord injury

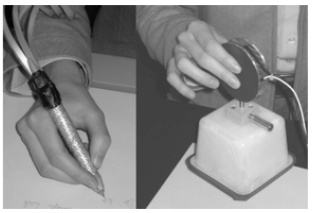
*Nupur Hajela, Andrew C. Smith, Chaithanya K. Mummidisetty, W. Zev Rymer, and Maria Knikou*

- Lokomat training (LT) in chronic complete SCI
- Electrophysiological tests before and after LT
- After LT, homosynaptic depression returned
- After LT, the soleus H-reflex was modulated
- Evidence support selective spinal plasticity

Poster Session - B33

Generalization of training-induced relaxation of muscular dystonia across tasks in patients with writer's cramp

*Kathrin Allgöwer, Waltraud Fürholzer, Barbara Baur, Joachim Hermsdörfer*

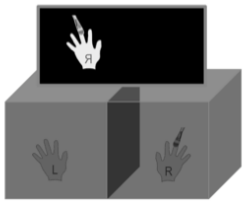


- Investigating grip force in writer`s cramp
- Measurement of hand writing with a graphic tablet
- Measurement of forces during weight lifting
- Implementation of a handwriting training
- Success of training extends to other motor skills

Poster Session - B34

Referred Sensations elicited by video-mediated mirroring of hands

*Simon Hoermann, Holger Regenbrecht, Liz Franz, Brian Dixon*

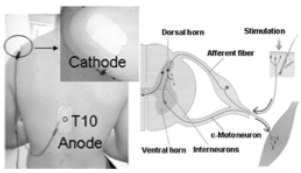


- Replication of referred sensation effects
- Video-mediation for more control e.g. environment
- By stimulating and visually mediating right hand
- sensations were elicited in the left hand
- Therapeutic potential for pain man-agement etc.

Poster Session - B35

Modulation of spinal neuronal circuitries by transcutaneous spinal direct current stimulation

*Michèle Hubli, Miriam Altermatt and Marc Bolliger*




- Non-invasive technique for spinal neuromodulation
- Modulation of spinal reflex circuits
- Assessments in healthy and SCI subjects
- Increase in spinal excitability in SCI subjects
- Potential for neurorehabilitation after SCI?

Poster Session - B36

Coordinative training in degenerative cerebellar disease

*W. Ilg, D. Brötz, S. Burkard, M.A. Giese, L. Schöls, M. Synofzik*

- Intensive coordination training for 4 weeks
- Focus on whole body coordination tasks
- Improvements in ataxia and dynamic balance
- Transfer to ADL
- Continious training is crucial

Poster Session - B37

Bimanual coordination in stroke recovery: Kinematic analysis provides open leads to individualize upper limb rehabilitation

*J. Metrot, D. Mottet, I. Relave, H.-Y. Bonnin, J.-Y. Pelissier, L. Van Dokkum, K. Torre and I. Laffont*

- Natural evolution of bimanual coordination
- Measure upper limb motor
- capabilities of patients
- Seven reaching kinematics using
- 3D motion capture
- Initial study with 15 subacute stroke patients

Poster Session - B38

Effectiveness of Robot-Assisted Gait Training in Children with Cerebral Palsy – Preliminary Results

*Corinne Ammann-Reiffer, Andreas Meyer-Heim and Hubertus van Hedel*

- Randomised clinical cross-over trial
- Effect of Lokomat therapy in children with CP
- 15 outpatient training sessions within 5 weeks
- Various functional gait parameters analysed
- No difference between training & control period

Poster Session - B42

The Effect of Aquatic Exercise on Cardiovascular Fitness in Subacute Stroke Patients

*Bo Ryun Kim, M.D., Eun Young Han, M.D., and Sang Hee Im, M.D.*

- 6 wks aquatic exercise using a water-based treadmill
- Symptom-limited graded exercise stress test
- 6 exercise stress test and 6MWT parameters analyzed
- Fourteen subacute stroke patients
- Analyzed parameters indicate cardiac function

Poster Session - B45

Effective Rehabilitation of Patients with Motor Disorders

*Bodrova R.A.*

- Assessment of ischemic stroke and paresis
- Combination of kinesiology, sling-theraphy, CPM-therapy,
- active mechanic on “Minitensor” and “EN-TreeM”, TENS
- Estimation of EMG and functional parameters
- Analyzed points are indicative of impairment

Poster Session - B46

Combined application of robot-assisted training and functional electrical stimulation in patients with acute stroke

*V. Daminov, A. Kuznetsov, N.Rybalko*

- Effectiveness of FES and Erigo training
- Monitoring of central and cerebral blood flow
- Combination of both treatments leads to better motor function
- FES and Erigo reduces risk of orthostatic reactions but does not improve cerebral circulation

Poster Session - B49

The Lokomat® effectiveness for the gait rehabilitation in the cronique stage after stroke

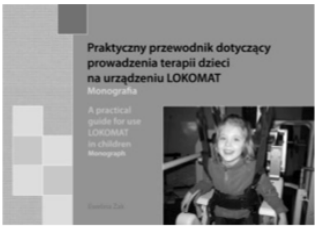
*A. Castrillo Calvillo, C. López Pascua, Mª Angeles Atin Arratibel, M. Benito García, B.Ruiz Vega, M. Presa Fernández, A. Vicario Méndez, et al.*

- Assessment of gait rehabilitation in stroke patients
- Lokomat and therapy based on the Bobath Concept
- 7 kinematic and kinetic parameters were analyzed
- Pilot study with unilateral stroke patients
- Parameters were translated into ICF language

Poster Session - B50

A practical guide for the use of the Lokomat in Children with cerebral palsy

*E. Zak, J. Durmala*




- The aim of the research is to present a unique monograph
- Analytical methodology of Lokomat training in the rehabilitation of children
- Step by step approach on how to conduct exercises starting from first setup to advanced forms of exercises

Poster Session - B52

Robotic Training and Kinematic Assessment of Arm and Hand after Incomplete Spinal Cord Injury: A Case Report

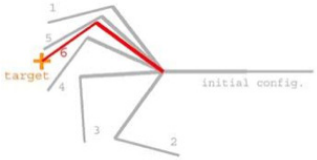
*Z. Kadivar, J.L. Sullivan, D.P. Eng, A.U. Pehlivan, M.K. O'Malley, G.E. Francisco, N. Yozbatiran*

- Robot-assisted training of forearm and wrist
- Suitable for persons with spinal cord injury (SCI)
- Operating modes: passive, active-constraint & triggered
- Tested for a tetraplegic person with SCI
- Kinematic improvements after 10 training sessions

Poster Session - C1

Reliable Strategy for Movement Learning and Control Optimisation

*Petko Kiriazov*




- control learning in goal-directed motion tasks
- new concepts for efficient learning control
- minimum number of control parameters to be learnt
- minimum number of test movements
- reliable control strategy in neurorehabilitation

Poster Session - C3

Cardiovascular response at LOKOMAT-training in spinal cord injured patients

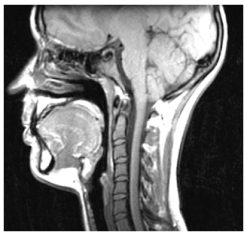
*Marina Makarova, Tatyana Shapovalenko, Konstantin Lyadov, Moscow, Russia*

- Complex programs arm spasticity
- Combined botuline and kinesiotherapeutic treatment
- Stroke 3 groups moderate expressed spacticity
- Methods MAS ARAT FIM; BT kinesiotherapy ARMEO
- Differentiated program of antispastic treatment

Poster Session - C5

Assessment of swallowing and its disorders – A dynamic MRI study

*Vijay Kumar. K.V., Shankar. V., and Roy Santosham*



- Dynamic MRI helps better to understand the physiology of swallowing
- This information helps modifying traditional maneuvers to overcome dysphagia
- It provide precise information about swallowing

Poster Session - C6

Cardiovascular response at LOKOMAT-training in spinal cord injured patients

*Marina Makarova, Tatyana Shapovalenko, Konstantin Lyadov, Moscow, Russia*

- 2 weeks Lokomat training in 57 chronic SCI patients
- Cardiovascular reactions were analyzed
- No circulatory disturbances during walking.
- Increase in diastolic blood pressure & cardiac output
- Decrease in peripheral resistance index

Poster Session - C7

Rehabilitation of post-stroke patients with BCI training

*Alexander Frolov, Ludmila Chernikova, Pavel Bobrov and Olesya Mokienko*

- Using the BCI based on Bayesian classifier
- Evaluation of the motor imagery performance
- Healthy subjects older 45 are able to Operate BCI
- BCI in rehabilitation of post-stroke patients

Poster Session - C8

New stance control orthotic knee joint for patients with anterior instability of the knee

*A. Norouzi-Javidan, S.h. Emami-Razavi, M.Omidzohour, R.Emadifard*

- Mechanical weight activated joint for patients with anterior knee instability.
- During weight support phase locked joint supports the knee from instability in the stance phase
- During swing phase the unlocked joint facilitates knee flexion

Poster Session - C10

New Pneumatic and Anti spastic Upper Limb Splint for CVA

*S.h. Emami-Razavi, A. Norouzi-Javidan, M.Omidzohour, R.Emadifard*

- Create anti-spastic and corrective positions in fingers / wrist and elbow
- Simultaneously prevent subluxation of the shoulder
- Very lightweight
- Easy to wear
- Cost effective

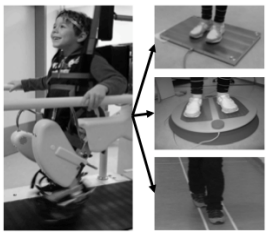
Poster Session - C11

Central and cerebral blood flow estimation of patients in acute stroke applying robotic devices Erigo and Lokomat
*V. Daminov, A. Kuznetsov, N. Rybalko*

- Cerebral blood flow in acute stroke patients
- Transcranial Doppler ultrasonography of damaged middle cerebral artery
- Application of both devices is safe
- Inclusion of robotic devices has positive effects on cerebral circulation

Poster Session - C12

Immediate Effects of a single Robotic Assisted Gait Training on Balance Skills in Children with Cerebral Palsy
*Tabea Schuler, Esther Keller, Roland Müller and Andreas Meyer-Heim*



- Effect of a single Lokomat® training:
- Outcome: (I) centre of pressure, (II) gait test
- (III)sensor motor abilities, symmetry, stability
- 7 Children with CP (mean age 13 years, GMFCS level I-III)
- Significant improved static balance and dynamic balance

Poster Session - C13

Application of robot device "Locomat" combined with epidural stimulation at patients with neglected vertebral and spinal trauma
*E. N. Shchurova, O. G. Prudnikova, D. N. Blyudenov*

- Rehabilitation of patients with spinal trauma
- Virtual reality and epidural stimulation
- Analysis of temperature and pain sensitivity
- Analysis of muscle function
- Interventions improve patients functional status

Poster Session - C14

Experience in application of «Amadeo» for the rehabilitation of patients with hemiparesis of different etiology
*Sidyakina I., Ivanov V., Shapovalenko T., Lyadov K.*

- Amadeo therapy in patients with distal upper limb pareses.
- 26 patients with various neurological pathologies.
- Training led to arbitrary activity in distal muscles
- Inclusion of «Amadeo» therapy in a complex treatment intensifies the rehabilitation program

Poster Session - C16

Early rehabilitation of patients with severe stroke
*Sidyakina I., Shapovalenko T., Ivanov V., Lyadov K.*

- Rehabilitation program starting 24 hours after stroke
- 258 patients (65,4+13,8 years) were included
- Significant decrease of stroke severity (NIHSS)
- Increased level of functional independence
- Safe & effective rehabilitation is possible at this stage

Poster Session - C17

Rehabilitation vision by means of influencing vibration on mimic muscle and biological active points
*Skuratovich A.S.*

- Myopia is caused by excessive strain eye muscles.
- It is necessary to design special exercises
- Rehabilitation incuding muscle stimulation
- Stimulate biological active points
- gain of visual acuity was in the range of 1.2 to 2.1.

Poster Session - C18

Device for rehabilitation of hand and finger mobility
*Skuratovich A.S.*

- Hand injuries compose 23%--32%
- develop the device
- develop methods and exercises of rehabilitation
- To reduce rehabilitation time
- develop methods of complex-coordination movements

Poster Session - C19

Evaluation of robot-assisted gait rehabilitation using integrated biofeedback in neurologic disorders
*Oliver Stoller, Marco Waser, Lukas Stammler and Corina Schuster*

- Clinical evaluation of 8 robot-assisted training sessions
- Using an existing biofeedback system
- Sign. differences in hip flexion and knee extension activities
- Biofeedback system is not appropriate to evaluate progress

Poster Session - C20

Changes of somatosensory sensibility of amputees by multi-channel vibration stimulator

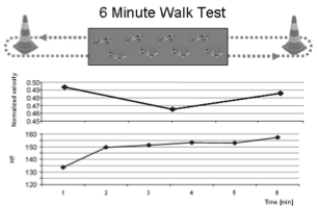
*Tae Soo Bae, Hyung Jae Kim, Jong Kwon Kim, Sol Bi Kim, Yun Hee Chang, Shin Ki Kim, and Mu Seong Mun*

- Assessment of somatosensory sensibility at stump
- Setup of multichannel vibraton stimulation system
- Subjective response for random stimulus analyzed
- Clinical research with amputee and non-amputee
- No difference of response at most of channels

Poster Session - C21

Stability of walking performance during the 6-minute walk test: Preliminary results in young patients with neurological disorders

*Huub van Hedel and Monika Leuenberger*




- 20 children with neurological gait-disorders
- stepped during 6MinWT repeatedly over GaitRite
- during the test: increase in heart frequency
- changes in velocity, step length and asymmetry
- performance during 6 MinWT is not constant

Poster Session - C22

Quantifying dexterity and grasping in children with cerebral palsy: Validity and reliability of the nine-hole-peg test and box-and-block test

*Huub van Hedel and Karin Wick*

- 25 children with cerebral palsy participated
- Dynamometry, BBT and NHPT repeatedly performed
- More affected side: $0.92 \leq ICC \leq 0.97$
- Reliability improves by using average/best value
- These tests are reliable in children with CP

Poster Session - C23

Mixed Reality to Strengthen Early Post Stroke Upper-Limb Rehabilitation

*Liesjet Van Dokkum, Ines di Loreto, Isabelle Laffont & Abdelkader Gouaich*

- Mixed Reality to improve upper-limb rehabilitation
- Real life hand movements within a virtual environment
- Enhancing motivation & fun
- Increasing quantity & quality of training
- Stroke experts ++ on utility,usefulness and clinical potential.

Poster Session - C25

Robotic training and clinical assessment of upper limb move-ments after incomplete spinal cord injury: two case reports

*Yozbatiran N, Berliner J, O'Malley M.K, Pehlivan A.U, Kadivar Z, Boake C, Francisco G.E*

- Robotic-assisted training of upper limb motor functions after SCI
- 10-12 sessions of treatment
- Clinical and functional assessment
- No adverse events
- Improvement in arm and hand functions

Poster Session - C26

A comprehensive assessment of motor function after 4 weeks of treatment of gait

*E. Zak, J. Durmala, G. Sobota, A. Glowacka, A. Czernuszenko, M. Bonikowski, S. Snela*

- Multicenter project conducted over a period of one year
- Dynamics of functional motor abilities of children with CP applying robotic as well as conventional therapy
- Pre-, and post training evaluation (GMFM-88, 6MWT, 10MWT, TUG, motion analysis)

Poster Session - C27

What kind of exercises can be led during gait therapy on a treadmill?

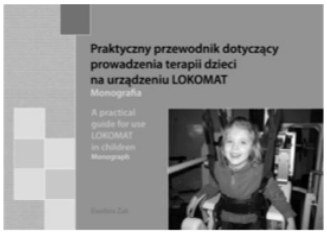
*E. Zak, J. Durmala*

- Gait is a set of controlled activities coordinated by movements of upper limb and trunk
- Effectiveness of rehabilitation depends on motivation, age, muscle strength and exercise
- We present exercises that can be used during Lokomat therapy in children

Poster Session - C28

A practical guide for the use of the Lokomat in Children with cerebral palsy

*E. Zak, J. Durmala*




- The aim of the research is to present a unique monograph
- Analytical methodology of Lokomat training in the rehabilitation of children
- Step by step approach on how to conduct exercises starting from first setup to advanced forms of exercises

Poster Session - C29

## Speaker Session

Measuring and Augmenting Locomotor Recovery after SCI with Spinal Cord Stimulation
*Keith Tansey*

- Reflexes track plasticity of locomotor recovery
- Spinal stimulation causes reflexes in leg muscles
- The Lokomat can trigger spinal stimulation in gait
- More loading and treadmill speed improves stepping
- This is augmented with tonic spinal stimulation

Paper 1

fNIRS monitoring of neurorehabilitation
*Ichiro Miyai*

- Functional NIRS is used to feed back cortical activation related to aimed movements before, during and after rehabilitation intervention.
- Knowledge of results and reward regarding performance may enhance efficacy of motor learning

Paper 2

Practical Considerations in Formulating Stroke Rehabilitation Clinical Trials
*Steven Wolf*

- Contemporary obstacles to implementing rehabilitation clinical trials
- Specifying generalizability of approaches
- Health care policies – hindrance or facilitator?
- The intellectual cost of financial cost constraints

Paper 3

Biomimetic Upper Limb NMES Integrated with Eye Tracking in Hybrid Assistive Exoskeletons
*Ferrigno G., Ferrante S. , Ambrosini E., Casellato C., Gandolla M., Pedrocchi A.*


- Identification of interaction tasks shared into sub-actions
- Identification of motor strategies during reaching supported by ArmeoSpring™
- Definition of a NMES biomimetic feedforward controller
- Use of the Eye tracking to detect user intention
- Initial study on healthy volunteers

Paper 4

Clinical use of Rehabilitation Robotics: Getting to best practices
*Michael Boninger*

- Is Standardization Best Practice?
- Standardizing Robotics Protocols
- Getting to Uniform Data Collection
- Techniques to Get to Consensus

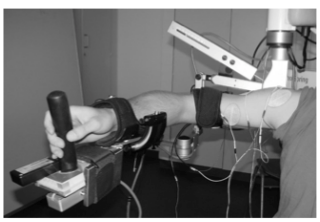
Paper 5

Strategies for Neuromuscular Recovery after Spinal Cord Injury
*Susan Harkema*

- Improvents of balance and ambulation in individuals with chronic spinal cord injury using locomotor training.
- Analyses of outcome measures for neurologic recovery
- New approaches for recovery with epidural stimulation

Paper 6

EMG-controlled functional electrical stimulation: devices and methods
*Thomas Schauer*



- EMG-based detection of muscle activity during FES
- Measurement from stimulation- or EMG-electrodes
- Filters for assessing volitional muscle activity
- EMG-driven FES: Triggered versus proportional
- Applications: Upper limb control & FES cycling

Paper 7

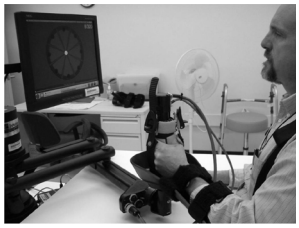
Robotic technologies for multiple sclerosis
*Vittorio Sanguinetti*

- Rehabilitation in multiple sclerosis: what use for robots?
- Using robots to assess impairment, adaptation, capabilities.
- Using robots for therapy:
- Reorganization, compensation, attention
- Personalization of exercise
- Adaptive training
- Motor skill learning

Paper 8

Clinical Evidence for Upper-Extremity Rehabilitation in Chronic Stroke and Implications for Use of Robotic Technology: Results of VA ROBOTIC Clinical Trial

*Albert Lo*



- Robot vs usual care significant at 36 wks not 12
- Robot vs conventional improvement is not different
- Subjects were more severe with multiple strokes
- Results suggest latent motor plasticity potential
- Overall health cost for rehabilitation robots

Paper 9

# ICVR Podium / Poster Sessions

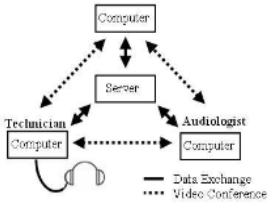
## Podium Session 1, Room HPV G5 — Monday, 13h15-14h00 — Sensory Impairment

Virtual Environment Support Orientation Skills of Newly Blind
*Orly Lahav, David W. Schloerb and Mandayam Srinivasan*

- Integrate VE in traditional rehabilitation program
- BlindAid aimed to serve as an O&M simulator
- Performance on orientation tasks in VE and real

Paper 1

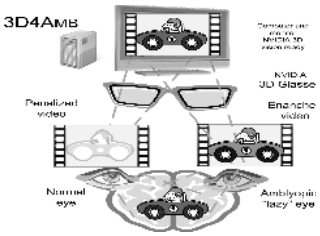
Remote Hearing Screening as Part of Auditory Telerehabilitation; a Preliminary Report
*Pasin Israsena*




- Teleaudiometry for universal hearing screening
- A low-cost software audiometer is proposed
- With extra features such as video conferencing
- Preliminary trial results are reported

Paper 2

Using 3D for Rebalancing the Visual System of Amblyopic Children
*Angelo Gargantini, Mariella Bana and Flavia Fabiani*

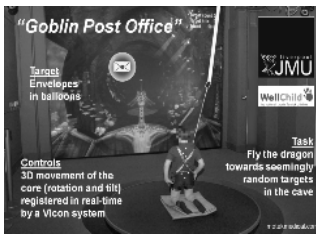



- 3D
- amblyopia
- vision rebalancing

Paper 3

## Podium Session 2, Room HPV G5 — Monday, 14h00-15h15 — Posture and Balance

Playing the Goblin Post Office game improves movement control of the core: A case study
*Gabor Barton, Richard Foster, Gill Holmes, Penny Butler and Malcolm Hawken*




- cerebral palsy
- movement training
- core control
- virtual rehabilitation

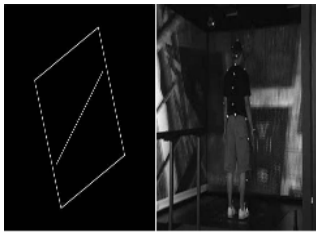
Paper 1

Postural responses of adults with cerebral palsy to combined base of support and visual field rotation
*Jill Slaboda, Richard Lauer and Emily Keshner*

- Cerebral palsy
- visual flow
- visual dependence

Paper 2

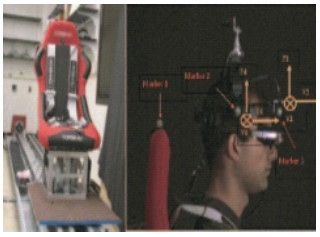
Visual Sensitivity Modulates Postural Sway in a Virtual Environment in Healthy Elderly and Individuals with Stroke
*Emily Keshner and Jill Slaboda*



- visual dependence and balance
- Rod and Frame Test
- Stroke and aging
- visual-vestibular conflict

Paper 3

Head stabilization shows multisensory dependence on spatiotemporal properties of visual-inertial passive stimulation
*W. Wright, Mobin Agah, Kurosh Darvish and Emily Keshner*



- Visual-vestibular integration
- Head-stabilization
- Postural adaptation

Paper 4

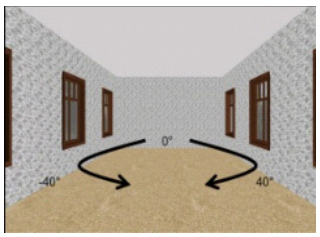
BioTrak: a comprehensive overview
*Roberto Lloréns , José Gil-Gómez, Patricia Mesa-Gresa, Mariano Alcañiz, Carolina Colomer and Enrique Noé*

- virtual rehabilitation
- balance recovery
- acquired brain injury
- virtual therapy
- neurorehabilitation

Paper 5

## Podium Session 3, Room HPV G5 Monday, 15h45-17h00 Post-stroke Rehabilitation

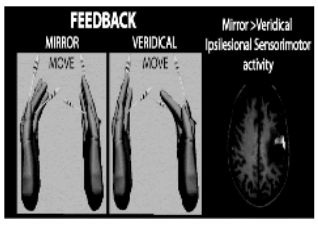
Optic flow in a virtual environment can impact on locomotor steering post stroke
*Jessica Berard, Joyce Fung and Anouk Lamontagne*




- Steering in response to optic flows while walking
- Visuomotor control altered after stroke
- History of neglect associated with poor steering

Paper 1

Mirror feedback in virtual reality elicits ipsilesional motor cortex activation in chronic stroke patients
*Eugene Tunik, Soha Saleh, Hamid Bagce, Alma Merians and Sergei Adamovich*




- MRI-compatible virtual reality system
- Paretic hand model controlled by nonparetic hand
- Facilitation of ipsilesional sensorimotor cortex
- Chronic stroke subjects

Paper 2

Rehabilitation Robot for Unimanual and Bimanual Training of Hemiparetic Subjects
*Matic Trlep, Matjaž Mihelj, Urška Puh and Marko Munih*

- bimanual post-stroke robot rehabilitation
- assistance control adepts to individual subjects
- unimanual vs. bimanual training
- tested with 4 chronic hemiparetic subjects

Paper 3

Integrative Motor, Emotive and Cognitive Therapy for Elderly Patients Chronic Post-Stroke - A Feasibility Study of the BrightArm™ Rehabilitation System
*Bryan Rabin, Grigore (Greg) Burdea, Jasdeep Hundal, Doru Roll and Frank Damiani*

- VR system used for integrative rehabilitation.
- Clinical study with 5 elderly chronic post-stroke.
- Rated an overall 4.1 out of 5 on subjective evals.
- UE Fugl-Meyer increases of 11+ by 2 participants.
- Supported arm reach increased an average 634%.

