ICORR Podium / Poster Sessions

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

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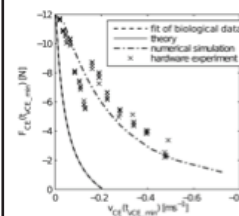
- design concept for an artificial muscle
- based on three simple mechanical elements
- shows hyperbolic force velocity relation
- harware experiments confirm numerical model
- test trilogy to validate the concept

Paper 2

Multi-Day Training with Vibrotactile Feedback for Virtual Object Manipulation
*Qi An, Yoky Matsuoka and Cara Stepp*
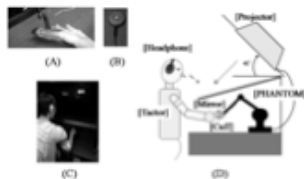
- Sensory feedback could improve prosthetic control
- Vibrotactile stimulation is a promising modality
- N=6 subjects performed virtual object manipulation
- Vibrotactile feedback related to contact force
- Performance increased over time

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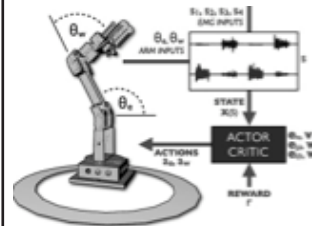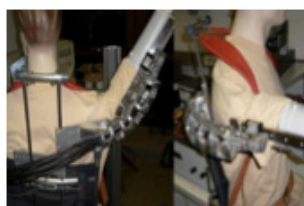
- Flexible approach to EMG-based prosthetic control.
- Amputee-specific controller optimization.
- Online adaptation through human feedback.
- Reinforcement learning artificial intelligence.
- Readily transferable to new domains and devices

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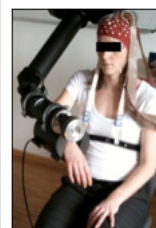
- A novel robot-based neurorehabilitation approach.
- Combines haptic feedback with BCIs.
- Experiments with healthy subjects & stroke patients.

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
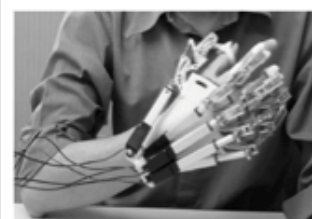

- Light and portable exoskeleton hand robotic device
- Intention driven using surface electromyography
- Assist in hand opening and closing functional task
- Eight chronic stroke subjects invited for training
- Improvement in hand functions after 20 sessions

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
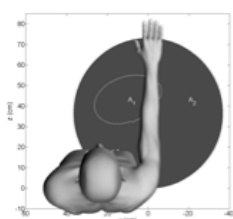

- Circle drawing as evaluative movement task
- Identification of synergistic movement patterns
- Significant differences between healthy and stroke
- High correlation with Fugl-Meyer scores

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