Paper 4

Neurorehabilitation of Poststroke Cognitive Impairments with the Use of Computed Programs

*Semyon Prokopenko , Elena Mozheyko, Tatyana Koryagina, Marina Petrova, Darya Kaskayeva, Tatyana Chernyh and Era Arakchaa*


- The present research was aimed at efficiency estim
- We have developed a method of restoration of 4 asp
- The method of training of the visual-spatial gnosi
- Training of visual-spatial memory with the use of
- The first experience of inclusion of the training

Paper 5

## Podium Session 4, Room HPH G3 Tuesday, 10h50-11h50 Games for Rehabilitation

An Investigation of User Acceptance and Flow Experience Using Video-Capture Gaming Technology for Exercise

*Gillian Barry, Paul Van Schaik, John Dixon, Alasdair MacSween and Denis Martin*

- User Acceptance and Flow Experience Using Video-Ca
- Balance based Exercise VR verse Normal
- 38 Sedentary Participants.
- Results show IREX™ to be an acceptable alternative

Paper 1

The Effects of Visual Feedback in Therapeutic Exergaming on Motor Task Accuracy

*Julie Doyle, Daniel Kelly, Matt Patterson and Brian Caulfield*

- Therapeutic exergaming
- Visual Feedback
- Sensors
- Exercise quality

Paper 2

Usability of Technology Supported Social Competence Training for Children on the Autism Spectrum

*Patrice (Tamar) Weiss, Eynat Gal, Sue Cobb, Laura Millen, Tessa Hawkins, Massimo Zancanaro, Leonardo Giusti, Sigal Eden and Tony Glover*

- To improve social competence skills in autism
- Use collaborative technologies to implement CBT
- Usability studies to evaluate technologies

Paper 3

## Podium Session 5, Room HPH G3 Tuesday, 11h50-12h35 Upper Limb Rehabilitation

Virtual Rehabilitation of Upper-Limb Function in TBI: A Mixed-Approach Evaluation of the Elements System

*Peter Wilson, Nicholas Mumford, Jonathan Duckworth, Patrick*

- Traumatic Brain Injury
- Virtual Reality
- Motor rehabilitation

Paper 1

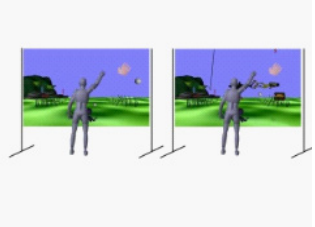
Arm motor rehabilitation in chronic stroke: Effects of two training environments

*Sandeep Subramanian, Christiane Lourenco, Heidi Sveistrup and Mindy Levin*

- comparison of virtual and physical environments
- enhanced therapy improves upper limb motor outcome
- stroke patients benefit from enhanced training

Paper 2

Short-Term Practice with Customized 3D Immersive Videogame Improves Arm-Postural Coordination in Patients with TBI
*Ksenia Ustinova, Christopher Ingersoll and Nick Cassavaugh*

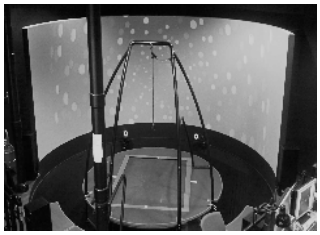


- 3D immersive game Octopus
- Patient with TBI practicing the game
- Improvement in arm-postural coordination

Paper 3

## Podium Session 6, Room HPH G3 Tuesday, 14h45-16h00 Gait, Locomotion and Navigation

Influence of moving visual surroundings on walking
*Agali Mert, Laura Hak and Willem Bles*



- Vestibular functioning
- vection
- falls
- rehabilitation
- gait stability

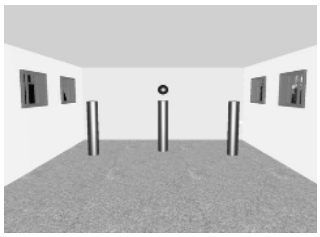
Paper 1

The effect of differing optic flow on steering behaviours during goal-oriented locomotion
*Andrei Garcia Popov and Anouk Lamontagne*

- Control of goal-oriented locomotion
- Effect of changing optic flow and target location
- Normative data from healthy young individuals

Paper 2

Perceptual and navigational strategies for obstacle circumvention in a virtual environment
*Anuja Darekar, Gayatri Aravind, Anouk Lamontagne and Joyce Fung*



- Obstacle circumvention strategies during locomotion
- Perception of time and distance to collision
- Effect of aging on locomotor strategies

Paper 3

Treadmill Training with Virtual Reality to Decrease Risk of Falls in Idiopathic Fallers: a Pilot Study
*Anat Mirelman, Noa Raphaeli-Beer, Moran Dorffman, Marina Brozgul and JM Hausdorff*

- VR for idiopathic fallers is feasible
- Improvements in both motor and cognitive abilities
- Fall mediators improved

Paper 4

Axis of visual field rotation and order of presentation differentially affect postural responses in virtual environment
*Ravi Buddharaju, Lois Lanaria and Emily Keshner*

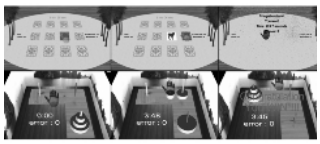
- perception
- posture
- muscle activity
- axis of optic flow

Paper 5

## Podium Session 7, Room HPH G3 — Tuesday, 16h30-17h30 — Rehabilitation for Brain Injuries

Emotive, Cognitive and Motor Rehabilitation Post Severe Traumatic Brain Injury – a New Convergent Approach

*Grigore (Greg) Burdea, Bryan Rabin, Aurélien Chaperon and Jasdeep Hundal*



- Two case studies chronic post-severe TBI
- Custom virtual reality games on Rutgers Arm II
- Cognitive gains in focusing and executive function
- Emotive gains in reduced depression
- Gains in shoulder strength and hand dexterity

Paper 1

Effectiveness of executive functions training within a virtual supermarket for adults with Traumatic Brain Injury

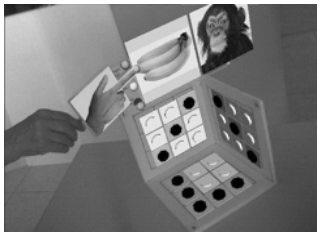
*Michele Jacoby, Sara Averbuch, Yaron Sachar, Noomi Katz, Patrice (Tamar) Weiss and Rachel Kizony*

- Executive functions important for daily function
- Virtual reality treatment may improve EF
- Overall, VR treatment better than conventional OT

Paper 2

Development of an Interactive Artifact for Cognitive Rehabilitation based on Augmented Reality

*Claudio Kirner and Tereza Kirner*



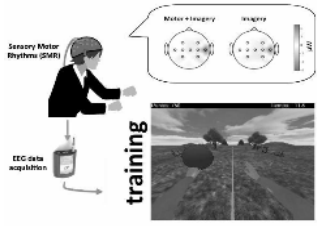
- Interactive artifact based on augmented reality
- cognitive disabled people and therapists
- low cost and easy customization
- user-friendly interface
- multi-sensory input/output

Paper 3

## Podium Session 8, Room HPH G3 — Wednesday, 10h50-12h35 — Virtual Reality Training for Pain and Disability

Exploring the Synergies of a Hybrid BCI – VR Neurorehabilitation System

*Sergi Bermudez i Badia, Andrés García Morgade, Hani Samaha*




- Hybrid BCI - VR system
- Exploits combined motor execution and imagery
- Personalized training in a VR environment

Paper 1

Development of virtual environments for patient-centered rehabilitation

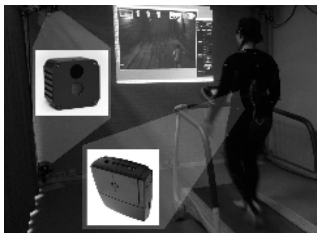
*Sebastian König, Andreas Duenser, Christoph Bartneck, John Dalrymple-Alford and Gregory Crucian*


- individually designed virtual environments
- relevant training tasks for neurological patients
- rapid workflow to build environment in few hours
- realistic virtual environments easily recognizable
- effortless integration in clinical practice

Paper 2

Chronic Pain Rehabilitation with a Serious Game using Multimodal Input

*Christian Schönauer, Stephanie Jansen – Kosterink, Hannes Kaufmann, Miriam Vollenbroek-Hutten and Thomas Pintaric*

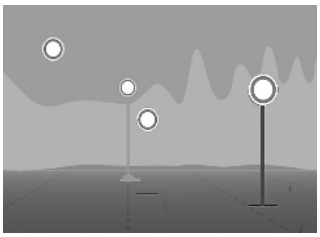


- Chronic pain rehabilitation
- Serious games
- Full body interaction

Paper 3

Effects of Shading and Droplines on Object Localization in VR for Patients with Neurological Conditions

*Wouter van den Hoogen, Peter Feys, Ilse Lamers, Sofie Notelaers, Katrien Baeten, Lore Kerkhofs, Karin Coninx and Wijnand IJsselsteijn*



- Neurorehabilitation
- Shading and Droplines
- Optimising Virtual Environments
- Movement quality

Paper 4

Virtual reality rehabilitation system for neuropathic pain and motor dysfunction in spinal cord injury patients

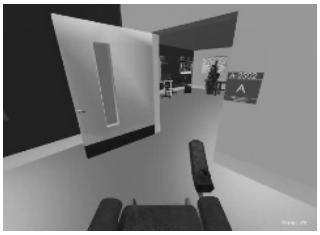
*Michael Villiger, Jeremy Spillman, Bruno Meilick, Daniel Kiper, Pawel Pyk, Natalia Estevez, Spyros Kollias, Armin Curt, Marie-Claude Hepp-Reymond, Sabina Hotz-Boendermaker and Kynan Eng*

- VR for incomplete spinal cord injury patients
- Lower limb motor dysfunction and neuropathic pain
- Training addresses both motor dysfunction and pain
- Single-case series patient testing
- Improved motor function and reduced pain

Paper 5

Comparison of powered wheelchair driving performance in a real and in a simulated environment

*Philippe Archambault, Jodie Ng Fuk Chong, Gianluca Sorrento, François Routhier and Patrick Boissy*



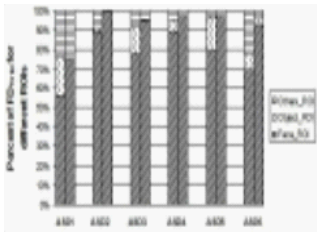
- simulator
- power wheelchair
- driving skills

Paper 6

## Podium Session 9, Room HPH G3 Wednesday, 16h45-17h30 Rehabilitation for Children

Dynamic Gaze Measurement with Adaptive Response Technology in Virtual Reality based Social Communication for Autism

*Uttama Lahiri, Zachary Warren and Nilanjan Sarkar*



- virtual-reality
- eye-tracking
- fixation counts
- fixation duration

Paper 1

Validation of the Elements/RE-ACTION System for use with Children: Evaluation of performance across developmental stages

*Dido Green and Peter Wilson*

- Feasibility/construct validity of assessment mode
- Subjective data showed enjoyment and satisfaction
- System documented age related changes
- Results reflect system's validity for children

Paper 2

Describing the Attention Deficit profile of Children with Neurofibromatosis Type 1 Using a Virtual Classroom Environment

*Yafit Gilboa, Sara Rosenblum , Aviva Fattal-Valevski , Hagit Toledano-Alhadef, Albert (Skip) Rizzo and Naomi Josman*

- The attention profile of NF1 children
- Diagnosis of attention deficits
- The Virtual Classroom

Paper 3

## Poster Session

Virtual Reality Games for Rehabilitation of People with Stroke: Perspectives from the Users

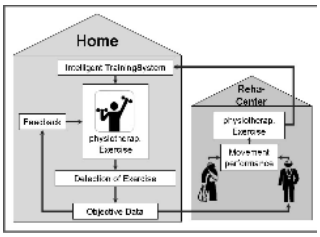
*Gwyn Lewis, Claire Woods, Juliet Rosie and Kathryn McPherson*


- Stroke
- Upper limb
- Virtual reality games

Poster Session - B1

Introducing an user-tailored rehabilitation system for patients in their home and work environment

*Michael Hennes, Fabian Kohler and Catherine Disselhorst-Klug*




- user-tailored home rehabilitation
- cost effective, movable and easy to use system
- patient guidance by visual feedback

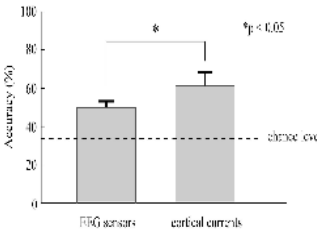
Poster Session - B2

Improving dexterity in children with cerebral palsy
*Huub van Hedel, Karin Wick, Kynan Eng and Andreas Meyer-Heim*

- Children with CP trained arm and hand function
- A glove-based VR system was compared to PC games
- Grip strength and manual dexterity were evaluated
- Improvements were larger in the VR-system group

Poster Session - B3

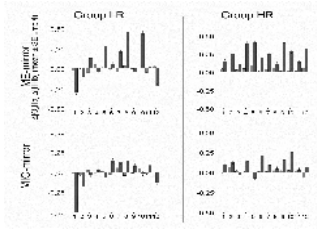
Usability of EEG Cortical Currents in Classification of Vowel Speech Imagery
*Natsue Yoshimura, Aruha Satsuma, Charles DaSalla, Takashi Hanakawa, Masa-aki Sato and Yasuharu Koike*




- A BCI to discriminate imagery speech of vowels.
- EEG cortical currents were estimated using EEG.
- Classification accuracy was improved.

Poster Session - B4

Trial-to-trial variability differs between low versus high responders in motor imagery: near-infrared spectroscopy study
*Lisa Holper, Martin Wolf, Nagisa Kobashi, Daniel Kiper and Kynan Eng*



- motor imagery
- Trial-to-Trial Variability
- Near-Infrared Spectroscopy

Poster Session - B5

Development of a Virtual Reality Leg-Cycling Training System for Stroke Patients
*Hsin-Chang Lo Lo, Chun-Yu Yeh, Ya-Hsin Hsueh and Sin-Lin Chen*

- virtual reality
- leg-cycling
- stroke

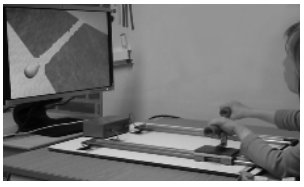
Poster Session - B6

The contribution of an online VR-based programme in cognitive rehabilitation following stroke
*Pedro Gamito, Jorge Oliveira, Jose Pacheco, Nuno Santos, Diogo Morais, Tomaz Saraiva, Fábio Soares and Catarina SottoMayor*

- Stroke
- Rehabilitation
- VR

Poster Session - B7

Serious gaming to improve bimanual coordination in children with spastic cerebral palsy
*Edwin van Loon, Anke van der Rijt, Annelie Salverda and Lieke Peper*



- Computer games to loosen bimanual coupling
- Fun therapy for children with CP
- Lissajous plane as basis for computer games

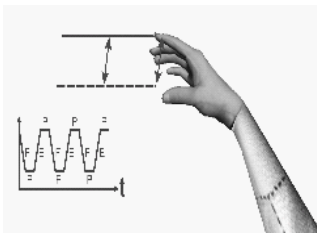
Poster Session - B8

Energy Demands During Interactive Video Gaming of Individuals Post-Stroke
*Michal Kafri, Mary Jane Myslinski and Judith Deutsch*

- Energy Expenditure during interactive video gaming
- for individuals post stroke was feasible
- and comparable to mild-moderate exercise

Poster Session - B9

The Effects of Manipulation of Visual Feedback in Virtual Reality on Cortical Activity: A Pilot Study
*Johannes Brand, Olivia Geisseler, Lisa Holper, Marie-Claude Hepp-Reymond, Manfred Morari, Daniel Kiper and Kynan Eng*



- VR-mediated visual feedback
- Finger flexion-extension movement
- Matching and mismatching conditions
- Functional near-infrared spectroscopy (fNIRS)

Poster Session - B10

ImAble System for Upper Limb Stroke Rehabilitation
*Kimberlee Jordan, Michael Sampson, Juha Hijmans, Leigh Hale and Marcus King*

- An integrated upper limb rehabilitation system
- Used with computer games and virtual reality
- Can be tailored to patient's strength and abilit
- Low cost, designed for home use
- Results show rehabilitation and motivation benefit

Poster Session - B11

Is Use of the Nintendo Wii Fit in Physiotherapy as Effective as Conventional Physiotherapy Training?
*Maria Crotty, Kate Laver, Stacey George and Julie Ratcliffe*

- A Randomised Controlled Trial with older people
- Compared conventional and WiiFit based therapy
- The Wii Fit was effective in retraining balance

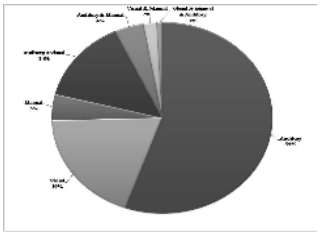
Poster Session - B12

Web Service for Cognitive Remediation in Depression
*Ouriel Grynszpan, Odile Komano, Pierre Leboucher, Julie Guertault, Franck Tarpin Bernard and Roland Jouvent*

- We present a web service for cognitive remediation
- The web application is specialized for depression
- The patient conducts sessions at home
- The therapist can remotely monitor the patient
- Preliminary observations show high acceptance rate

Poster Session - B13

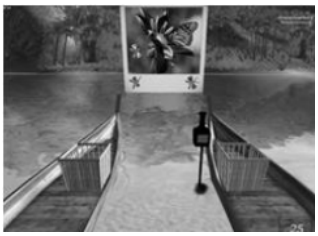
The role of visual feedback in conventional therapy and future research
*Birgit Molier, Gerdienke Prange and Jaap Buurke*



- Clinical practice mainly verbal feedback
- Research combined visual and sensory/auditory
- Application of simple experiments in clinic

Poster Session - B14

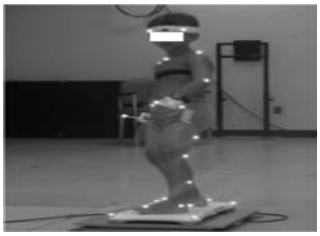
Cognitive demand in a VR-enriched arm training and its relation to performance, motivation and cognitive abilities
*Katharina Volkening , Jeannine Bergmann, Jaka Ziherl, Domen Novak, Matjaž Mihelj, Marko Munih and Friedemann Müller*



- VR-enriched arm training
- Scenarios with varying cognitive complexity
- Effects on performance & arousal?
- Influenced by cognitive abilities & motivation?

Poster Session - B15

Active Video Games and Children with Cerebral Palsy: the Future of Rehabilitation?
*Laurent Ballaz, Maxime Robert, François Prince and Martin Lemay*



- Cerebral palsy
- Active video game
- Rehabilitation

Poster Session - B16

Spatial orientation decline in elderly population
*Francesca Morganti and Giuseppe Riva*

- VR Maze test
- Wayfinding
- Alzheimer

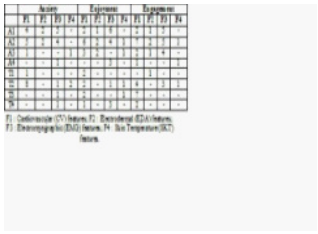
Poster Session - B17

User-Acceptance and Flow in Two Gaming Platforms Used for Exercise
*Jonathan Robinson, Paul Van Schaik, Alasdair MacSween, John Dixon and Denis Martin*

- Four week balance training with 33 healthy persons
- Virtual reality gaming (IREX™ and Nintendo Wii)
- Recording users' acceptance and flow experience
- No significant differences between gaming platform
- Significant increases in acceptance and flow

Poster Session - B18

Understanding Psychophysiological Response to a Virtual Reality-based Social Communication System for Children with ASD

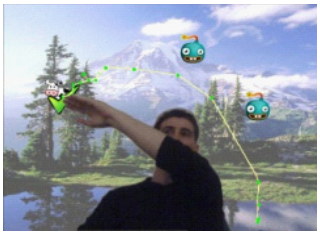


- ASD
- virtual-reality
- physiology
- affective states

Poster Session - B19

A reliable low-cost platform for neglect Virtual Rehabilitation

*Nunzio Alberto Borghese, Anna Sedda, Renato mainetti, Marco Ronchetti, Fabrizio Pasotti and Gabriella Bottini*



- virtual reality rehabilitation
- hands free tracking
- neglect rehabilitation

Poster Session - B20

10 Years Experience in the Application of the Reinforced Feedback in Virtual Environment (RFVE) for Neurorehabilitation

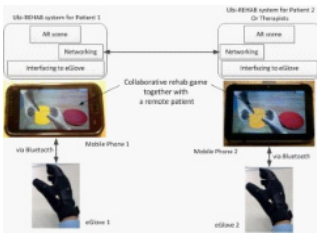
*Andrea Turolla, Michela Agostini, Carla Zucconi, Pawel Kiper, Andrea Vendramin, Mauro Dam, Paolo Tonin, Laura Ventura, Michela Dalmartello and Lamberto Piron*

- Stroke
- Upper limb
- Reinforced Feedback in Virtual Environment

Poster Session - B21

Ubi-REHAB: An Android-Based Portable Augmented Reality Stroke Rehabilitation System using the eGlove for Multiple Partic

*Young Geun Choi*



- Wireless portable rehabilitation glove
- AR rehabilitation game with a smart phone
- Collaborative rehab training with a remote patient

Poster Session - B22

The effect of social gaming in performance and mood in virtual reality based rehabilitation of stroke patients

*Belén Rubio Ballester, Sergi Bermudez i Badia and Paul Verschure*

- Motor rehabilitation
- rehabilitation gaming system
- stroke neurorehabilitation

Poster Session - B23

Development of a Haptic Keypad for Training Finger Individuation after Stroke

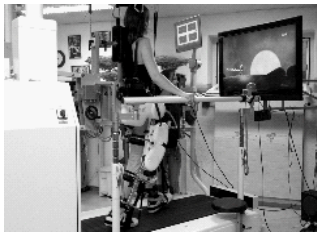
*Thomas Lord, Diana Keefe, Yu Li, Nikolay Stoykov and Derek Kamper*


- Visual and audial feedback of performance
- Pneumatic glove provides variable assistance
- Level of difficulty controlled by therapist

Poster Session - B24

A Virtual Reality System for Robot-Assisted Gait Training Based on Game Design Principles

*Ulrich Götz, Karin Brütsch, René Bauer, Florian Faller, Reto Spoerri, Andreas Meyer-Heim, Robert Riener and Alexander Koenig*

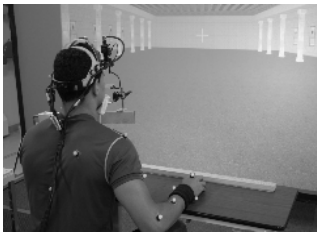


- Currently no gameplay principles in rehabilitation
- Game design principles maximize motivation
- Gabarello combines therapy with gameplay
- Questionnaire on motivation among 45 children
- Gabarello increases rehabilitation motivation

Poster Session - B25

Altered steering strategies for goal-directed locomotion in stroke

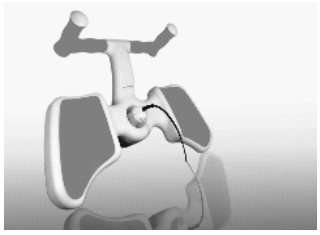
*Ala' Aburub*



- Goal-directed locomotion in a virtual environment
- Effects of changing optic flow and target location
- Effects of stroke

Poster Session - B26

Computer-Aided Arm Rehabilitation
*Mike Hartwig, Alexander Kollreider and David Ram*



- Arm-Rehabilitation
- Computer-Aided Neurorehabilitation
- Fun and Evidence based Therapy

Poster Session - B27

Use of Novel Virtual Reality System for the Assessment and Treatment of Unilateral Spatial Neglect: a Feasibility Study
*Heidi Sugarman, Aviva Weisel-Eichler, Riki Brown and Arie Burstin*


- SeeMe, a novel virtual reality system
- Potential tool for detection and treatment of USN
- Affordable and easy to use

Poster Session - B28

Low-Cost Motion Interactive Video Games in Home Training for Children with Cerebral Palsy: a Kinematic Evaluation
*Marlene Sandlund, Erik Domellöf, Helena Grip, Louise Rönnqvist and Charlotte Häger*

- Home training for children
- Low-cost games
- Kinematic analysis
- Movement control

Poster Session - B29

Virtual Reality Enhanced Balance Training for Service Members with Amputations
*Vanessa Everding and Sarah Kruger*

- CAREN virtual buoy course for balance training
- Three Service Members with traumatic amputations
- Combined data characterized with power curve fit
- Performance improved over several weeks

Poster Session - D1

Cycling Rate Is Modulated by Optic Flow In a Virtual Bicycle Environment
*Vengata Gade, Inbal Maidan, Rosemary Gallagher, Carina Torres and Judith Deutsch*

- Optic Flow Modulates Cycling Rate
- Modulation Requires High Gain Contrast
- Cycling Modulation Differs from Walking

Poster Session - D2

# ICORR Podium / Poster Sessions

## Podium Session 1, Room HPH G1 — Wednesday, 11h15-12h30 — Orthotics and Prosthetics

An Active Foot Lifter Orthosis Based on a PCPG Algorithm

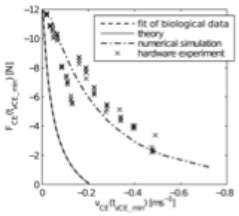
*Matthieu Duvinage, René Jiménez-Fabián, Thierry Castermans, Olivier Verlinden and Thierry Dutoit*

- Foot lifter orthosis for foot drop problems
- Integration of a human gait model based on a PCPG
- Stance and swing phases are differently controlled
- Phase-resetting is applied to the PCPG

Paper 1

Proof of Concept of an Artificial Muscle: Theoretical Model, Numerical Model, and Hardware Experiment

*Daniel Häufle, Michael Günther, Reinhard Blickhan and Syn Schmitt*

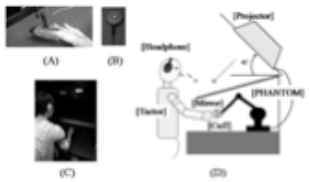



- design concept for an artificial muscle
- based on three simple mechanical elements
- shows hyperbolic force velocity relation
- harware experiments confirm numerical model
- test trilogy to validate the concept

Paper 2

Multi-Day Training with Vibrotactile Feedback for Virtual Object Manipulation

*Qi An, Yoky Matsuoka and Cara Stepp*

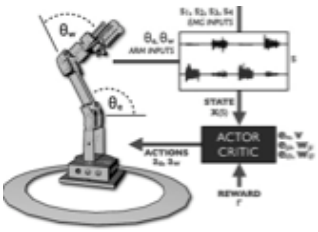


- Sensory feedback could improve prosthetic control
- Vibrotactile stimulation is a promising modality
- N=6 subjects performed virtual object manipulation
- Vibrotactile feedback related to contact force
- Performance increased over time

Paper 3

Online Human Training of a Myoelectric Prosthesis Controller via Actor-Critic Reinforcement Learning

*Patrick Pilarski, Michael Dawson, Thomas Degris, Farbod Fahimi, Jason Carey and Richard Sutton*




- Flexible approach to EMG-based prosthetic control.
- Amputee-specific controller optimization.
- Online adaptation through human feedback.
- Reinforcement learning artificial intelligence.
- Readily transferable to new domains and devices

Paper 4

ShouldeRO, an Alignment-Free Two-DOF Rehabilitation Robot for the Shoulder Complex

*Bruno Dehez and Julien Sapin*

- Rehabilitation robot for the shoulder complex
- Polyarticulated structure with Bowden transmission
- Action principle requiring no alignement

Paper 5

## Podium Session 2, Room HPH G1 Wednesday, 17h00-18h00 Neuroprosthetics and Brain Machine Interfaces

Use of an Electromyographically Driven Hand Orthosis for Training after Stroke
*Jose Ochoa, Derek Kamper and Sang Lee*

- Electromyography driven
- Voice activated
- Hand Orhtosis

Paper 1

Walking after Partial Paralysis Assisted with EMG-Triggered or Switch-Triggered Functional Electrical Stimulation
*Anirban Dutta, Rudi Kobetic and Ronald Triolo*

- Functional electrical therapy
- Mobility rehabilitation
- Non-invasive brain stimulation
- Neuroplasticity
- Movement science

Paper 2

Body Machine Interface: Remapping Motor Skills after Spinal Cord Injury
*M. Casadio, A. Pressman, S. Acosta, Z. Danziger, A. Fishbach, K.Muir, HsiangYi Tseng, D. Chen and F. Mussa-Ivaldi*


- The proposed new body machine interface:
- Maps residual movement into operational functions
- Adaptively changes based on subjects' ability
- Provides continuous control
- Can exercise and evaluate the available movements

Paper 3

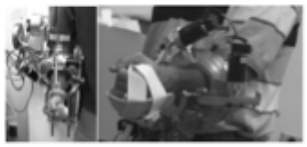
Towards Brain-Robot Interfaces for Stroke Rehabilitation
*Manuel Gomez-Rodriguez, Moritz Grosse-Wentrup, Alireza Gharabaghi, Jeremy Hill, Bernhard Schoelkopf and Jan Peters*

- A novel robot-based neurorehabilitation approach.
- Combines haptic feedback with BCIs.
- Experiments with healthy subjects & stroke patients.

Paper 4

## Podium Session 3, Room HPH G1 Thursday, 11h15-12h30 Evaluation and Clinical Experience

Robotic Training and Kinematic Analysis of Arm and Hand After Incomplete Spinal Cord Injury: a Case Study
*Zahra Kadivar, Jenny Sullivan, Dillon Eng, Ali Pehlivan, Marcia O'Malley, Nuray Yozbatiran and Gerard Francisco*



- First attempt of SCI upper-limb robotic training
- RiceWrist robotic device used for training purpose
- A novel measure of smoothness used for evaluation
- Great improvements were observed for hand function

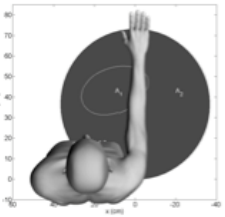
Paper 1

An EMG-Driven Exoskeleton Hand Robotic Training Device on Chronic Stroke Subjects
*Newmen Ho, Kaiyu Tong, Xiaoling Hu, Kai Lok Fung, Xijun Wei, Wei Rong and Evan Aditya Susanto*

- Light and portable exoskeleton hand robotic device
- Intention driven using surface electromyography
- Assist in hand opening and closing functional task
- Eight chronic stroke subjects invited for training
- Improvement in hand functions after 20 sessions

Paper 2

Objective Measurement of Synergistic Movement Patterns of the Upper Extremity Following Stroke: an Explorative Study
*Thijs Krabben, Gerdienke Prange, Birgit Molier, J.S. Rietman and Jaap Buurke*



- Circle drawing as evaluative movement task
- Identification of synergistic movement patterns
- Significant differences between healthy and stroke
- High correlation with Fugl-Meyer scores

Paper 3

A Comparison of Motor Adaptations to Robotically Facilitated Upper Extremity Task Practice Demonstrated by Children with CP
*Qinyin Qiu, Soha Saleh, Ian Lafond, Alma Merians, Gerard Fluet and Sergei Adamovich*

- Children with CP and adults with CVA
- Training UE with the same robot
- Children learned skills slower.
- Children made larger overall changes.
- All subjects made real world improvements

Paper 4

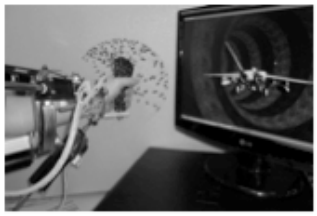
Ankle Control and Strength Training for Children with Cerebral Palsy Using the Rutgers Ankle CP - a Case Study
*Daniel Cioi, Angad Kale, Grigore (Greg) Burdea, Jack Engsberg, William Janes and Sandy Ross*

- Virtual rehabilitation of the ankle using a robot
- Case study of a child with cerebral palsy
- 36 sessions training ankle strength/ motor control
- Ankle kinematics, gait speed, endurance improved

Paper 5

## Podium Session 4, Room HPH G1 Thursday, 14h30-15h30 Upper Limb Robotics

Passive Velocity Field Control of a Forearm-Wrist Rehabilitation Robot
*Ahmetcan Erdogan, Aykut Cihan Satici and Volkan Patoglu*



- Design and control of a forearm-wrist exoskeleton
- Passive Velocity Field Control for assistance
- Assist as needed through PVFC in virtual tunnels
- Integration to a virtual flight simulator

Paper 1

Online Learning and Adaptation of Patient Support During ADL Training
*Marco Guidali, Philippe Schlink, Alexander Duschau-Wicke and Robert Riener*

- Robot assisted ADL training
- Patient is supported by a cooperative controller
- Required arm support is learned online

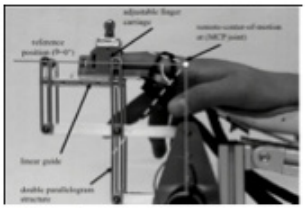
Paper 2

Challenges in Biocooperative Rehabilitation Robotics
*Matjaž Mihelj, Domen Novak, Jaka Ziherl, Andrej Olenšek and Marko Munih*

- Biocooperative control of rehabilitation robots
- Analysis of psychophysiological responses
- Factors affecting psychophysiological responses

Paper 3

Design of a Robotic Device for Assessment and Rehabilitation of Hand Sensory Function
*Olivier Lambercy, Alejandro Juarez Robles, Yeongmi Kim and Roger Gassert*

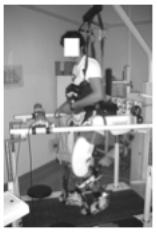


- Platform to assess and treat sensory deficits
- 3 types of stimuli at the palm and index finger
- Displacement at the MCP joint, pressure, vibration
- First study on sensory thresholds of MCP movement
- JND of 2.46° was determined for MCP joint angle

Paper 4

## Podium Session 5, Room HPH G1 Thursday, 17h00-18h00 Lower Limb Robotics

Changes on EMG Activation in Healthy Subjects and Incomplete SCI Patients Following a Robot-Assisted Locomotor Training
*Stefano Mazzoleni, Elisa Boldrini, Giulia Stampacchia, Cecilia Laschi, Bruno Rossi and Maria Chiara Carrozza*



- Robot-assisted exercise in healthy/ SCI subject
- Analysis of EMG activity of four leg's muscl
- High muscular recruitment (actively cooperatin
- Treadmill exercise without robot support

Paper 1

Design and Evaluation of Mina a Robotic Orthosis for Paraplegics
*Peter Neuhaus, Jerrlly Noorden, Travis Craig, Tecolote Torres, Justin Kirschbaum and Jerry Pratt*

- Paraplegic mobility orthosis
- Electric actuators at hips and knees
- Evaluated with 2 SCI ASIA-A people
- Rehabilitation with SCI and stroke survivors

Paper 2

Walking Assistance Apparatus Using a Spatial Parallel Link Mechanism and a Weight Bearing Lift
*E. Tanaka, T. Ikehara, Y. Sato, H. Yusa, S. Saegusa, T. Sakurai, K. Ito and L. Yuge*

- A prototype for a walking assistance apparatus for
- A spatial parallel link mechanism and a bearing li
- This apparatus can be utilized as a next-generation

Paper 3

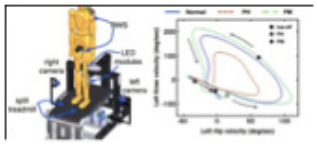
A Passive Exoskeleton with Artificial Tendons
*Wietse van Dijk, Herman van der Kooij and Edsko Hekman*

- A passive exoskeleton using artificial tendons
- Optimized for a more efficient gait
- Evaluation in an experiment with nine subjects

Paper 4

## Podium Session 6, Room HPH G1 Friday, 11h15-12h15 Neuroscience Robotics

Interlimb Coordination Evoked by Unilateral Mechanical Perturbation During Body-Weight Supported Gait
*Panagiotis Artemiadis and Hermano Igo Krebs*



- Unilateral perturbation during walking
- Contralateral effects during weight supported gait
- Supraspinal mechanisms for interlimb coordination

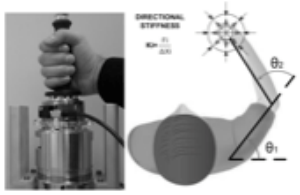
Paper 1

Evaluation of Negative Viscosity as Upper Extremity Training for Stroke Survivors
*Felix Huang and James Patton*

- Destabilizing forces as training for stroke
- Force augmented exploration --> no load eval
- Compare training: null, neg visc, inertia+neg visc

Paper 2

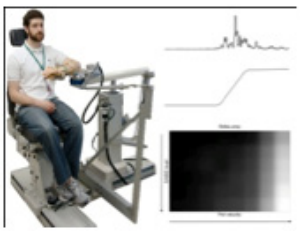
A Novel Mechatronic System for Measuring End-Point Stiffness: Mechanical Design and Preliminary Tests
*Lorenzo Masia, Giulio Sandini and Pietro Morasso*



- rotational high speed mechatronic device
- 1 DoF modular measurement system
- online estimation of human endpoint stiffness

Paper 3

The Relationship Between the Flexion Synergy and Stretch Reflexes in Individuals with Chronic Hemiparetic Stroke
*J. McPherson, A. Stienen, J. Drogos and J. Dewald*



- Expression of the flexion synergy post-stroke
- Flexion synergy modifies stretch reflexes
- Synergy and reflexes assessed by robotic devices

Paper 4

## Poster Session 2, Room HPH G1 Wednesday, 16h00-17h00

An EMG-Driven Exoskeleton Hand Robotic Training Device on Chronic Stroke Subjects
*Newmen Ho, Kaiyu Tong, Xiaoling Hu, Kai Lok Fung, Xijun Wei, Wei Rong and Evan Aditya Susanto*

- Light and portable exoskeleton hand robotic device
- Intention driven using surface electro-myography
- Assist in hand opening and closing functional task
- Eight chronic stroke subjects invited for training
- Improvement in hand functions after 20 sessions

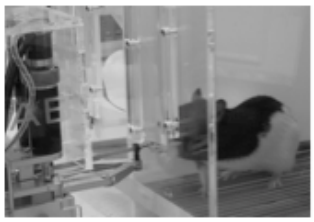
Poster Session 2 - A1

Development of a Parametric Kinematic Model of the Human Hand and a Novel Robotic Exoskeleton
*Thomas Burton, Ravi Vaidyanathan, Stuart C. Burgess, Ailie J. Turton and Chris Melhuish*

- Novel hand exoskeleton.
- Integrated kinematic model of the hand.
- Specific focus on thumb motion.
- Parametric design.
- Optimized design.

Poster Session 2 - A3

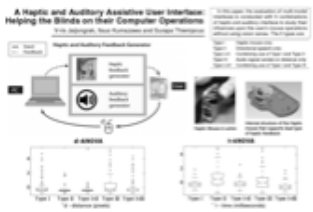
A Small-Scale Robotic Manipulandum for Motor Training in Stroke Rats
*B. Vigaru, O. Lambercy, L. Graber, R. Fluit, P. Wespe, M. Schubring-Giese, A. Luft and R. Gassert*



- Design and evaluation of a 3-DOF robotic device
- Controlled training and quantitative assessment
- Dynamic interaction in repeatable tasks
- Investigation of motor learning in stroke rats
- Rats trained to grasp, pull and rotate handle

Poster Session 2 - A4

A Haptic and Auditory Assistive User Interface: Helping the Blinds on their Computer Operations
*V-ris Jaijongrak, Itsuo Kumazawa and Surapa Thiemjarus*



- Haptic Mouse
- Assistive Device
- Assistive Application

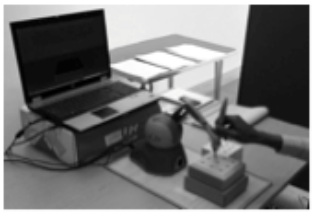
Poster Session 2 - A5

Knee Orthopaedic Device, how Robotic Technology Can Improve Outcome in Knee Rehabilitation
*Agathe Koller-Hodac, Domenico Leonardo, Silvio Walpen and Daniel Felder*

- Robotic device for knee rehabilitation
- Improved rehabilitation outcome
- Immediate therapy feedback

Poster Session 2 - A6

Using an Embedded Reality Approach to Improve Test Reliability for NHPT Tasks
*Michael Bowler, Farshid Amirabdollahian and Kerstin Dautenhahn*



- Nine Hole Peg Test (NHPT) for clinical assessment
- Explores an Embedded reality approach to the NHPT
- This approach improves upon a hapto-virtual setup
- We discuss future work towards clinical validation

Poster Session 2 - A9

An Exoskeleton Using Controlled Energy Storage and Release to Aid Ankle Propulsion
*Bruce Wiggin, Steven Collins and Gregory Sawicki*

- Energy-neutral, passive elastic ankle assistance.
- No motors or electronic components
- Reduce metabolic cost of human walking

Poster Session 2 - A10

Variable Stiffness Structure for Limb Attachment
*Maxime Bureau, Thierry Keller, Rosemarie Velik, Joel Perry and Jan Veneman*


- Attachment of rehabilitation robotics to the limbs
- Crucial for comfort, safety and accurate control
- Novel variable stiffness technology
- Vacuum-based compression of textile laminate
- Flexible during fitting; rigid during use

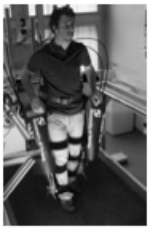
Poster Session 2 - A11

Upper Limb Assessment Using a Virtual Peg Insertion Test
*Marie-Christine Fluet, Olivier Lambercy and Roger Gassert*

- Objective assessment of upper limb function
- Combines virtual reality and haptic feedback
- Nine kinematic and kinetic parameters analyzed
- Initial study with healthy and stroke subjects
- Analyzed parameters are indicative of impairment

Poster Session 2 - A12

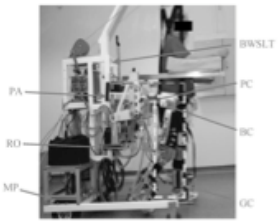
Oscillator-Based Walking Assistance: a Model-Free Approach
*R. Ronsse, B. Koopman, N. Vitiello, T. Lenzi, S. De Rossi, J. van den Kieboom, E. van Asseldonk, M. C. Carrozza, H. van der Kooij and A. Ijspeert*



- Motor primitive to assist walking
- Adaptive controller based on oscillators
- Trajectory-free assistance
- Reduction of metabolic cost
- Movement prediction

Poster Session 2 - B1

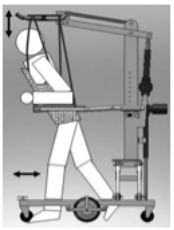
SynchronizedCoordinationWalking with Impact-less Footpad Contact of an Over-ground GaitRehabilitationSystem: NaTUre-gaits
*Ping Wang, Kin Huat Low and Adela Tow*




- Rehabilitation
- Over-ground walking training
- Gait device

Poster Session 2 - B2

Modulation of Weight Off-loading Level over Body-weight Supported Locomotion Training
*Ping Wang, Kin Huat Low, Peter Lim and Alison Hazel McGregor*



- Gait rehabilitation
- EMG
- OFf-loading level

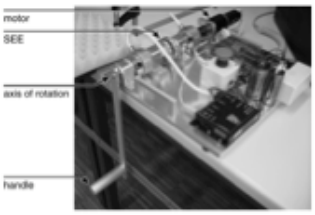
Poster Session 2 - B3

Design of a Novel Mobility Device Controlled by the Feet Motion of a Standing Child
*Zachary Schoepflin, Xi Chen, Christina Ragonesi, James Galloway and Sunil Agrawal*

- A Novel Bio-Driven Mobility Device
- Amplify Small Body Movements
- Encourage Children to Exercise and Explore

Poster Session 2 - B4

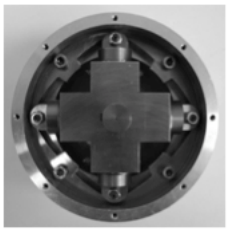
Assistance Using Adaptive Oscillators: Robustness to Errors in the Identification of the Limb Parameters
*Mike Rinderknecht, Fabien Delaloye, Alessandro Crespi, Renaud Ronsse and Auke Ijspeert*




- adaptive assistance of cyclical movements
- simple sensing
- robustness analysis
- motor primitive
- model-based predictions

Poster Session 2 - B5

Design of a Rotary Passive Viscoelastic Joint for Wearable Robots
*Giorgio Carpino, Dino Accoto, Michelangelo Di Palo, Nevio Luigi Tagliamonte, Fabrizio Sergi and Eugenio Guglielmelli*



- Modular design comprising two submodules
- Functionally distinct damping/stiffness modules
- Performances tuned by replacing single components

Poster Session 2 - B6

A new dynamic model of the manual wheelchair for straight and curvilinear propulsion
*Félix Chénier, Pascal Bigras and Rachid Aissaoui*

- Subject: Curvilinear propulsion on a MWC ergometer
- Problem: MWC model valid only on straight line
- Solution: New MWC model for curvilinear paths
- Method: Characterization and validation (n=10)

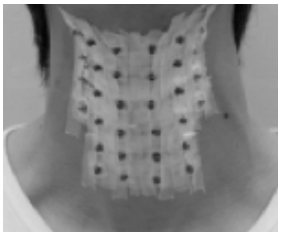
Poster Session 2 - B7

Assessing the Quality and Quantity of Social Interaction in a Socially Assistive Robot–Guided Therapeutic Setting
*Eric Wade, Jonathan Dye, Ross Mead and Maja Mataric*

- Socially assistive robots for rehabilitation.
- Motor task practice for post-stroke rehabilitation
- Human robot interaction

Poster Session 2 - B8

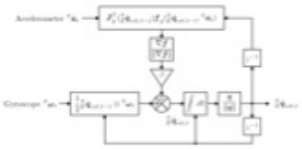
Tongue Motion-Based Operation of Support System for Paralyzed Patients
*Junji Takahashi, Satoru Suezawa, Yasuhisa Hasegawa and Yoshiyuki Sankai*



- An alternative interface system
- Using tongue motion for paralyzed patients
- Bio-Electric-Potentials of neck surface
- are used for estimating user's intentions
- Six number of intentions are successfully divided

Poster Session 2 - B9

Estimation of IMU and MARG orientation using a gradient descent algorithm
*Sebastian Madgwick, Ravi Vaidyanathan and Andrew Harrison*



- Quaternion estimation for IMUs and MARG sensors
- Computational inexpensive
- Patient motion tracking

Poster Session 2 - B10

On the Development of a Walking Rehabilitation Device with a Large Workspace
*Clément Gosselin and Thierry Laliberté*

- Walking rehab. device with large workspace
- Based on passive static balancing
- Allows free walking in all directions
- Device can be passive or actuated
- Experimental validation led to promising results

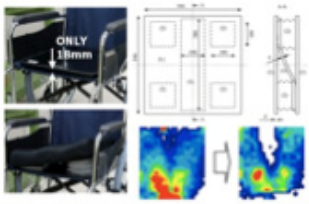
Poster Session 2 - B11

Assistive Control of Motion Therapy Devices Based on Pneumatic Soft-Actuators with Rotary Elastic Chambers
*André Wilkening, David Baiden and Oleg Ivlev*

- Compliant pneumatic direct rotary Soft-Actuators
- Assistive control concept for soft therapy devices
- Imitation of physiotherapist's treatment
- Prototype is being tested in Klinikum Stuttgart

Poster Session 2 - B12

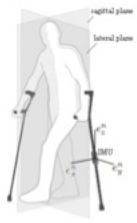
A Depressurization Assistance Control Based on the Posture of a Seated Patient on a Wheelchair
*Daisuke Chugo, Kazuya Fujita, Yuki Sakaida, Sho Yokota and Kunikatsu Takase*




- Depressurization Motion Assistance System
- Thin Design, Low Cost and Easy to Use.
- Our System Assists based on the Patient's Will

Poster Session 2 - B13

INS/EKF Based Stride Length, Height and Direction Intent-Detection for Walking Assistance Robots
*Brescianini Dario, Jun-Young Jung, In-Hun Jang, Hyun Sub Park and Robert Riener*



- EKF based sensor fusion method
- Walking parameter estimation from user's intent
- Experiment is conducted with normal.

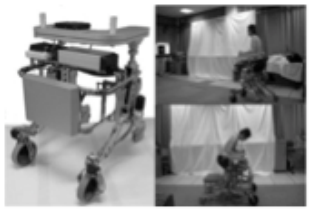
Poster Session 2 - B14

Semi-Autonomous Competency Assessment of Powered Mobility Device Users
*Jaime Valls Miro, Ross Black, Freek De Bruijn and Gamini Dissanayake*

- Stand-alone sensor package for powered wheelchairs
- Aids OT mobility assessment of patients
- Quantitative metrics, e.g speed, distance to wall
- Quantitative to augment qualitative assessments
- System acts as a "silent therapist"

Poster Session 2 - B15

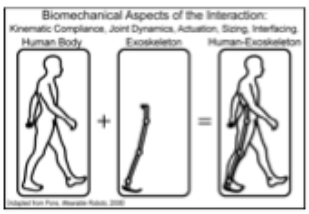
Walking and Sit-to-Stand Support System for Elderly and Disabled
*H.-G. Jun, Y. Y. Chang, B. Dan, B.-R. Jo, B.-H. Min, H. Yang, W.-K. Song and J. Kim*



- Mechanism for walking and sit-to-stand support
- Motion compliance control for walking support
- Sit-to-stand evaluation using force reflection

Poster Session 2 - B16

Biomechanical Considerations in the Design of Lower Limb Exoskeletons
*Massimo Cenciarini and Aaron Dollar*




- Exoskeletons supplement limb function in humans
- Aspects of leg mechanics and design are presented
- Design specifications of prototypes are discussed
- Evaluation of proposed designs is often lacking
- Gaps and how those might be filled are discussed

Poster Session 2 - B25

Clinical Effects of Combined Bilateral Arm Training with Functional Electrical Stimulation in Patients with Stroke

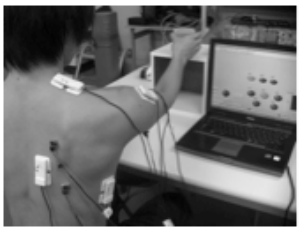
*Fang-Chen Wu, Yin-Tsong Lin, Te-Son Kuo, Jer-Junn Luh and Jin-Shin Lai*

- Bilateral arm training with FES
- more efficient treatment in patients with stroke
- neurorehabilitation

Poster Session 2 - B17

Preliminary Results of Online Classification of Upper Limb Motions from Around-Shoulder Muscle Activities

*Hirokazu Soma, Yuse Horiuchi, Jose Gonzalez and Wenwei Yu*

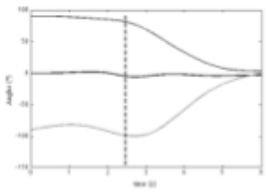


- Explore an online intention-detection system
- Around-Shoulder Muscles' EMG and MMG was measured
- Neural Network was used for motion classification
- 3 different grips were discriminated
- 5 reaching directions were discriminated

Poster Session 2 - B18

Improving Valid and Deficient Body Segment Coordination to Improve FES-Assisted Sit-to-Stand in Paraplegic Subjects

*Jovana Jovic, Vincent Bonnet, Charles Fattal , Philippe Fraisse and Christine Azevedo Coste*

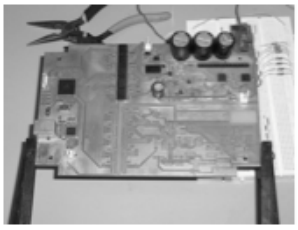


- Sit to stand motion
- Optimization of trunk movement
- Application in paraplegic patients

Poster Session 2 - B19

Enhancing Functional Electrical Stimulation for Emerging Rehabilitation Robotics in the Framework of Hyper Project

*Fernando Brunetti, Angel Garay, Juan Moreno and José Pons*

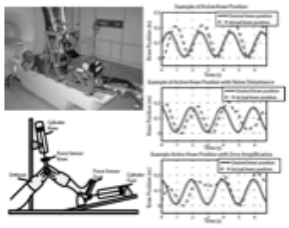


- Based on Howlland's transconductance amp circuit
- Up to 32 independent stimulation channels
- Portable, specially designed to use it within WR

Poster Session 2 - B23

An fMRI Pilot Study to Evaluate Brain Activation Associated with Locomotion Adaptation

*Laura Marchal-Crespo, Christoph Hollnagel, Mike Brügger, Spyros Kollias and Robert Riener*

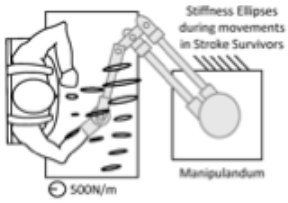


- MARCOS is an fMRI compatible robotic stepper
- Study locomotion adaptation to error amplification
- More activity in motor/sensory as more challenge

Poster Session 2 - B31

Multijoint Arm Stiffness During Movements Following Stroke: Implications for Robot Therapy

*Davide Piovesan, Maura Casadio, Pietro Morasso and Ferdinando Mussa-Ivaldi*




- New technique assessing stiffness during movement
- Stiffness decreases with robot mediated training
- How does the Ashworth relate to stiffness?

Poster Session 2 - B32

Improving Robotics for Neurorehabilitation: Enhancing Engagement, Performance, and Learning with Auditory Feedback

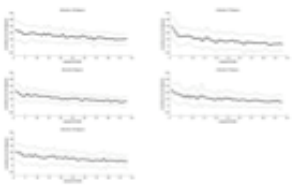
*G. Rosati, F. Oscari, D. Reinkensmeyer, R. Secoli, S. Avanzini, S. Spagnol and S. Masiero*

- Audio feedback is underexploited in rehabrobotics
- Experiments on sound feedback are presented
- A proper sound cue can help patients during rehab

Poster Session 2 - B33

Influence of reaching direction on visuomotor adaptation: an explorative study

*Birgit Molier, Edwin van Asseldonk, Gerdienke Prange and Jaap Buurke*

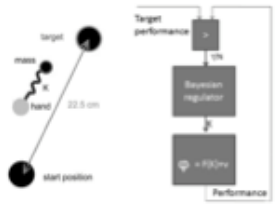


- Robotics is increasingly used in rehabilitation
- Effect reaching direction on visuomotor learning
- Different amount of adaptation to one direction
- Role of feedback and corrections mechanisms

Poster Session 2 - B34

Adaptive Regulation of Assistance 'as Needed' in Robot-Assisted Motor Skill Learning and Neuro-Rehabilitation

*Valentina Squeri, Angelo Basteris and Vittorio Sanguineti*

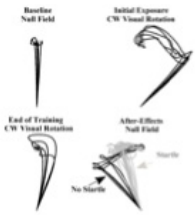



- Adaptive procedure to select assistance
- No need of an accurate model of learning
- Task: control of a virtual object
- The task difficulty increases as learning proceeds
- Useful to promote also neuromotor recovery

Poster Session 2 - B35

Startle Reduces Recall of a Recently Learned Internal Model

*Zachary Wright, James Patton and Venn Ravichandran*



- Startle probes preparation responses in humans
- Introduces startle into adaptation paradigm
- Startle reduces after-effects of adaptation
- Startle reduces performance of learned task
- Multiple nueral centers involved in learning

Poster Session 2 - B36

Preliminary Results of BRAVO Project

*M. Bergamasco, A. Frisoli, M. Fontana, D. Leonardis, C. Loconsole, M. Troncossi, M. Mozaffari Foumashi and V. Parenti-Castelli*


- BRAVO Prj: BCI driven interfaces for rehab
- System Overview
- Preliminary developments for grasping and reching

Poster Session 2 - B38

Clinical Training and Competency Guidelines for Using Robotic Devices

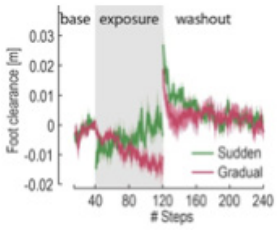
*Kathaleen Brady, Joseph Hidler, Diane Nichols and Susan Ryerson*

- Developed by clinicians and engineers
- Guidelines contain four major sections
- Formatted as an easy-to-use checklist
- Directs users to choose tools for their device

Poster Session 2 - B39

Locomotor Adaptation and Retention to Gradual and Sudden Dynamic Perturbations

*Edwin van Asseldonk, Bram Koopman and Herman van der Kooij*

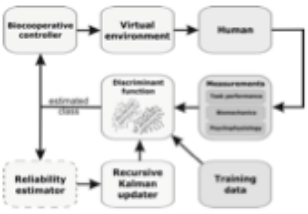



- Motor learning principles are increasingly used in
- Assess effect of different dynamic perturbations o
- Gradually introduced perturbation results in less
- In contrast to results from reaching adaptation

Poster Session 2 - B40

Task Difficulty Adjustment in Biocooperative Rehabilitation Using Psychophysiological Responses

*Domen Novak, Matjaž Mihelj, Jaka Ziherl, Andrej Olenšek and Marko Munih*




- psychophysiological feedback loop
- identify whether task is too easy or too hard
- discriminant analysis used for data fusion
- online adaptation of data fusion rules
- tested with 34 healthy subjects and 17 patients

Poster Session 2 - B41

From Training to Robot Behavior: Towards Custom Scenarios for Robotics in Training Programs for ASD

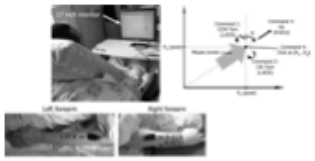
*Jan Gillesen, Emilia Barakova, Bibi Huskens and Loe Feijs*

- Develop scenarios for training children with ASD
- End-user programming for therapists with a robot
- Platform consists of NAO robot and TiViPE software
- Online community of therapists and engineers

Poster Session 2 - B42

## Poster Session 3, Room HPH G1 Thursday, 10h20-11h15

Development and Evaluation of an Assistive Computer Interface by SEMG for Individuals with Spinal Cord Injuries
*Changmok Choi, ByeongCheol Rim and Jung Kim*



- Surface electromyography
- Alternative computer interface
- Spinal cord injury

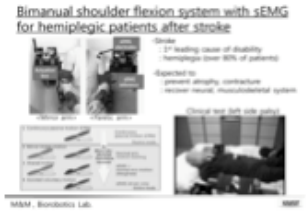
Poster Session 3 - B1

iHandRehab: an Interactive Hand Exoskeleton for Active and Passive Rehabilitation
*Jiting Li, Ruoyin Zheng, Yuru Zhang and Jianchu Yao*

- iHandRehab
- acive rehabilitation
- passive rehabilitation

Poster Session 3 - B2

Bimanual Shoulder Flexion System with Surface Electromyography for Hemiplegic Patients after Stroke: A Preliminary Study
*K. Park, S. Kwon, B. Rim and J. Kim*




- A bimanual system for hemiplegia is presented.
- It targets shoulder flexion to assist paretic arm.
- This system provides various mode as recovery

.

Poster Session 3 - B3

Robotic Arm Skate for Stroke Rehabilitation
*Chee Kit Wong, Kimberlee Jordan and Marcus King*

- Robotic platform for upper limb rehabilitation
- Low-cost and lightweight tabletop device
- Used with computer-based goal-directed exercises
- Track patients progress during completion of tasks

Poster Session 3 - B4

An Upper-Limb Power-Assist Robot with Tremor Suppression Control
*Kazuo Kiguchi, Yoshiaki Hayashi and Toyoko Asami*

- The tremor suppression control method is proposed
- The EMG signals are used to detect the user's mo
- The vibrations of the hand and the tip of the tool

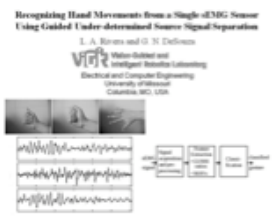
Poster Session 3 - B5

Effector Force Requirements to Enable Robotic Systems to Provide Assisted Exercise in People with Upper Limb Impairment
*Andrew Jackson, Sophie Makower, Peter Culmer, Martin Levesley, Alastair Cozens and Bipin Bhakta*

- iPAM is a dual robot upper-limb exercise system
- Assisted movements are prescribed by a therapist
- Forces and workspace required are recorded by iPAM
- Data from pilot study with 16 patients presented
- Results can be used to inform future robot design

Poster Session 3 - B6

Recognizing Hand Movements from a Single sEMG Sensor Using Guided Under-Determined Source Signal Separation
*Luis Rivera and Guilherme DeSouza*




- Pattern recognition using sEMG signals
- New ICA-based source signal separation technique
- Single sEMG source
- Only two features and a simple distance classifier

Poster Session 3 - B7

Analysis of Elbow-Joints Misalignment in Upper-Limb Exoskeleton
*Matteo Malosio, Nicola Pedrocchi, Federico Vicentini and Lorenzo Molinari Tosatti*

- Elbow singularity-free exoskeleton
- Elbow joints misalignment effects analysis
- Compliances and cuffs controllability relapses
- Benefits for therapies and range of motions

Poster Session 3 - B8

Jointless Structure and Under-Actuation Mechanism for Compact Hand Exoskeleton

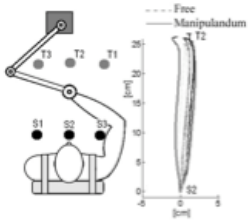
*HyunKi In, Kyu-Jin Cho, KyuRi Kim and BumSuk Lee*

- Wearable robotic hand with compact structure
- Joint-less structure
- New type of differential mechanism
- Fingertip force measurement to evaluate the device

Poster Session 3 - B9

Influence of Planar Manipulandum to the Hand Trajectory During Point to Point Movement

*Milos Kostic, Dejan Popovic and Mirjana Popovic*




- Haptic robots show great promise in rehabilitation
- These robots introduce new dynamics in the system
- Additional dynamics change movement strategies
- Taking this into consideration improves therapy

Poster Session 3 - B10

Evaluation of the JACO robotic arm:clinico-economic study for powered wheelchair users with upper-extremity disabilities

*Veronique Maheu, Julie Frappier, Philippe Archambault and François Routhier*

- The JACO robotic arm may achieve ADL tasks.
- It is expected to enhance user autonomy.
- Clinical trial performed to evaluate its efficacy.
- JACO is safe, efficient and easy to use.
- Daily use could reduce care time of 41%

Poster Session 3 - B11

Recognition of Grasp Types Through Principal Components of DWT Based EMG Features

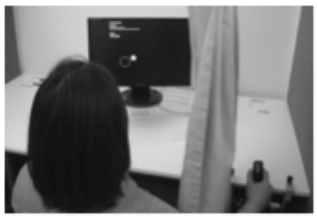
*Nayan Kakoty and Shyamanta Hazarika*

- Architecture for classification of six grasp types
- Classification using PCA of DWT based EMG features
- Achieved an average recognition rate of 97.5%

Poster Session 3 - B12

Effect of Progressive Visual Error Amplification on Human Motor Adaptation

*Cynthia Sung and Marcia O'Malley*

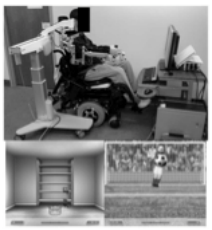


- Background: Error augmentation increases learning
- Test: Performance-based error amplification gains
- Method: 30 subjects trained with different gains
- Results: No benefit of error amplification
- Relevance: Protocols for robotic rehabilitation

Poster Session 3 - B13

Effect of a Robotic Rehabilitation Device on Upper Limb Function in a Sub-Acute Cervical Spinal Cord Injury Population

*J. Zariffa, N. Kapadia, J. Kramer, P. Taylor, M. Alizadeh-Meghrazi, V. Zivanovic, R. Willms, A. Townson, A. Curt, M. Popovic and J. Steeves*

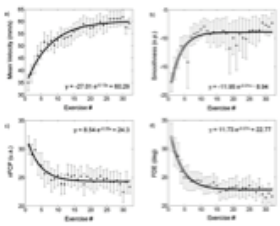


- Pilot study of Armeo® Spring (Hocoma, AG) in SCI.
- 12 cervical traumatic in-patients (multi-center).
- GRASSP and ARAT used to measure functional change.
- Subjects with some hand function benefited most.

Poster Session 3 - B14

Modeling Upper Limb Clinical Scales by Robot-Measured Performance Parameters

*Roberto Colombo, Irma Sterpi, Alessandra Mazzone, Carmen Delconte and Fabrizio Pisano*



- Robot-aided Neurorehabilitation
- Analysis of movement kinematics and kinetics
- Modeling time course of recovery
- Modeling clinical variables by performance

Poster Session 3 - B15

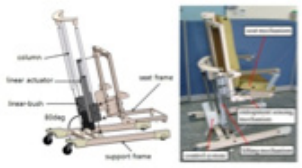
An Explorative Study into Changes in Circle Drawing after Gravity Compensation Training in Chronic Stroke Patients

*Gerdienke Prange, Thijs Krabben, Arno Stienen, Herman van der Kooij, J.S. Rietman and Jaap Buurke*

- Arm support improves work area of hemiparetic arm
- Improved work area after arm support training?
- 6 wk arm support training with interactive game
- Increased circle area after arm support training
- Less synergistic arm movement restrictions

Poster Session 3 - B16

Biomechanical Assessment of Electric Lifting Chair for Persons with Disability
*Ju-Hwan Bae and Inhyuk Moon*



- Lifting chair with hip-up function is developed.
- Biomechanical assessment is presented.
- Optimal hip-up angle was 15 degrees.

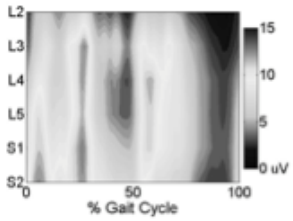
Poster Session 3 - B17

Detecting Falls by Analyzing Angular Momentum
*Dario Martelli, Vito Monaco and Silvestro Micera*

- Unexpected perturbation during locomotion
- Biomechanical modeling: angular momentum
- Body segment behavior after a perturbation
- Identification of body segments more reactive

Poster Session 3 - B24

Computational Aspects of MN Activity Estimation: a Case Study with Post-Stroke Subjects
*Martina Coscia, Vito Monaco, Marco Capogrosso, Carmelo Chisari and Silvestro Micera*




- Quantitative representation of MN activity
- Spinal maps in post-stroke patients
- Implications for rehabilitation

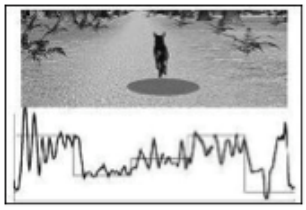
Poster Session 3 - B25

Evaluation of Short Term Effects of the IROMEC Robotic Toy for Children with Developmental Disabilities
*Tanja Klein, Gert Jan Gelderblom, Silvie Vanstipelen and Luc de Witte*


- IROMEC robot supporting play
- Developed in EU project
- For children with developmental disability
- Short term evaluation of effectiveness
- Occupational Therapy intervention

Poster Session 3 - B26

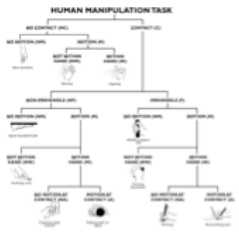
Virtual Reality to control active Participation in a subacute Stroke Patient during robot-assisted Gait Training
*Jeannine Bergmann, Carmen Krewer, Alexander Koenig, Robert Riener and Friedemann Müller*



- VR-enriched robot-assisted gait rehabilitation
- Bilateral and unilateral modes to control VR
- Evaluation of paretic and non-paretic leg activity
- Successful control and increase of motor output

Poster Session 3 - B27

Classifying Human Manipulation Behavior
*Ian Bullock and Aaron Dollar*




- Hand-centric, motion-centric manipulation taxonomy
- Classifies by object contact, prehension, motion
- Helps emphasize differences in hand function
- Also sub-classifies most dexterous category
- Can be used to compare human and robot hands

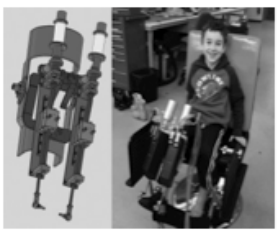
Poster Session 3 - B28

Characterizing Head Motor Disorders to Create Novel Interfaces for People with Cerebral Palsy
*Rafael Raya, Eduardo Rocon, Ramon Ceres, Jaap Harlaar and Joke Geytenbeek*

- An alternative communication based on head motion
- Characterizing motor and posture disorders
- Empowering the automony of people with CP

Poster Session 3 - B29

Pediatric Anklebot
*H. I. Krebs, S. Rossi, S.-J. Kim, P. Artemiadis, D. Williams, E. Castelli and P. Cappa*



- Alpha-prototype of a novel pediatric ankle robot
- Recovery of ankle function in children with CP
- Pilot data with healthy children are presented

Poster Session 3 - B18

Development of a One-Body Optical Torque Sensor for Rehabilitation Robotic Systems

*Gwang Min Gu and Pyung Hun Chang*

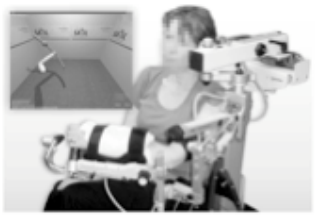
Experiment setting of test bed for calibration

- proposes a one-body optical torque sensor
- has advantages of ease of design and manufacture
- demonstrates the per-formance of proposed design

Poster Session 3 - B19

Design & Control of a 3D Stroke Rehabilitation Platform

*Zhonglun Cai, Daisy Tong, Katie Meadmore, Chris Freeman, Ann-Marie Hughes, Eric Rogers and Jane Burridge*

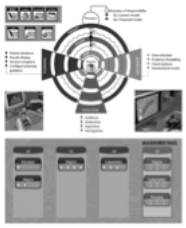


- Stroke rehabilitation system
- Employs functional electrical stimulation (FES)
- Iterative learning control (ILC) of applied FES
- Overview of upper limb models used in controller
- Experimental results support system efficacy

Poster Session 3 - B20

Telerehabilitation: Toward a Cost-Efficient Platform for Post-Stroke Neurorehabilitation

*Joel Perry, Javier Arcas Ruiz-Ruano and Thierry Keller*

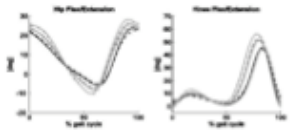


- Integrated solutions for rehabilitation are needed
- Cyclic and iterative rehab model proposed
- Patient training autonomy extended to sessions
- Usability in display of assessment tasks discussed
- Preliminary telerehabilitation platform evaluated

Poster Session 3 - B21

Velocity-Dependent Reference Trajectory Generation for the LOPES Gait Training Robot

*Nese Tufekciler, Edwin Asseldonk and Herman van der Kooij*

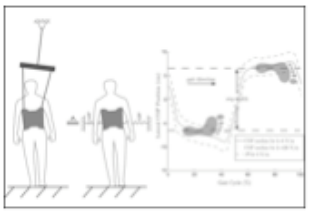


- Velocity-dependent reference trajectories
- Regression analysis of key parameters
- Constructing trajectories by fitting splines

Poster Session 3 - B22

Effects of Added Inertia and Body Weight Support on Lateral Balance Control During Walking

*Andrew Pennycott, Dario Wyss, Heike Vallery and Robert Riener*

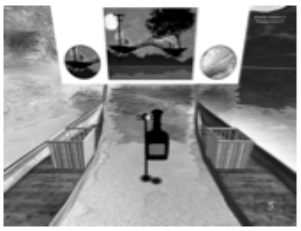


- Balance training enhances robotic gait therapy.
- Subjects walked loaded with additional mass.
- Step width decreased with increasing added mass.
- Body weight support reduces balance challenge

Poster Session 3 - B23

River Multimodal Scenario for Rehabilitation Robotics

*Marko Munih, Domen Novak, Maja Milavec, Jaka Ziherl, Andrej Olenšek and Matjaž Mihelj*

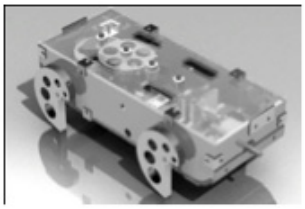


- Motor rehabilitation task and cognitive challenge
- Haptic, video and audio modalities
- Adaptive assistance, voice instructions
- Two clinical evaluations, 16 + 6 stroke patients

Poster Session 3 - B30

Motion Controlled Gait Enhancing Mobile Shoe for Rehabilitation

*Ismet Handzic, Erin Vasudevan and Kyle Reed*

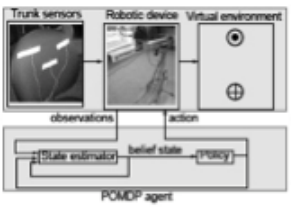


- Mobile shoe for asymmetric gait rehabilitation
- Previous methods show no long-term effects
- Design, fabrication, and testing of mobile shoe
- New motion controlled shoe shows good results

Poster Session 3 - B31

A Decision-Theoretic Approach in the Design of an Adaptive Upper-Limb Stroke Rehabilitation Robot

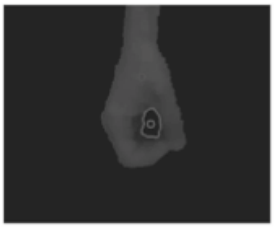
*Rajibul Huq, Patricia Kan, Robby Goetschalckx, Debbie Hebert, Jesse Hoey and Alex Mihailidis*




- We present a rehabilitation robot that uses POMDPs
- The POMDP estimates the user's belief state
- An action generates a target to be reached
- Using haptics the system gives adpative feedback
- Simulation results of performance are presented

Poster Session 3 - B32

Computer Vision-Based Classification of Hand Grip Variations in Neurorehabilitation
*Jose Zariffa and John Steeves*



- Computer vision is used to identify hand postures.
- 3 postures relevant to ADLs were discriminated.
- The overall classification success rate was 91.2%.
- This has applications to rehab robots with VR.

Poster Session 3 - B33

Robot-Aided Therapy on the Upper Limb of Subacute and Chronic Stroke Patients: a Biomechanical Approach
*Stefano Mazzoleni, Massimo Filippi, Luciano Puzzolante, Elisa Falchi, Federico Posteraro and Maria Chiara Carrozza*

- Upper limb robot therapy biomechanical approac
- 56 stroke subjects, 13 subacute and 43 chronic
- 2DOF robotic system ("assist-as-needed" co
- Evaluation of speed and movement's smoothnes
- Motor impairment decrease in both groups

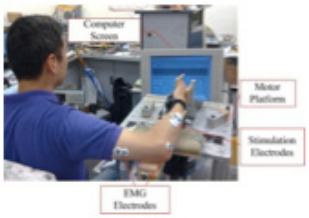
Poster Session 3 - B34

Development of an Evaluation Function for Eye-Hand Coordination Robotic Therapy
*Norali Pernalete, F Tang, S Chang, F Cheng, P Vetter, M Stegemann and J Grantner*

- Eye-Hand Coordination Robotic Therapy
- Design of Haptic Tasks with Assistance Algorithms
- Evaluation Function for Performance Analysis

Poster Session 3 - B35

Post-Stroke Wrist Rehabilitation Assisted with an Intention-Driven Functional Electrical Stimulation (FES)-Robot System
*Xiaoling Hu, Kaiyu Tong, Newmen Ho, Rui Li, Mo Chen, Jingjing Xue and Pengnan Chen*




- Rehabiliation assisted with both FES and Robot
- Increased muscle activiation
- Improved muscle coordination

Poster Session 3 - B36

Robotic Training and Clinical Assessment of Forearm and Wrist Movements after Incomplete Spinal Cord Injury:a Case Study
*Nuray Yozbatiran, Jeffrey Berliner, Corwin Boake, Marcia O'Malley, Zahra Kadivar and Gerard Francisco*

- Incomplete Spinal Cord Injury and arm functions
- Robotic training with RiceWrist exoskeleton
- Feasibility and effectiveness
- Clinical assessment
- Improvement in hand functions

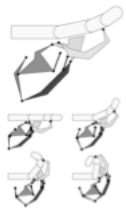
Poster Session 3 - B39

A Pilot Study of Robotic-Assisted Exercise for Hand Weakness after Stroke
*Joel Stein, Lauri Bishop, Glen Gillen and Raimund Helbok*

- Energy-neutral, passive elastic ankle assistance.
- No motors or electronic components
- Reduce metabolic cost of human walking

Poster Session 3 - B40

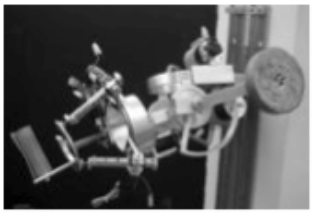
Single Degree-of-Freedom Exoskeleton Mechanism Design for Finger Rehabilitation
*Eric Wolbrecht, David Reinkensmeyer and Alba Perez-Gracia*



- Kinematic design of a finger rehabilitation device
- Design is a single-degree-of-freedom exoskeleton
- A planar 8-bar linkage guides the finger motion
- Vision-based finger data is used for the synthesis

Poster Session 3 - B41

Mechanical Design of a Distal Arm Exoskeleton for Stroke and Spinal Cord Injury Rehabilitation
*Ali Pehlivan, Ozkan Celik and Marcia O'Malley*

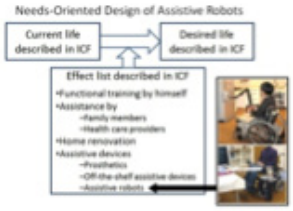


- Mechanical design of a distal arm exoskeleton
- Five actuated degrees-of-freedom
- Designed for both stroke and SCI rehabilitation

Poster Session 3 - B42

## Poster Session 4, Room HPH G1 Thursday, 16h00-17h00

A Concept of Needs-Oriented Design and Evaluation of Assistive Robots Based on ICF
*Yoshio Matsumoto, Yoshifumi Nishida, Yoichi Motomura and Yayoi Okawa*




- How to design and evaluate assitive robots?
- Utilize ICF as terminology.
- Concept of robot design based on ICF is porposed.
- Example of use of ICF is indicated

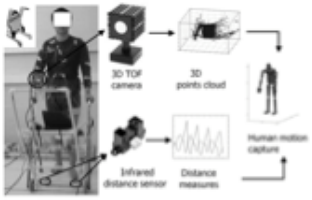
Poster Session 4 - B1

Kinematics Analysis of Sit-To-Stand Assistive Device for the Elderly and Disabled
*Inho Kim, Hyunseok Yang, Woonghee Cho and Gyunghwan Yuk*

- Introduce a robotic sit-to-stand supporting system
- Kinematics Analysis of the system
- Demonstrate feasibility of the system

Poster Session 4 - B2

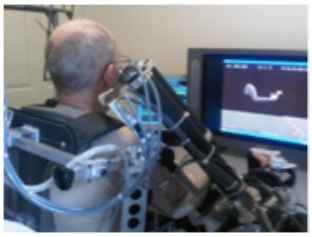
An Embedded Human Motion Capture System for an Assistive Walking Robot
*Cong ZONG, Xavier Clady and Mohamed Chetouani*




- 3D camera: 3D points cloud from the top body
- Infrared sensors: feet movement capture
- 3D human body modeling from sensor data
- Comparison and validation with Codamotion system

Poster Session 3 - B3

Feasibility Studies of Robot-Assisted Stroke Re-habilitation at Clinic and Home Settings Using RUPERT
*Hang Zhang, Hiroko Austin, Sharon Buchanan, Richard Herman, Jim Koeneman and Jiping He*



- wearable exoskeleton for arm
- at home robot assisted therapy
- task based therapy mode
- patient operated stroke therapy

Poster Session 3 - B4

A Neuromusculoskeletal Model of the Human Lower Limb: Towards EMG-Driven Actuation of Multiple Joints in Powered Orthoses
*M. Sartori, M. Reggiani, D. G. Lloyd and E. Pagello*

- EMG-driven musculoskeletal model
- Comprehensive and physiologically accurate
- Force estimation from 34 musculotendon actuators
- Moment estimation at hip, knee and ankle joints
- Multi-joint powered orthosis control

Poster Session 4 - B5

Model Predictive Control Based Gait Pattern Generation for Wearable Exoskeletons
*Letian Wang, Edwin Asseldonk and Herman van der Kooij*


- A new method for controlling wearable exoskeletons
- Predefined joint trajectories free
- Basic gait descriptors necessary, e.g. step length
- Able to control the swing phase on the LOPES

Poster Session 4 - B6

The Effects of Robotic-Assisted Locomotor Training on Spasticity and Volitional Control
*M. Mirbagheri, L.L. Ness, C Patel, K. Quiney and W. Zev Rymer*

- spasticity
- reflex
- voluntary control
- locomotion
- spinal cord injury

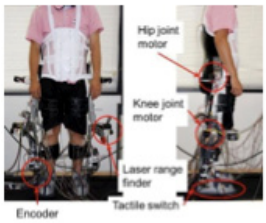
Poster Session 4 - B7

Exoskeletal Meal Assistance System (EMAS II) for Progressive Muscle Dystrophy Patient
*Yasuhisa Hasegawa and Saori Oura*

- Development of exoskeletal meal assistance system (EMAS II) for progressive muscle dystrophy.
- Use of residual function to maintain oskeletal
- conditions and to keep dignity of individual.
- Confirmation of basic performances of EMAS II

Poster Session 4 - B8

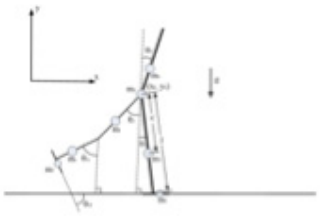
A Lower-Limb Power-Assist Robot with Perception-Assist
*Yoshiaki Hayashi and Kazuo Kiguchi*




- Perception-assist is applied to a lower-limb power
- The robot tries to modify the user's motion automa
- ZMP is taken into account

Poster Session 4 - B9

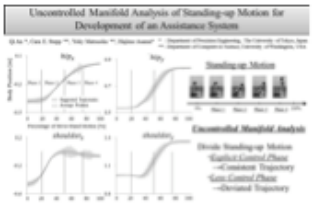
Effects of Ankle Stiffness on Gait Selection of Dynamic Bipedal Walking with Flat Feet
*Yan Huang and Qining Wang*



- dynamic walking
- ankle stiffness
- gait selection

Poster Session 4 - B10

Uncontrolled Manifold Analysis of Standing-Up Motion for Development of an Assistance System
*Qi An, Cara Stepp, Yoky Matsuoka and Hajime Asama*



- Human standing-up motion was analysed.
- Joint coordination indicates explict control.
- New control scheme for force assistance system.

Poster Session 4 - B11

Rendering potential wearable robot designs with the LOPES gait trainer
*Bram Koopman, Edwin Asseldonk, Renaud Ronsse, Wietse Dijk and Herman van der Kooij*

- wearable robots are gaining interest
- more energy-efficient designs are being developed
- human-robot interaction difficult to predict
- LOPES used to simulate mechanical design
- Preliminary results look promising

Poster Session 4 - B12

Development of Closed-Fitting-Type Walking Assistance Device for Legs and Evaluation of Muscle Activity
*Tadaaki Ikehara, Eiichirou Tanaka, Kazuteru Nagamura, Shozo Saegusa, Takurou Ushida, Sho Kojima and Louis Yuge*

- Walking assistance device using a flexible shaft
- Integrated hybrid control system
- Control of torque and angle at ankle and knee
- Self-contained system integrated in backpack
- Powered by lithium-ion battery

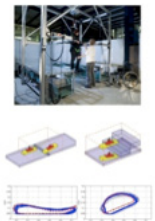
Poster Session 4 - B13

Study on Possible Control Algorithms for Lower Limb Rehabilitation System
*Marta Kordasz, Krzysztof Kuczkowski and Piotr Sauer*

- Design of Changeable Stiffness Manipulator
- Dynamic equivalent of a real rehabilitation system
- Experiments on two control algorithms

Poster Session 4 - B14

Patient Adaptive Control of End-Effector Based Gait Rehabilitation Devices Using a Haptic Control Framework
*Sami Hussein and Joerg Krueger*



- Patient-adaptive end-effector based gait training
- Haptics framework for virtual training scenarios
- Integration of adjustable training assistance
- Automatic performance based assistance adaptation
- Preliminary evaluation in one healthy subject

Poster Session 4 - B25

Development of Gait Training System Powered by Pneumatic Actuator like Human Musculoskeletal System
*Shin-ichiroh Yamamoto, Yoshiyuki SHIBATA, Shingo IMAI, Tatsuya NOBUTOMO and Tasuku Miyoshi*

- Gait Training
- Body Weight Support
- McKiben Pneumatic Actuator

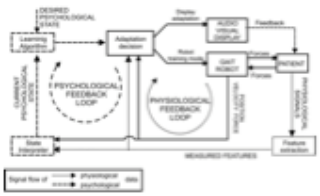
Poster Session 4 - B26

Using Robots to Help People Habituate to Visible Disabilities
*Laurel Riek and Peter Robinson*

- Robots to facilitate inter-ability communication
- Performance-driven animation on robot
- EMG of participants interacting with robot
- Realistic patient simulator

Poster Session 4 - B15

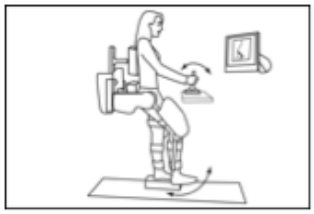
A Review on Bio-Cooperative Control in Gait Rehabilitation
*Alexander Koenig, Ximena Omlin, Domen Novak and Robert Riener*



- Gait robots are used in stroke rehabilitation
- Robots do not yet react compliantly to the patient
- Solution: bio-cooperative control (BCC)
- BCC incorporates patient in control loop
- Possible on physiological and psychological level

Poster Session 4 - B16

Quantifying Lower Limb Joint Position Sense Using a Robotic Exoskeleton: a Pilot Study
*Antoinette Domingo, Eric Marriott, Remco Benthem de Grave and Tania Lam*



- Quantitative assessment of sensory deficits needed
- Used Lokomat to assess leg proprioception
- Tested remembered and visual presentation paradigm
- Lokomat feasible tool to measure proprioception

Poster Session 4 - B17

Position and Torque Tracking: Series Elastic Actuation versus Model-Based-Controlled Hydraulic Actuation
*Alexander Otten, Wieke van Vuuren, Arno Stienen, Edwin van Asseldonk, Alfred Schouten and Herman van der Kooij*

- Rotational hydraulic actuation
- Nonlinear modeling and control
- Model-based versus series-elastic control
- High torque tracking performance
- Fast step response

Poster Session 4 - B18

Quantifying Learned Non-Use after Stroke Using Unilateral and Bilateral Steering Tasks
*Michelle Johnson, Ruta Paranjape, Elaine Strachota, Guennady Tchekanov and John McGuire*

- 1. Learned non-use is common after stroke
- Bilateral tracking tasks can assess LNU
- TheraDrive is one such assessment system

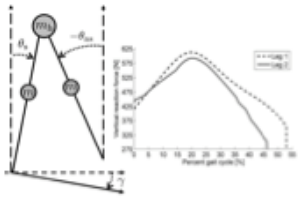
Poster Session 4 - B19

Instrumented Sorting Block Box for Children, a Preliminary Experiment
*Julius Klein, Along Chen and Etienne Burdet*

- objective training for cerebral palsy subjects
- instrumented real sorting block box
- low cost force/position sensing
- assessment parameters tested on healthy subjects

Poster Session 4 - B20

The Basic Mechanics of Bipedal Walking Lead to Asymmetric Behavior
*Robert Gregg IV, Amir Degani, Yasin Dhaher and Kevin Lynch*



- Able-bodied gait asymmetry is subject of debate
- Passive biped mechanics facilitate asymmetry
- We examine kinetic and stability variables
- Asymmetric gaits can be more stable than symmetric
- GRF impulses suggest functional asymmetry

Poster Session 4 - B21

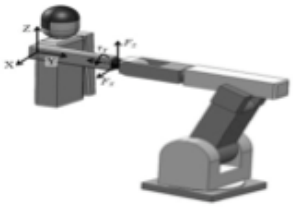
The ACT-4D: a Novel Rehabilitation Robot for the Quantification of Upper Limb Motor Impairments Following Brain Injury
*A. Stienen, J. McPherson, A. Schouten and J. Dewald*

- Stroke Diagnostic Robot
- Elbow Spasticity
- Upper Extremity Rehabilitation
- Abnormal Muscle Synergies

Poster Session 4 - B22

Thursday, 16:00 - 17:00, Room HPH G1 ICORR Poster Session 4

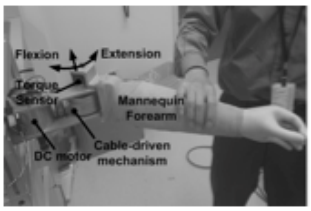
Stochastic Estimation of Human Shoulder Impedance with Robots: An Experimental Design
*Kyungbin Park and Pyung Hun Chang*



- Problem of vast simplification of the shoulder
- General & realistic shoulder impedance estimation
- Stochastic estimation with IMBIC
- 3 DOF human shoulder impedance estimation

Poster Session 4 - B23

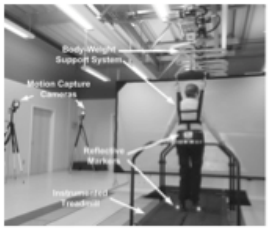
Haptic Recreation of Elbow Spasticity
*Hyung-Soon Park, Jonghyun Kim and Diane Damiano*




- Haptic device developed for Training Clinicians
- Elbow Spasticity (from CP patients) was modeled
- Clinicians assessed patients and the Haptic Model
- Same MAS (Modified Ashworth Scale) was obtained
- It will enhance reliability of clinical assessment

Poster Session 4 - B24

Development of a VR-based Treadmill Control Interface for Gait Assessment of Patients with Parkinson's Disease
*Hyung-Soon Park, Jung Won Yoon, Jonghyun Kim, Kazumi Iseki and Mark Hallett*




- What is Cause of Freezing of Gait in PD?
- Walking platform where patients walk naturally
- Developed Treadmill Speed Adaptation Control+ VR
- More responsive and reliable control was achieved
- The VR-based platform coule evoke FOG in PD

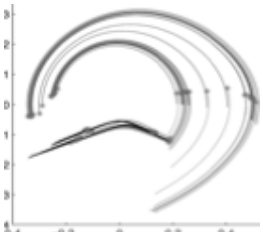
Poster Session 4 - B27

Wrist and Finger Torque Sensor for the Quantification of Upper Limb Motor Impairments Following Brain Injury
*Arno Stienen, Theresa Sukal Moulton, Laura Miller and Julius Dewald*

- Hard and Wrist Torque Sensing
- Impairment Diagnostic after Brain Injury
- Upper Extremity Rehabilitation

Poster Session 4 - B28

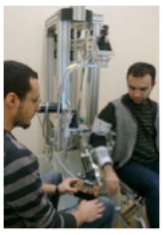
Asymmetric Passive Dynamic Walker
*Craig Honeycutt, John Sushko and Kyle Reed*



- Passive dynamic walker generates asymmetric gait
- Results: Four different asymmetric step patterns
- Image: Limit cycle trajectory plot
- Step lengths of two legs can differ by over 15%
- These gaits can be compared to human asymmetries

Poster Session 4 - B29

Evaluation of Proprioceptive Sense of the Elbow Joint with RehabRoby
*Duygun Erol Barkana, Fatih Ozkul, Sule Badilli Demirbas and Serap Inal*

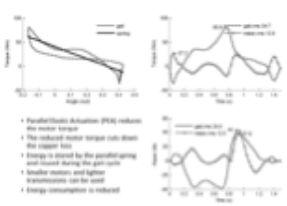


- A robot-assisted rehabilitation system RehabRoby
- Control architecture for RehabRoby
- Evaluation of proprioceptive sense
- Evaluation of usability of RehabRoby

Poster Session 4 - B30

## Poster Session 5, Room HPH G1 Friday, 10h20-11h15

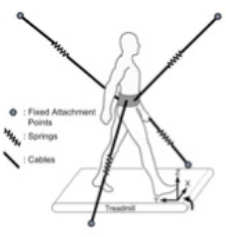
Spring Uses in Exoskeleton Actuation Design
*SHIQIAN WANG, Wietse van Dijk and Herman van der Kooij*



- Parallel springs reduce motor/gear size
- Less weight
- lower energy consumption

Poster Session 5 - B1

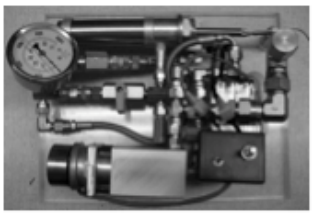
Experimental Studies on the Human Gait Using a Tethered Pelvic Assist Device (T-PAD)
*Vineet Vashista, Mustafa Shabbir Kurbanhusen and Sunil Agrawal*




- T-PAD is a novel passive pelvic assist device.
- It consists of elastic tethers and a hip brace.
- Studies were done on different configurations.
- Goal was to observe its effect on the human gait.
- T-PAD shows potential as a low-cost device.

Poster Session 5 - B2

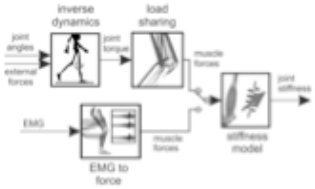
Tiny Hydraulics for Powered Orthotics
*William Durfee, Jicheng Xia and Elizabeth Hsiao-Wecksler*



- Untethered orthotics need small actuators
- Fluid power has high force-to-weight
- Fluid power has high power-to-weight
- High-pressure hydraulics lighter than motor

Poster Session 5 - B3

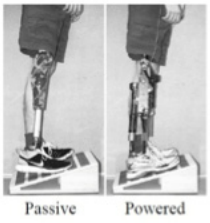
Model-Based Estimation of Active Knee Stiffness
*Serge Pfeifer, Michael Hardegger, Heike Vallery, Renate List, Mauro Foresti, Robert Riener and Eric Perreault*




- Motivation: variable-stiffness knee prostheses
- Goal: quantitative stiffness estimates during gait
- Model-based method using gait lab measurements
- No need to apply joint perturbations
- Validation by isometric perturbation measurements

Poster Session 5 - B4

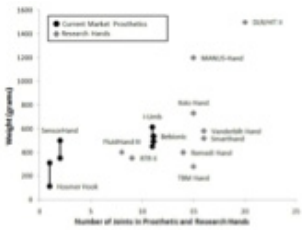
Ground Adaptive Standing Controller for a Powered Transfemoral Prosthesis
*Brian Lawson, Huseyin Varol and Michael Goldfarb*




- Ground adaptive standing controller
- Comprehensive standing behavior on unlevel terrain
- Orientation tracking using an IMU
- +/- 1 degree ground slope estimation in real-time
- Biomechanical joint impedances for standing

Poster Session 5 - B5

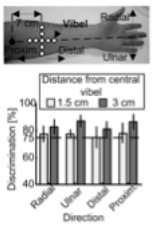
Performance Characteristics of Anthropomorphic Prosthetic Hands
*Joseph Belter and Aaron Dollar*



- No current hand performance standards exist
- A survey of published hand data was complied
- Data can be used to formulate performance ranges
- Specific testing methods for hands are desired

Poster Session 5 - B6

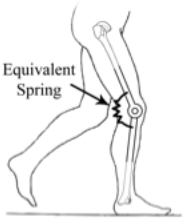
Vibrotactile Sensory Substitution in Multi-Fingered Hand Prostheses: Evaluation Studies
*Marco D'Alonzo, Christian Cipriani and Maria Chiara Carrozza*




- New vibrotactile sensory substitution system
- Variation of both amplitude and frequency
- Discrimination experiments with healthy subjects

Poster Session 5 - B7

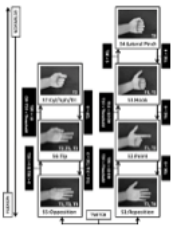
On the Mechanics of the Knee during the Stance Phase of the Gait
*Kamran Shamaei and Aaron Dollar*




- The knee behaves like a torsional spring in stance
- Knee stiffness is a function of the gait speed
- Knee stiffness is a function of the load weight
- Implications for design of orthoses and prostheses

Poster Session 5 - B8

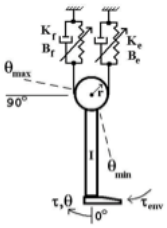
Multigrasp Myoelectric Control for a Transradial Prosthesis
*Skyler Dalley, Huseyin Varol and Michael Goldfarb*



- Multigrasp Myoelectric Control
- Nine Possible Postures
- Direct, Proportional Control of Motion
- Average Transition Completion Rate: 99.2%
- Average Transition Completion Time: 1.49 sec.

Poster Session 5 - B9

A Configuration Dependent Muscle Model for the Myoelectric Control of a Transfemoral Prosthesis
*Carl Hoover and Kevin Fite*




- Active-Knee Transfemoral Prosthesis
- Myoelectric Impedance Control
- Antagonist Pair Coactivation Model
- Angle-Dependent Moment Arm Muscle Model

Poster Session 5 - B10

Control and Implementation of a Powered Lower Limb Orthosis to Aid Walking in Paraplegic Individuals
*Hugo Quintero, Ryan Farris and Michael Goldfarb*


- Lower limb orthosis for gait restoration in SCI
- Powered hip and knee joints
- Automated gait that responds to user intentions
- Clinical trials with paraplegic subject.

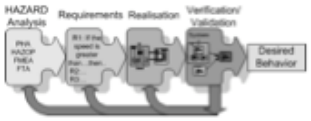
Poster Session 5 - B11

Robotic Wheelchair Control Interface Based on Headrest Pressure Measurement
*Jan Heitmann, Dimitar Stefanov and Carsten Köhn*

- Fully proportional head control
- No attachments to the head
- Precise steering
- head movements are not restricted
- The only adjustment is the headrest height

Poster Session 5 - B12

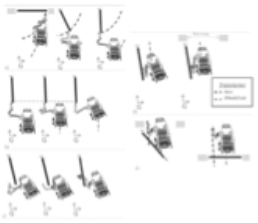
Building a Safe Care-Providing Robot
*Leila Fotoohi and Axel Gräser*




- A stepwise safety approach iteratively and paralle
- Novel application of Ramadge-Wonham (RW) framework
- Results for a verification of a safety requirement

Poster Session 5 - B13

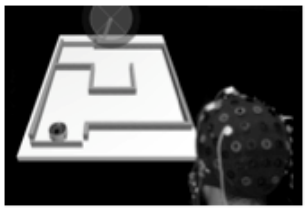
Task-Oriented Control of a 9-DoF WMRA System for Opening a Spring-Loaded Door Task
*Fabian Farelo, Redwan Alqasemi and Rajiv Dubey*



- 9-Dof wheelchair mounted robotic arm (WMRA)
- Mobile manipulation control
- Execution of a group of pre-set ADL task
- Opening and holding a spring loaded door

Poster Session 5 - B14

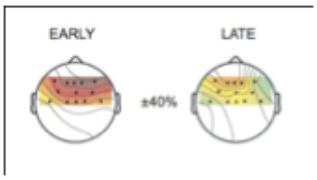
A Two-class Self-Paced BCI to Control a Robot in Four Directions
*Ricardo Ron-Angevin, Francisco Velasco-Alvarez, Salvador Sancha-Ros and Leandro da Silva-Sauer*



- Virtual and real environments
- Audio-cued control interface
- Two mental states mapped into four commands
- "Non-control" and "Intentional control" states
- Usability sopported by the results

Poster Session 5 - B25

Neural Correlates of Motor Learning and Performance in a Virtual Ball Putting Task
*Lorenzo Pitto, Vladimir Novakovic, Angelo Basteris and Vittorio Sanguineti*




- EEG activity during skill acquisition
- EEG correlates of learning and task difficulty
- EEG correlates of successful/unsuccessful trials
- EEG to monitor/regulate motor learning/recovery

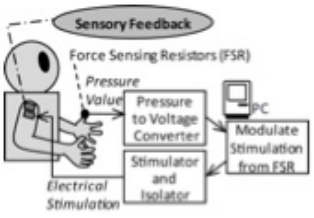
Poster Session 5 - B26

Nonlinear and Nonstationary Framework for Feature Extraction and Classification of Motor Imagery
*Dalila Trad, Tarik Al Ani, E. Monacelli, S. Delaplace and M. Jemni*

- BCI
- mu
- beta

Poster Session 5 - B27

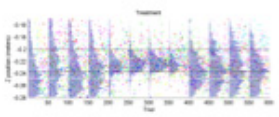
A Sensory Feedback System Utilizing Cutaneous Electrical Stimulation for Stroke Patients with Sensory Loss
*Kahori Kita, Kotaro Takeda, Sachiko Sakata, Junichi Ushiba, Rieko Osu and Yohei Otaka*




- Rehabilitation for patints with sensory loss
- Feedback pinch pressue of fingertip
- Utilize cutaneous electrical stimulation

Poster Session 5 - B28

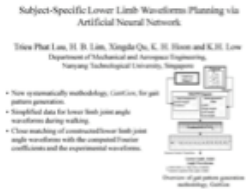
Limit-Push Training Reduces Motor Variability
*Ian Sharp and James Patton*



- conditioned variability
- redundant task space
- information transfer

Poster Session 5 - B29

Subject-Specific Lower Limb Waveforms Planning via Artificial Neural Network
*Luu Trieu Phat, Hup Boon Lim, Qu Xingda, Kay Hiang Hoon and Kin Huat Low*



- New systematically methodology, GaitGen, for gait
- Simplified data for lower limb joint angle wavefor
- Close matching of constructed lower limb joint ang

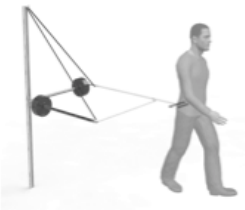
Poster Session 5 - B15

Adaptive Locomotor Training on an End-Effector
Christopher Tomelleri, Stefan Hesse, Cordula Werner and Andreas Waldner

- End Effector Robotics
- Adaptive Control
- Vertical Ground Reaction Forces

Poster Session 5 - B16

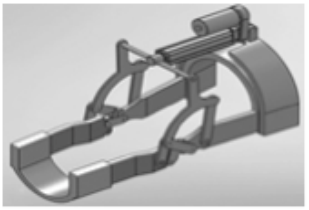
Effect of Added Inertia on the Pelvis on Gait
*Jos Meuleman, Wybren Terpstra, Edwin van Asseldonk and Herman van der Kooij*



- Gait-training robots must display a low inertia
- We applied inertias to the pelvis during gait
- anterior inertias > 4kg had a significant effect
- lateral inertias < 6 kg had no signifcant effect

Poster Session 5 - B17

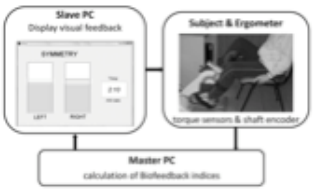
Conceptualization of an Exoskeleton Continuous Passive Motion (CPM) Device Using a Link Structure
Kyu-Jung Kim, Min-Sung Kang, Youn-Sung Choi, jungsoo han and changsoo han



- The design of the exoskeleton CPM
- For Knee rehabilitation device
- Create a design based on human knee joint

Poster Session 5 - B18

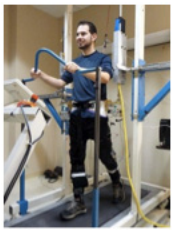
A Novel Biofeedback Cycling Training to Improve Gait Symmetry in Stroke Patients: a Case Series Study
*Emilia Ambrosini, Simona Ferrante, Eleonora Guanziroli, Franco Molteni, Giancarlo Ferrigno and Alessandra Pedrocchi*




- Design of a biofeedback pedaling training
- Feasibility study on 3 chronic stroke patients
- Significant decrease of pedaling unbalance
- Some modifications on the gait kinematic pattern
- Is there a carry-over effect from cycling to gait?

Poster Session 5 - B19

Design of Human-Machine Interface and Altering of Pelvic Obliquity with RGR Trainer
*Maciej Pietrusinski, Ozer Unluhisarcikli, Iahn Cajigas, Constantinos Mavroidis and Paolo Bonato*



- Robotic Gait Rehabilitation Trainer
- Targets secondary gait deviations
- Generates force field with impedance control
- Human Machine Interface transfers forces to pelvis
- Can affect pelvic obliquity during gait

Poster Session 5 - B20

On Stability and Passivity of Haptic Devices Characterized by a Series Elastic Actuation and Considerable End-Point Mass
*Jakob Oblak and Zlatko Matjacic*

- Conditions for passivity of SEA-based haptic robot
- Gain limited by actuator and mechanism masses
- Virtual stiffness limited by gain and SEA spring
- Sufficient damping in parallel to the SEA spring

Poster Session 5 - B21

Psychophysiological Responses to Robot Training in Different Recovery Phases after Stroke

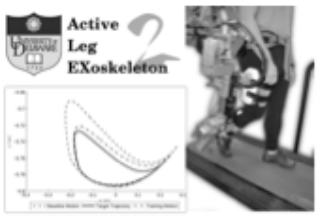
*N. Goljar, M. Javh, J. Poje, J. Ocepek, D. Novak, J. Ziherl, A. Olenšek, M. Mihelj and M. Munih*

- reaching and grasping task
- subacute and chronic stroke groups + controls
- psychophysiological measurements
- kinematic + static parameters

Poster Session 5 - B22

Design of a Minimally Constraining, Passively Supported Gait Training Exoskeleton: ALEX II

*Kyle Winfree, Paul Stegall and Sunil Agrawal*




- Unilateral Exoskeleton works on Right or Left Leg
- Evaluated with Healthy Subjects
- Improvements in Degrees of Freedom over ALEX I

Poster Session 5 - B23

Integrating Proprioceptive Assessement with Proprioceptive Training of Stroke Patients

*Valentina Squeri, Angelo Basteris, Jacopo Zenzeri, Psiche Giannoni and Pietro Morasso*

- Robotic evaluation of the hand position sense
- Setup: a bimanual manipulandum
- Protocol: assessment and training phases
- Subjects: a stroke patient and 3 controls
- This procedure is well accepted and understood

Poster Session 5 - B24

Time Independent Functional Task Training

*Elizabeth Brokaw, Diane Nichols, Rahsaan Holley, Theresa Murray, Tobias Nef and Peter Lum*

- Retraining normal inter-joint coordination
- Functional training with joint-space haptic walls
- Visual interface for motivation and feedback
- Case study showed improved ROM and coordination

Poster Session 5 - B30

Upper Limb Stroke Rehabilitation: the Effectiveness of Stimulation Assistance through Iterative Learning (SAIL)

*Katie Meadmore, Zhonglun Cai, Daisy Tong, Ann-Marie Hughes, Chris Freeman, Eric Rogers and Jane Burridge*

- Stimulation Assistance through Iterative Learning
- A novel 3D upper limb stroke rehabilitation system
- The feasibility of SAIL was confirmed
- SAIL increased participants tracking performance
- SAIL reduced upper limb impairment in stroke

Poster Session 5 - B31

Cable-Based Parallel Manipulator for Rehabilitation of Shoulder and Elbow Movements

*Wilgo Nunes, Lucas Antônio Rodrigues, Lucas Oliveira, José Ribeiro, João Carlos, Carvalho and Rogério Gonçalves*

- Cable-Based Parallel Manipulator
- Rehabilitation of Shoulder and Elbow Movements
- email: rsgoncalves@mecanica.ufu.br

Poster Session 5 - B32

Arm Control Recovery Enhanced by Error Augmentation

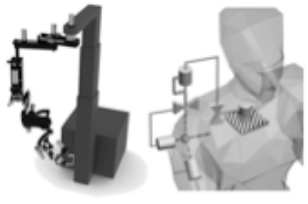
*Farnaz Abdollahi, Sylvester Rozario, Emily Case, Mark Kovic, Molly Listenberger, Robert Kenyon and James Patton*

- Practice with visual & haptic augmentation
- Chronic, hemiparetic stroke survivors
- 6-week randomized wait-list crossover study
- Incremental benefits on most but not all days
- Significant benefit from error augmentation

Poster Session 5 - B33

Shoulder Mechanism Design of an Exoskeleton Robot for Stroke Patient Rehabilitation

*Donghan Koo, Pyung Hun Chang, Min Kyun Sohn and Ji-hyeon Shin*



- Shoulder mechanism considering the shoulder girdle
- Mimic natural motion of human shoulder
- Increase workspace for rehabilitation
- Does not require additional adjustment

Poster Session 5 - B34

Wrist-RoboHab: a Robot for Treatment and Evaluation of Brain Injury Patients
*Mina Baniasad, Farzam Farahmand and Nureddin Ansari*

- Different Techniques For Treatment
- Objective Evaluation Capability
- Feedback To Both Patient And Therapist
- Good Interaction With Both Patient And Therapist
- Attractive Game

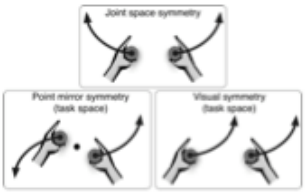
Poster Session 5 - B35

Facilitating Robot-Assisted Training in MS Patients with Arm Paresis
*H. Bastiaens, G. Alders, P. Feys, S. Notelaers, K. Coninx, L. Kerkhofs, V. Truyens, R. Geers and A. Goedhart*

- Gravity compensation (GC) of the arm can be used t
- Procedure to measure the need for GC and to estima
- Reaching movements with no support, HapticMaster s
- GC could have a positive effect on arm rehabilitat

Poster Session 5 - B36

Symmetry Modes and Stiffnesses for Bimanual Rehabilitation
*Samuel McAmis and Kyle Reed*




- Bimanual could be used for low cost rehabilitation
- We performed a bimanual haptic tracking task
- Compared different symmetry modes and stiffness
- Two modes significantly easier than the third mode
- High stiffnesses lead to better neural duplication

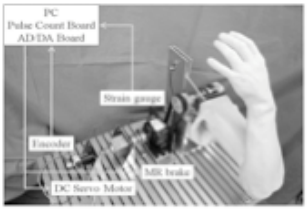
Poster Session 5 - B38

A tailored exercise of manipulation of virtual tools to treat upper limb impairment in Multiple Sclerosis
*A. Basteris, A. De Luca, I. Carpinella, M. Mueller, R. Bertoni, D. Cattaneo, M. Ferrarin, C. Solaro and V. Sanguineti*

- Therapy for incoordination and muscle weakness
- Controlling a virtual tool against resistance
- Task difficulty adapted to subject impairment
- Improvements in performance for six subjects
- Increase in task difficulty across sessions

Poster Session 5 - B39

Development of an Upper Limb Patient Simulator for Physical Therapy Exercise
*T. Komeda, Y. Takahashi, Y. Kawakami, T. Arimatsu, Hi. Koyama, S.-I. Yamamoto, K. Inoue and Y. Ito*




- physical therapy
- patient simulator
- rehabilitation trainee

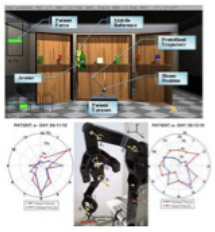
Poster Session 5 - B40

Design of the ROBIN System: Whole-Arm Multi-Model Sensorimotor Environment for the Rehabilitation of Brain Injuries
*Rui Loureiro and Thomas Smith*

- ROBIN (Rehabilitation Of Brain INjuries) system
- UL therapy retraining following brain injury
- Support multiple exercise design approaches
- Provide grasp and full upper limb movement
- Support whilst sitting or standing

Poster Session 5 - B41

Design and Implementation of a Training Strategy in Chronic Stroke with an Arm Robotic Exoskeleton
*Antonio Frisoli, Edoardo Sotgiu, Caterina Procopio, Massimo Bergamasco, Carmelo Chisari and Bruno Rossi*



- Upper limb rehabilitation with active exoskeleton
- Design of a triggered gain control strategy
- Clinical and performance-based evaluation

Poster Session 5 - B42

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ICVR
Poster Session/Number: 1/B10

**Gelderblom, G.**
ICORR
Poster Session/Number: 3/B26

**George, S.**
ICVR
Poster Session/Number: 1/B12

**Geytenbeek, J.**
ICORR
Poster Session/Number: 3/B29

**Gharabaghi, A.**
ICORR
Podium Session: 2

**Giannoni, P.**
ICORR
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**Gil-Gómez, J.**
ICVR
Podium Session: 2

**Gilboa, Y.**
ICVR
Podium Session: 9

**Gillen, G.**
ICORR
Poster Session/Number: 3/B40

**Gillesen, J.**
ICORR
Poster Session/Number: 2/B42

**Giusti, L.**
ICVR
Podium Session: 4

**Glover, T.**
ICVR
Podium Session: 4

**Goedhart, A.**
ICORR
Poster Session/Number: 5/B36

**Goetschalckx, R.**
ICORR
Poster Session/Number: 3/B32

**Goldfarb, M.**
ICORR
Poster Session/Number: 5/B5
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**Goljar, N.**
ICORR
Poster Session/Number: 5/B22

**Gomez-Rodriguez, M.**
ICORR
Podium Session: 2

**Gonzalez, J.**
ICORR
Poster Session/Number: 2/B18

**Goncalves, R.**
ICORR
Poster Session/Number: 5/B32

**Gosselin, C.**
ICORR
Poster Session/Number: 2/B11

**Graber, L.**
ICORR
Poster Session/Number: 2/A4

**Grantner, J.**
ICORR
Poster Session/Number: 3/B35

**Green, D.**
ICVR
Podium Session: 9

**Gregg IV, R.**
ICORR
Poster Session/Number: 4/B21

**Grip, H.**
ICVR
Poster Session/Number: 1/B29

**Grosse-Wentrup, M.**
ICORR
Podium Session: 2

**Grynszpan, O.**
ICVR
Poster Session/Number: 1/B13

**Gräser, A.**
ICORR
Poster Session/Number: 5/B13

**Gu, G.**
ICORR
Poster Session/Number: 3/B19

**Guanziroli, E.**
ICORR
Poster Session/Number: 5/B19

**Guertault, J.**
ICVR
Poster Session/Number: 1/B13

**Guglielmelli, E.**
ICORR
Poster Session/Number: 2/B6

**Guidali, M.**
ICORR
Podium Session: 4

**Günther, M.**
ICORR
Podium Session: 1

**Götz, U.**
ICVR
Poster Session/Number: 1/B25

**Hak, L.**
ICVR
Podium Session: 6

**Hale, L.**
ICVR
Poster Session/Number: 1/B11

**Hallett, M.**
ICORR
Poster Session/Number: 4/B27

**Han, C.**
ICORR
Poster Session/Number: 5/B18

**Han, J.**
ICORR
Poster Session/Number: 5/B18

**Hanakawa, T.**
ICVR
Poster Session/Number: 1/B4

**Handzic, I.**
ICORR
Poster Session/Number: 3/B31

**Hardegger, M.**
ICORR
Poster Session/Number: 5/B4

**Harlaar, J.**
ICORR
Poster Session/Number: 3/B29

**Harrison, A.**
ICORR
Poster Session/Number: 2/A3

**Hartwig, M.**
ICVR
Poster Session/Number: 1/B27

**Hasegawa, Y.**
ICORR
Poster Session/Number: 2/B9 4/B8

**Hausdorff, J.**
ICVR
Podium Session: 6

**Hawken, M.**
ICVR
Podium Session: 2

**Hawkins, T.**
ICVR
Podium Session: 4

**Hayashi, Y.**
ICORR
Poster Session/Number: 3/B5 4/B9

**Hazarika, S.**
ICORR
Poster Session/Number: 3/B12

**He, J.**
ICORR
Poster Session/Number: 4/B4

**Hebert, D.**
ICORR
Poster Session/Number: 3/B32

**Heitmann, J.**
ICORR
Poster Session/Number: 5/B12

**Hekman, E.**
ICORR
Podium Session: 5

**Helbok, R.**
ICORR
Poster Session/Number: 3/B40

**Hemakom, A.**
ICVR
Podium Session: 1

**Hennes, M.**
ICVR
Poster Session/Number: 1/B2

**Hepp-Reymond, M.**
ICVR
Poster Session/Number: 1/B10
Podium Session: 8

**Herman, R.**
ICORR
Poster Session/Number: 4/B4

**Hesse, S.**
ICORR
Poster Session/Number: 5/B16

**Hidler, J.**
ICORR
Poster Session/Number: 2/B39

**Hijmans, J.**
ICVR
Poster Session/Number: 1/B11

**Hill, J.**
ICORR
Podium Session: 2

**Ho, N.**
ICORR
Poster Session/Number: 2/A1 3/B36
Podium Session: 3

**Hoey, J.**
ICORR
Poster Session/Number: 3/B32

**Holley, R.**
ICORR
Poster Session/Number: 5/B30

**Hollnagel, C.**
ICORR
Poster Session/Number: 2/B31

**Holmes, G.**
ICVR
Podium Session: 2

**Holper, L.**
ICVR
Poster Session/Number: 1/B5 1/B10

**Honeycutt, C.**
ICORR
Poster Session/Number: 4/B29

**Hoon, K.**
ICORR
Poster Session/Number: 5/B15

**Hoover, C.**
ICORR
Poster Session/Number: 5/B10

**Horiuchi, Y.**
ICORR
Poster Session/Number: 2/B18

**Hotz-Boendermaker, S.**
ICVR
Podium Session: 8

**Hsiao-Wecksler, E.**
ICORR
Poster Session/Number: 5/B3

**Hsueh, Y.**
ICVR
Poster Session/Number: 1/B6

**Hu, X.**
ICORR
Poster Session/Number: 2/A1 3/B36
Podium Session: 3

**Huang, F.**
ICORR
Podium Session: 6

**Huang, Y.**
ICORR
Poster Session/Number: 4/B10

**Hughes, A.**
ICORR
Poster Session/Number: 3/B20 5/B31

**Hundal, J.**
ICVR
Podium Session: 3 7

**Huq, R.**
ICORR
Poster Session/Number: 3/B32

**Huskens, B.**
ICORR
Poster Session/Number: 2/B42

**Hussein, S.**
ICORR
Poster Session/Number: 4/B25

**Häufle, D.**
ICORR
Podium Session: 1

**Häger, C.**
ICVR
Poster Session/Number: 1/B29

**Ijspeert, A.**
ICORR
Poster Session/Number: 2/A2 2/B1

**Ijsselsteijn, W.**
ICVR
Podium Session: 8

**Ikehara, T.**
ICORR
Poster Session/Number: 4/B13
Podium Session: 5

**Imai, S.**
ICORR
Poster Session/Number: 4/B26

**In, H.**
ICORR
Poster Session/Number: 3/B9

**Inal, S.**
ICORR
Poster Session/Number: 4/B30

**Inoue, K.**
ICORR
Poster Session/Number: 5/B40

**Iseki, K.**
ICORR
Poster Session/Number: 4/B27

**Israsena, P.**
ICVR
Podium Session: 1

**Ito, K.**
ICORR
Podium Session: 5

**Ito, Y.**
ICORR
Poster Session/Number: 5/B40

**Ivlev, O.**
ICORR
Poster Session/Number: 2/B12

**Jackson, A.**
ICORR
Poster Session/Number: 3/B6

**Jacoby, M.**
ICVR
Podium Session: 7

**Jaijongrak, V.**
ICORR
Poster Session/Number: 2/A5

**Janes, W.**
ICORR
Podium Session: 3

**Jang, I.**
ICORR
Poster Session/Number: 2/B14

**Jansen-Kosterink, S.**
ICVR
Podium Session: 8

**Javh, M.**
ICORR
Poster Session/Number: 5/B22

**Jemni, M.**
ICORR
Poster Session/Number: 5/B27

**Jiménez-Fabián, R.**
ICORR
Podium Session 1

**Jo, B.**
ICORR
Poster Session/Number: 2/B16

**Johnson, M.**
ICORR
Poster Session/Number: 4/B19

**Jordan, K.**
ICVR
Poster Session/Number: 1/B11
ICORR
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**Josman, N.**
ICVR
Podium Session: 9

**Jouvent, R.**
ICVR
Poster Session/Number: 1/B13

**Jovic, J.**
ICORR
Poster Session/Number: 2/B19

**Juarez Robles, A.**
ICORR
Podium Session: 4

**Jun, H.**
ICORR
Poster Session/Number: 2/B16

**Jung, J.**
ICORR
Poster Session/Number: 2/B14

**Kadivar, Z.**
ICORR
Poster Session/Number: 3/B39
Podium Session: 3

**Kafri, M.**
ICVR
Poster Session/Number: 1/B9

**Kakoty, N.**
ICORR
Poster Session/Number: 3/B12

**Kale, A.**
ICORR
Podium Session: 3

**Kamper, D.**
ICVR
Poster Session/Number: 1/B24
ICORR
Podium Session: 2

**Kan, P.**
ICORR
Poster Session/Number: 3/B32

**Kang, M.**
ICORR
Poster Session/Number: 5/B18

**Kapadia, N.**
ICORR
Poster Session/Number: 3/B14

**Kaskayeva, D.**
ICVR
Podium Session: 3

**Katz, N.**
ICVR
Podium Session: 7

**Kaufmann, H.**
ICVR
Podium Session: 8

**Kawakami, Y.**
ICORR
Poster Session/Number: 5/B40

**Keefe, D.**
ICVR
Poster Session/Number: 1/B24

**Keller, T.**
ICORR
Poster Session/Number: 2/A11 3/B21

**Kelly, D.**
ICVR
Podium Session: 4

**Kenyon, R.**
ICORR
Poster Session/Number: 5/B33

**Kerkhofs, L.**
ICVR
Podium Session: 8
ICORR
Poster Session/Number: 5/B36

**Keshner, E.**
ICVR
Podium Session: 2 2 2 6

**Kiguchi, K.**
ICORR
Poster Session/Number: 3/B5 4/B9

**Kim, I.**
ICORR
Poster Session/Number: 4/B2

**Kim, J.**
ICORR
Poster Session/Number: 3/B1 3/B3

**Kim, J.**
ICORR
Poster Session/Number: 4/B27

**Kim, J.**
ICORR
Poster Session/Number: 4/B24

**Kim, J.**
ICORR
Poster Session/Number: 2/B16

**Kim, K.**
ICORR
Poster Session/Number: 5/B18

**Kim, K.**
ICORR
Poster Session/Number: 3/B9

**Kim, S.**
ICORR
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**Kim, Y.**
ICORR
Podium Session: 4

**King, M.**
ICVR
Poster Session/Number: 1/B11
ICORR
Poster Session/Number: 3/B4

**Kiper, D.**
ICVR
Poster Session/Number: 1/B5 1/B10
Podium Session: 8

**Kiper, P.**
ICVR
Poster Session/Number: 1/B21

**Kirner, C.**
ICVR
Podium Session: 7

**Kirner, T.**
ICVR
Podium Session: 7

**Kirschbaum, J.**
ICORR
Podium Session: 5

**Kita, K.**
ICORR
Poster Session/Number: 5/B28

**Kizony, R.**
ICVR
Podium Session: 7

**Klein, J.**
ICORR
Poster Session/Number: 4/B20

**Klein, T.**
ICORR
Poster Session/Number: 3/B26

**Kobashi, N.**
ICVR
Poster Session/Number: 1/B5

**Kobetic, R.**
ICORR
Podium Session: 2

**Koeneman, J.**
ICORR
Poster Session/Number: 4/B4

**Koenig, A.**
ICVR
Poster Session/Number: 1/B25
ICORR
Poster Session/Number: 3/B27 4/B16

**Kohler, F.**
ICVR
Poster Session/Number: 1/B2

**Koike, Y.**
ICVR
Poster Session/Number: 1/B4

**Kojima, S.**
ICORR
Poster Session/Number: 4/B13

**Koller-Hodac, A.**
ICORR
Poster Session/Number: 2/A6

**Kollias, S.**
ICVR
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ICORR
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**Kollreider, A.**
ICVR
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**Komano, O.**
ICVR
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**Komeda, T.**
ICORR
Poster Session/Number: 5/B40

**Koo, D.**
ICORR
Poster Session/Number: 5/B34

**Koopman, B.**
ICORR
Poster Session/Number: 2/B1 2/B40 4/B12

**Kordasz, M.**
ICORR
Poster Session/Number: 4/B14

**Koryagina, T.**
ICVR
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**Kostic, M.**
ICORR
Poster Session/Number: 3/B10

**Kovic, M.**
ICORR
Poster Session/Number: 5/B33

**Koyama, H.**
ICORR
Poster Session/Number: 5/B40

**Krabben, T.**
ICORR
Poster Session/Number: 3/B16
Podium Session: 3

**Kramer, J.**
ICORR
Poster Session/Number: 3/B14

**Krebs, H.**
ICORR
Poster Session/Number: 3/B18
Podium Session: 6

**Krewer, C.**
ICORR
Poster Session/Number: 3/B27

**Krueger, J.**
ICORR
Poster Session/Number: 4/B25

**Kruger, S.**
ICVR
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**Kuczkowski, K.**
ICORR
Poster Session/Number: 4/B14

**Kumazawa, I.**
ICORR
Poster Session/Number: 2/A5

**Kuo, T.**
ICORR
Poster Session/Number: 2/B17

**Kurbanhusen, M.**
ICORR
Poster Session/Number: 5/B2

**Kwon, S.**
ICORR
Poster Session/Number: 3/B3

**Köhn, C.**
ICORR
Poster Session/Number: 5/B12

**König, S.**
ICVR
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**Lafond, I.**
ICORR
Podium Session: 3

**Lahav, O.**
ICVR
Podium Session: 1

**Lahiri, U.**
ICVR
Poster Session/Number: 1/B19
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**Lai, J.**
ICORR
Poster Session/Number: 2/B17

**Laliberté, T.**
ICORR
Poster Session/Number: 2/B11

**Lam, T.**
ICORR
Poster Session/Number: 4/B17

**Lambercy, O.**
ICORR
Poster Session/Number: 2/A4 2/A12
Podium Session: 4

**Lamers, I.**
ICVR
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**Lamontagne, A.**
ICVR
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**Lanaria, L.**
ICVR
Podium Session: 6

**Laschi, C.**
ICORR
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**Lauer, R.**
ICVR
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**Laver, K.**
ICVR
Poster Session/Number: 1/B12

**Lawson, B.**
ICORR
Poster Session/Number: 5/B5

**Leboucher, P.**
ICVR
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**Lee, B.**
ICORR
Poster Session/Number: 3/B9

**Lee, S.**
ICORR
Podium Session: 2

**Lemay, M.**
ICVR
Poster Session/Number: 1/B16

**Lenzi, T.**
ICORR
Poster Session/Number: 2/B1

**Leonardis, D.**
ICORR
Poster Session/Number: 2/B38

**Leonardo, D.**
ICORR
Poster Session/Number: 2/A6

**Levesley, M.**
ICORR
Poster Session/Number: 3/B6

**Levin, M.**
ICVR
Podium Session: 5

**Lewis, G.**
ICVR
Poster Session/Number: 1/B1

**Li, J.**
ICORR
Poster Session/Number: 3/B2

**Li, R.**
ICORR
Poster Session/Number: 3/B36

**Li, Y.**
ICVR
Poster Session/Number: 1/B24

**Lim, H.**
ICORR
Poster Session/Number: 5/B15

**Lim, P.**
ICORR
Poster Session/Number: 2/B3

**Lin, Y.**
ICORR
Poster Session/Number: 2/B17

**List, R.**
ICORR
Poster Session/Number: 5/B4

**Listenberger, M.**
ICORR
Poster Session/Number: 5/B33

**Lloréns, R.**
ICVR
Podium Session: 2

**Lloyd, D.**
ICORR
Poster Session/Number: 4/B5

**Lo, H.**
ICVR
Poster Session/Number: 1/B6

**Loconsole, C.**
ICORR
Poster Session/Number: 2/B38

**Lord, T.**
ICVR
Poster Session/Number: 1/B24

**Loureiro, R.**
ICORR
Poster Session/Number: 5/B41

**Lourenco, C.**
ICVR
Podium Session: 5

**Low, K.**
ICORR
Poster Session/Number: 2/B2 2/B3 5/B15

**Luft, A.**
ICORR
Poster Session/Number: 2/A4

**Luh, J.**
ICORR
Poster Session/Number: 2/B17

**Lum, P.**
ICORR
Poster Session/Number: 5/B30

**Lynch, K.**
ICORR
Poster Session/Number: 4/B21

**Macsween, A.**
ICVR
Poster Session/Number: 1/B18

**Madgwick, S.**
ICORR
Poster Session/Number: 2/A3

**Maheu, V.**
ICORR
Poster Session/Number: 3/B11

**Maidan, I.**
ICVR
Poster Session/Number: 1/D2

**Mainetti, R.**
ICVR
Poster Session/Number: 1/B20

**Makower, S.**
ICORR
Poster Session/Number: 3/B6

**Malosio, M.**
ICORR
Poster Session/Number: 3/B8

**Marchal-Crespo, L.**
ICORR
Poster Session/Number: 2/B31

**Marriott, E.**
ICORR
Poster Session/Number: 4/B17

**Martelli, D.**
ICORR
Poster Session/Number: 3/B24

**Martin, D.**
ICVR
Poster Session/Number: 1/B18

**Masia, L.**
ICORR
Podium Session: 6

**Masiero, S.**
ICORR
Poster Session/Number: 2/B33

**Mataric, M.**
ICORR
Poster Session/Number: 2/B8

**Matjacic, Z.**
ICORR
Poster Session/Number: 5/B21

**Matsumoto, Y.**
ICORR
Poster Session/Number: 4/B1

**Matsuoka, Y.**
ICORR
Podium Session: 1
Poster Session/Number: 4/B11

**Mavroidis, C.**
ICORR
Poster Session/Number: 5/B20

**Mazzoleni, S.**
ICORR
Poster Session/Number: 3/B34
Podium Session: 5

**Mazzone, A.**
ICORR
Poster Session/Number: 3/B15

**McAmis, S.**
ICORR
Poster Session/Number: 5/B38

**McGregor, A.**
ICORR
Poster Session/Number: 2/B3

**McGuire, J.**
ICORR
Poster Session/Number: 4/B19

**McPherson, J.**
ICORR
Poster Session/Number: 4/B22
Podium Session: 6

**McPherson, K.**
ICVR
Poster Session/Number: 1/B1

**Mead, R.**
ICORR
Poster Session/Number: 2/B8

**Meadmore, K.**
ICORR
Poster Session/Number: 3/B20 5/B31

**Meilick, B.**
ICVR
Podium Session: 8

**Melhuish, C.**
ICORR
Poster Session/Number: 2/A3

**Merians, A.**
ICVR
Podium Session: 3
ICORR
Podium Session: 3

**Mert, A.**
ICVR
Podium Session: 6

**Mesa-Gresa, P.**
ICVR
Podium Session: 2

**Meuleman, J.**
ICORR
Poster Session/Number: 5/B17

**Meyer-Heim, A.**
ICVR
Poster Session/Number: 1/B3 1/B25

**Micera, S.**
ICORR
Poster Session/Number: 3/B24 3/B25

**Mihailidis, A.**
ICORR
Poster Session/Number: 3/B32

**Mihelj, M.**
ICVR
Poster Session/Number: 1/B15
Podium Session: 3
ICORR
Poster Session/Number: 2/B41 3/B30 5/B22
Podium Session: 4

**Milavec, M.**
ICORR
Poster Session/Number: 3/B30

**Millen, L.**
ICVR
Podium Session: 4

**Miller, L.**
ICORR
Poster Session/Number: 4/B28

**Min, B.**
ICORR
Poster Session/Number: 2/B16

**Mirbagheri, M.**
ICORR
Poster Session/Number: 4/B7

**Mirelman, A.**
ICVR
Podium Session: 6

**Miyoshi, T.**
ICORR
Poster Session/Number: 4/B26

**Molier, B.**
ICORR
Poster Session/Number: 2/B34
Podium Session: 3

**Molier, B.**
ICVR
Poster Session/Number: 1/B14

**Molinari Tosatti, L.**
ICORR
Poster Session/Number: 3/B8

**Molteni, F.**
ICORR
Poster Session/Number: 5/B19

**Monacelli, E.**
ICORR
Poster Session/Number: 5/B27

**Monaco, V.**
ICORR
Poster Session/Number: 3/B24 3/B25

**Moon, I.**
ICORR
Poster Session/Number: 3/B17

**Morais, D.**
ICVR
Poster Session/Number: 1/B7

**Morari, M.**
ICVR
Poster Session/Number: 1/B10

**Morasso, P.**
ICORR
Poster Session/Number: 2/B32 5/B24
Podium Session: 6

**Moreno, J.**
ICORR
Poster Session/Number: 2/B23

**Morganti, F.**
ICVR
Poster Session/Number: 1/B17

**Motomura, Y.**
ICORR
Poster Session/Number: 4/B1

**Mozaffari Foumashi, M.**
ICORR
Poster Session/Number: 2/B38

**Mozheyko, E.**
ICVR
Podium Session: 3

**Mueller, M.**
ICORR
Poster Session/Number: 5/B39

**Muir, K.**
ICORR
Podium Session: 2

**Mumford, N.**
ICVR
Podium Session: 5

**Munih, M.**
ICVR
Poster Session/Number: 1/B15
Podium Session: 3
ICORR
Poster Session/Number: 2/B41 3/B30 5/B22
Podium Session: 4

**Murray, T.**
ICORR
Poster Session/Number: 5/B30

**Mussa-Ivaldi, F.**
ICORR
Poster Session/Number: 2/B32
Podium Session: 2

**Myslinski, M.**
ICVR
Poster Session/Number: 1/B9

**Müller, F.**
ICVR
Poster Session/Number: 1/B15
ICORR
Poster Session/Number: 3/B27

**Nagamura, K.**
ICORR
Poster Session/Number: 4/B13

**Nef, T.**
ICORR
Poster Session/Number: 5/B30

**Ness, L.**
ICORR
Poster Session/Number: 4/B7

**Neuhaus, P.**
ICORR
Podium Session: 5

**Ng Fuk Chong, J.**
ICVR
Podium Session: 8

**Nichols, D.**
ICORR
Poster Session/Number: 2/B39

**Nichols, D.**
ICORR
Poster Session/Number: 5/B30

**Nishida, Y.**
ICORR
Poster Session/Number: 4/B1

**Nobutomo, T.**
ICORR
Poster Session/Number: 4/B26

**Noorden, J.**
ICORR
Podium Session: 5

**Notelaers, S.**
ICVR
Podium Session: 8
ICORR
Poster Session/Number: 5/B36

**Novak, D.**
ICVR
Poster Session/Number: 1/B15
ICORR
Poster Session/Number: 2/B41 3/B30 4/B16 5/B22
Podium Session: 4

**Novakovic, V.**
ICORR
Poster Session/Number: 5/B26

**Noymai, A.**
ICVR
Podium Session: 1

**Noé, E.**
ICVR
Podium Session: 2

**Nunes, W.**
ICORR
Poster Session/Number: 5/B32

**O'Malley, M.**
ICORR
Poster Session/Number: 3/B13 3/B39 3/B42

**Oblak, J.**
ICORR
Poster Session/Number: 5/B21

**Ocepek, J.**
ICORR
Poster Session/Number: 5/B22

**Ochoa, J.**
ICORR
Podium Session: 2

**Okawa, Y.**
ICORR
Poster Session/Number: 4/B1

**Olenšek, A.**
ICORR
Poster Session/Number: 2/B41 3/B30 5/B22
Podium Session: 4

**Oliveira, J.**
ICVR
Poster Session/Number: 1/B7

**Oliveira, L.**
ICORR
Poster Session/Number: 5/B32

**Omlin, X.**
ICORR
Poster Session/Number: 4/B16

**Oscari, F.**
ICORR
Poster Session/Number: 2/B33

**Osu, R.**
ICORR
Poster Session/Number: 5/B28

**Otaka, Y.**
ICORR
Poster Session/Number: 5/B28

**Otten, A.**
ICORR
Poster Session/Number: 4/B18

**Oura, S.**
ICORR
Poster Session/Number: 4/B8

**Ozkul, F.**
ICORR
Poster Session/Number: 4/B30

**Pacheco, J.**
ICVR
Poster Session/Number: 1/B7

**Pagello, E.**
ICORR
Poster Session/Number: 4/B5

**Paranjape, R.**
ICORR
Poster Session/Number: 4/B19

**Parenti-Castelli, V.**
ICORR
Poster Session/Number: 2/B38

**Park, H.**
ICORR
Poster Session/Number: 2/B14

**Park, H.**
ICORR
Poster Session/Number: 4/B24 4/B27

**Park, K.**
ICORR
Poster Session/Number: 3/B3

**Park, K.**
ICORR
Poster Session/Number: 4/B23

**Pasotti, F.**
ICVR
Poster Session/Number: 1/B20

**Patel, C.**
ICORR
Poster Session/Number: 4/B7

**Patoglu, V.**
ICORR
Podium Session: 4

**Patterson, M.**
ICVR
Podium Session: 4

**Patton, J.**
ICORR
Poster Session/Number: 2/B36 5/B29 5/B33
Podium Session: 6

**Pedrocchi, A.**
ICORR
Poster Session/Number: 5/B19

**Pedrocchi, N.**
ICORR
Poster Session/Number: 3/B8

**Pehlivan, A.**
ICORR
Poster Session/Number: 3/B42

**Pennycott, A.**
ICORR
Poster Session/Number: 3/B23

**Peper, L.**
ICVR
Poster Session/Number: 1/B8

**Perez-Gracia, A.**
ICORR
Poster Session/Number: 3/B41

**Pernalete, N.**
ICORR
Poster Session/Number: 3/B35

**Perreault, E.**
ICORR
Poster Session/Number: 5/B4

**Perry, J.**
ICORR
Poster Session/Number: 2/A11 3/B21

**Peters, J.**
ICORR
Podium Session: 2

**Petrova, M.**
ICVR
Podium Session: 3

**Pfeifer, S.**
ICORR
Poster Session/Number: 5/B4

**Pietrusinski, M.**
ICORR
Poster Session/Number: 5/B20

**Pilarski, P.**
ICORR
Podium Session: 1

**Pintaric, T.**
ICVR
Podium Session: 8

**Piovesan, D.**
ICORR
Poster Session/Number: 2/B32

**Piron, L.**
ICVR
Poster Session/Number: 1/B21

**Pisano, F.**
ICORR
Poster Session/Number: 3/B15

**Pitto, L.**
ICORR
Poster Session/Number: 5/B26

**Poje, J.**
ICORR
Poster Session/Number: 5/B22

**Pons, J.**
ICORR
Poster Session/Number: 2/B23

**Popovic, D.**
ICORR
Poster Session/Number: 3/B10

**Popovic, M.**
ICORR
Poster Session/Number: 3/B10

**Popovic, M.**
ICORR
Poster Session/Number: 3/B14

**Posteraro, F.**
ICORR
Poster Session/Number: 3/B34

**Prange, G.**
ICVR
Poster Session/Number: 1/B14
ICORR
Poster Session/Number: 2/B34 3/B16
Podium Session: 3

**Pratt, J.**
ICORR
Podium Session: 5

**Pressman, A.**
ICORR
Podium Session: 2

**Prince, F.**
ICVR
Poster Session/Number: 1/B16

**Procopio, C.**
ICORR
Poster Session/Number: 5/B42

**Prokopenko, S.**
ICVR
Podium Session: 3

**Puh, U.**
ICVR
Podium Session: 3

**Puzzolante, L.**
ICORR
Poster Session/Number: 3/B34

**Pyk, P.**
ICVR
Podium Session: 8

**Qiu, Q.**
ICORR
Podium Session: 3

**Quiney, K.**
ICORR
Poster Session/Number: 4/B7

**Quintero, H.**
ICORR
Poster Session/Number: 5/B11

**Rabin, B.**
ICVR
Podium Session: 3 7

**Ragonesi, C.**
ICORR
Poster Session/Number: 2/B4

**Ram, D.**
ICVR
Poster Session/Number: 1/B27

**Raphaeli-Beer, N.**
ICVR
Podium Session: 6

**Ratcliffe, J.**
ICVR
Poster Session/Number: 1/B12

**Ravichandran, V.**
ICORR
Poster Session/Number: 2/B36

**Raya, R.**
ICORR
Poster Session/Number: 3/B29

**Reed, K.**
ICORR
Poster Session/Number: 3/B31 5/B38 4/B29

**Reggiani, M.**
ICORR
Poster Session/Number: 4/B5

**Reinkensmeyer, D.**
ICORR
Poster Session/Number: 2/B33 3/B41

**Ribeiro, J.**
ICORR
Poster Session/Number: 5/B32

**Riek, L.**
ICORR
Poster Session/Number: 4/B15

**Riener, R.**
ICVR
Poster Session/Number: 1/B25
ICORR
Poster Session/Number: 2/B14 2/B31 3/B23 3/B27 4/B16 5/B4
Podium Session: 4

**Rietman, J.**
ICORR
Poster Session/Number: 3/B16
Podium Session: 3

**Rim, B.**
ICORR
Poster Session/Number: 3/B1 3/B3

**Rinderknecht, M.**
ICORR
Poster Session/Number: 2/A2

**Riva, G.**
ICVR
Poster Session/Number: 1/B17

**Rivera, L.**
ICORR
Poster Session/Number: 3/B7

**Rizzo, A.**
ICVR
Podium Session: 9

**Robert, M.**
ICVR
Poster Session/Number: 1/B16

**Robinson, P.**
ICORR
Poster Session/Number: 4/B15

**Robinson, J.**
ICVR
Poster Session/Number: 1/B18

**Rocon, E.**
ICORR
Poster Session/Number: 3/B29

**Rodrigues, L.**
ICORR
Poster Session/Number: 5/B32

**Rogers, E.**
ICORR
Poster Session/Number: 3/B20 5/B31

**Roll, D.**
ICVR
Podium Session: 3

**Ron-Angevin, R.**
ICORR
Poster Session/Number: 5/B25

**Ronchetti, M.**
ICVR
Poster Session/Number: 1/B20

**Rong, W.**
ICORR
Poster Session/Number: 2/A1
Podium Session: 3

**Ronsse, R.**
ICORR
Poster Session/Number: 2/A2 2/B1 4/B12

**Rosati, G.**
ICORR
Poster Session/Number: 2/B33

**Rosenblum, S.**
ICVR
Podium Session: 9

**Rosie, J.**
ICVR
Poster Session/Number: 1/B1

**Ross, S.**
ICORR
Podium Session: 3

**Rossi, B.**
ICORR
Poster Session/Number: 5/B42
Podium Session: 5

**Rossi, S.**
ICORR
Poster Session/Number: 3/B18
Podium Session: 5

**Routhier, F.**
ICVR
Podium Session: 8
ICORR
Poster Session/Number: 3/B11

**Rozario, S.**
ICORR
Poster Session/Number: 5/B33

**Rubio Ballester, B.**
ICVR
Poster Session/Number: 1/B23

**Ryerson, S.**
ICORR
Poster Session/Number: 2/B39

**Rymer, W.**
ICORR
Poster Session/Number: 4/B7

**Rönnqvist, L.**
ICVR
Poster Session/Number: 1/B29

**Sachar, Y.**
ICVR
Podium Session: 7

**Saegusa, S.**
ICORR
Poster Session/Number: 4/B13
Podium Session: 5

**Sakaida, Y.**
ICORR
Poster Session/Number: 2/B13

**Sakata, S.**
ICORR
Poster Session/Number: 5/B28

**Sakurai, T.**
ICORR
Podium Session: 5

**Saleh, S.**
ICVR
Podium Session: 3
ICORR
Podium Session: 3

**Salverda, A.**
ICVR
Poster Session/Number: 1/B8

**Samaha, H.**
ICVR
Podium Session: 8

**Sampson, M.**
ICVR
Poster Session/Number: 1/B11

**Sancha-Ros, S.**
ICORR
Poster Session/Number: 5/B25

**Sandini, G.**
ICORR
Podium Session: 6

**Sandlund, M.**
ICVR
Poster Session/Number: 1/B29

**Sanguineti, V.**
ICORR
Poster Session/Number: 2/B35 5/B26 5/B39

**Sankai, Y.**
ICORR
Poster Session/Number: 2/B9

**Santos, N.**
ICVR
Poster Session/Number: 1/B7

**Sapin, J.**
ICORR
Podium Session: 1

**Saraiva, T.**
ICVR
Poster Session/Number: 1/B7

**Sarkar, N.**
ICVR
Poster Session/Number: 1/B19
Podium Session: 9

**Sartori, M.**
ICORR
Poster Session/Number: 4/B5

**Satici, A.**
ICORR
Podium Session: 4

**Sato, M.**
ICVR
Poster Session/Number: 1/B4

**Sato, Y.**
ICORR
Podium Session: 5

**Satsuma, A.**
ICVR
Poster Session/Number: 1/B4

**Sauer, P.**
ICORR
Poster Session/Number: 4/B14

**Sawicki, G.**
ICORR
Poster Session/Number: 2/A10

**Schlink, P.**
ICORR
Podium Session: 4

**Schloerb, D.**
ICVR
Podium Session: 1

**Schmitt, S.**
ICORR
Podium Session: 1

**Schoelkopf, B.**
ICORR
Podium Session: 2

**Schoepflin, Z.**
ICORR
Poster Session/Number: 2/B4

**Schouten, A.**
ICORR
Poster Session/Number: 4/B18 4/B22

**Schubring-Giese, M.**
ICORR
Poster Session/Number: 2/A4

**Schönauer, C.**
ICVR
Podium Session: 8

**Secoli, R.**
ICORR
Poster Session/Number: 2/B33

**Sedda, A.**
ICVR
Poster Session/Number: 1/B20

**Sergi, F.**
ICORR
Poster Session/Number: 2/B6

**Shamaei, K.**
ICORR
Poster Session/Number: 5/B8

**Sharp, I.**
ICORR
Poster Session/Number: 5/B29

**Shibata, Y.**
ICORR
Poster Session/Number: 4/B26

**Shin, J.**
ICORR
Poster Session/Number: 5/B34

**Shum, D.**
ICVR
Podium Session: 5

**Slaboda, J.**
ICVR
Podium Session: 2 2

**Smith, T.**
ICORR
Poster Session/Number: 5/B41

**Soares, F.**
ICVR
Poster Session/Number: 1/B7

**Sohn, M.**
ICORR
Poster Session/Number: 5/B34

**Solaro, C.**
ICORR
Poster Session/Number: 5/B39

**Soma, H.**
ICORR
Poster Session/Number: 2/B18

**Song, W.**
ICORR
Poster Session/Number: 2/B16

**Sorrento, G.**
ICVR
Podium Session: 8

**Sotgiu, E.**
ICORR
Poster Session/Number: 5/B42

**Sottomayor, C.**
ICVR
Poster Session/Number: 1/B7

**Spagnol, S.**
ICORR
Poster Session/Number: 2/B33

**Spillman, J.**
ICVR
Podium Session: 8

**Spoerri, R.**
ICVR
Poster Session/Number: 1/B25

**Squeri, V.**
ICORR
Poster Session/Number: 2/B35 5/B24

**Srinivasan, M.**
ICVR
Podium Session: 1

**Stampacchia, G.**
ICORR
Podium Session: 5

**Steeves, J.**
ICORR
Poster Session/Number: 3/B14 3/B33

**Stefanov, D.**
ICORR
Poster Session/Number: 5/B12

**Stegall, P.**
ICORR
Poster Session/Number: 5/B23

**Stegemann, M.**
ICORR
Poster Session/Number: 3/B35

**Stein, J.**
ICORR
Poster Session/Number: 3/B40

**Stepp, C.**
ICORR
Poster Session/Number: 4/B11
Podium Session: 1

**Sterpi, I.**
ICORR
Poster Session/Number: 3/B15

**Stienen, A.**
ICORR
Poster Session/Number: 3/B16 4/B18 4/B22 4/B28
Podium Session: 6

**Stoykov, N.**
ICVR
Poster Session/Number: 1/B24

**Strachota, E.**
ICORR
Poster Session/Number: 4/B19

**Subramanian, S.**
ICVR
Podium Session: 5

**Suezawa, S.**
ICORR
Poster Session/Number: 2/B9

**Sugarman, H.**
ICVR
Poster Session/Number: 1/B28

**Sukal Moulton, T.**
ICORR
Poster Session/Number: 4/B28

**Sullivan, J.**
ICORR
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**Sung, C.**
ICORR
Poster Session/Number: 3/B13

**Susanto, E.**
ICORR
Poster Session/Number: 2/A1
Podium Session: 3

**Sushko, J.**
ICORR
Poster Session/Number: 4/B29

**Sutton, R.**
ICORR
Podium Session: 1

**Sveistrup, H.**
ICVR
Podium Session: 5

**Tagliamonte, N.**
ICORR
Poster Session/Number: 2/B6

**Takahashi, J.**
ICORR
Poster Session/Number: 2/B9

**Takahashi, Y.**
ICORR
Poster Session/Number: 5/B40

**Takase, K.**
ICORR
Poster Session/Number: 2/B13

**Takeda, K.**
ICORR
Poster Session/Number: 5/B28

**Tanaka, E.**
ICORR
Poster Session/Number: 4/B13
Podium Session: 5

**Tang, F.**
ICORR
Poster Session/Number: 3/B35

**Tarpin Bernard, F.**
ICVR
Poster Session/Number: 1/B13

**Taylor, P.**
ICORR
Poster Session/Number: 3/B14

**Tchekanov, G.**
ICORR
Poster Session/Number: 4/B19

**Terpstra, W.**
ICORR
Poster Session/Number: 5/B17

**Thiemjarus, S.**
ICORR
Poster Session/Number: 2/A5

**Thomas, P.**
ICVR
Podium Session: 5

**Toledano-Alhadef, H.**
ICVR
Podium Session: 9

**Tomelleri, C.**
ICORR
Poster Session/Number: 5/B16

**Tong, D.**
ICORR
Poster Session/Number: 3/B20 5/B31

**Tong, K.**
ICORR
Poster Session/Number: 2/A1 3/B36
Podium Session: 3

**Tonin, P.**
ICVR
Poster Session/Number: 1/B21

**Torres, C.**
ICVR
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**Torres, T.**
ICORR
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**Tow, A.**
ICORR
Poster Session/Number: 2/B2

**Townson, A.**
ICORR
Poster Session/Number: 3/B14

**Trad, D.**
ICORR
Poster Session/Number: 5/B27

**Trieu Phat, L.**
ICORR
Poster Session/Number: 5/B15

**Triolo, R.**
ICORR
Podium Session: 2

**Trlep, M.**
ICVR
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**Troncossi, M.**
ICORR
Poster Session/Number: 2/B38

**Truyens, V.**
ICORR
Poster Session/Number: 5/B36

**Tseng, H.**
ICORR
Podium Session: 2

**Tufekciler, N.**
ICORR
Poster Session/Number: 3/B22

**Tunik, E.**
ICVR
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**Turolla, A.**
ICVR
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**Turton, A.**
ICORR
Poster Session/Number: 2/A3

**Unluhisarcikli, O.**
ICORR
Poster Session/Number: 5/B20

**Ushiba, J.**
ICORR
Poster Session/Number: 5/B28

**Ushida, T.**
ICORR
Poster Session/Number: 4/B13

**Ustinova, K.**
ICVR
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**Vaidyanathan, R.**
ICORR
Poster Session/Number: 2/A3 2/A3

**Vallery, H.**
ICORR
Poster Session/Number: 3/B23 5/B4

**Valls Miro, J.**
ICORR
Poster Session/Number: 2/B15

**van Asseldonk, E.**
ICORR
Poster Session/Number: 2/B1
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**van Den Hoogen, W.**
ICVR
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**van den Kieboom, J.**
ICORR
Poster Session/Number: 2/B1

**van der Kooij, H.**
ICORR
Poster Session/Number: 2/B1 2/B40 3/B16
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Podium Session: 5

**van der Rijt, A.**
ICVR
Poster Session/Number: 1/B8

**van Dijk, W.**
ICORR
Poster Session/Number: 5/B1
Podium Session: 5

**van Hedel, H.**
ICVR
Poster Session/Number: 1/B3

**van Loon, E.**
ICVR
Poster Session/Number: 1/B8

**van Schaik, P.**
ICVR
Poster Session/Number: 1/B18

**van Vuuren, W.**
ICORR
Poster Session/Number: 4/B18

**Vanstipelen, S.**
ICORR
Poster Session/Number: 3/B26

**Varol, H.**
ICORR
Poster Session/Number: 5/B5 5/B9

**Vashista, V.**
ICORR
Poster Session/Number: 5/B2

**Vasudevan, E.**
ICORR
Poster Session/Number: 3/B31

**Velasco-Alvarez, F.**
ICORR
Poster Session/Number: 5/B25

**Velik, R.**
ICORR
Poster Session/Number: 2/A11

**Vendramin, A.**
ICVR
Poster Session/Number: 1/B21

**Veneman, J.**
ICORR
Poster Session/Number: 2/A11

**Ventura, L.**
ICVR
Poster Session/Number: 1/B21

**Verlinden, O.**
ICORR
Podium Session: 1

**Verschure, P.**
ICVR
Poster Session/Number: 1/B23
Podium Session: 8

**Vetter, P.**
ICORR
Poster Session/Number: 3/B35

**Vicentini, F.**
ICORR
Poster Session/Number: 3/B8

**Vigaru, B.**
ICORR
Poster Session/Number: 2/A4

**Villiger, M.**
ICVR
Podium Session: 8

**Vitiello, N.**
ICORR
Poster Session/Number: 2/B1

**Volkening, K.**
ICVR
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**Vollenbroek-Hutten, M.**
ICVR
Podium Session: 8

**Wade, E.**
ICORR
Poster Session/Number: 2/B8

**Waldner, A.**
ICORR
Poster Session/Number: 5/B16

**Walpen, S.**
ICORR
Poster Session/Number: 2/A6

**Wang, L.**
ICORR
Poster Session/Number: 4/B6

**Wang, P.**
ICORR
Poster Session/Number: 2/B2 2/B3

**Wang, Q.**
ICORR
Poster Session/Number: 4/B10

**Wang, S.**
ICORR
Poster Session/Number: 5/B1

**Warren, Z.**
ICVR
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Podium Session: 9

**Wei, X.**
ICORR
Poster Session/Number: 2/A1
Podium Session: 3

**Weisel-Eichler, A.**
ICVR
Poster Session/Number: 1/B28

**Weiss, P.**
ICVR
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**Welch, K.**
ICVR
Poster Session/Number: 1/B19

**Werner, C.**
ICORR
Poster Session/Number: 5/B16

**Wespe, P.**
ICORR
Poster Session/Number: 2/A4

**Wick, K.**
ICVR
Poster Session/Number: 1/B3

**Wiggin, B.**
ICORR
Poster Session/Number: 2/A10

**Wilkening, A.**
ICORR
Poster Session/Number: 2/B12

**Williams, D.**
ICORR
Poster Session/Number: 3/B18

**Williams, G.**
ICVR
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**Willms, R.**
ICORR
Poster Session/Number: 3/B14

**Wilson, P.**
ICVR
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**Winfree, K.**
ICORR
Poster Session/Number: 5/B23

**Wolbrecht, E.**
ICORR
Poster Session/Number: 3/B41

**Wolf, M.**
ICVR
Poster Session/Number: 1/B5

**Wong, C.**
ICORR
Poster Session/Number: 3/B4

**Woods, C.**
ICVR
Poster Session/Number: 1/B1

**Wright, Z.**
ICORR
Poster Session/Number: 2/B36

**Wright, W.**
ICVR
Podium Session: 2

**Wu, F.**
ICORR
Poster Session/Number: 2/B17

**Wyss, D.**
ICORR
Poster Session/Number: 3/B23

**Xia, J.**
ICORR
Poster Session/Number: 5/B3

**Xingda, Q.**
ICORR
Poster Session/Number: 5/B15

**Xue, J.**
ICORR
Poster Session/Number: 3/B36

**Yamamoto, S.**
ICORR
Poster Session/Number: 4/B26 5/B40

**Yang, H.**
ICORR
Poster Session/Number: 2/B16 4/B2

**Yao, J.**
ICORR
Poster Session/Number: 3/B2

**Yeh, C.**
ICVR
Poster Session/Number: 1/B6

**Yokota, S.**
ICORR
Poster Session/Number: 2/B13

**Yoon, J.**
ICORR
Poster Session/Number: 4/B27

**Yoshimura, N.**
ICVR
Poster Session/Number: 1/B4

**Yozbatiran, N.**
ICORR
Poster Session/Number: 3/B39

**Yu, W.**
ICORR
Poster Session/Number: 2/B18

**Yuge, L.**
ICORR
Poster Session/Number: 4/B13
Podium Session: 5

**Yuk, G.**
ICORR
Poster Session/Number: 4/B2

**Yusa, H.**
ICORR
Podium Session: 5

**Zancanaro, M.**
ICVR
Podium Session: 4

**Zariffa, J.**
ICORR
Poster Session/Number: 3/B14 3/B33

**Zenzeri, J.**
ICORR
Poster Session/Number: 5/B24

**Zhang, H.**
ICORR
Poster Session/Number: 4/B4

**Zhang, Y.**
ICORR
Poster Session/Number: 3/B2

**Zheng, R.**
ICORR
Poster Session/Number: 3/B2

**Ziherl, J.**
ICVR
Poster Session/Number: 1/B15

**ICORR**
Poster Session/Number: 2/B41 3/B30 5/B22
Podium Session: 4

**Zivanovic, V.**
ICORR
Poster Session/Number: 3/B14

**Zong, C.**
ICORR
Poster Session/Number: 4/B3

**Zucconi, C.**
ICVR
Poster Session/Number: 1/B21

## Notes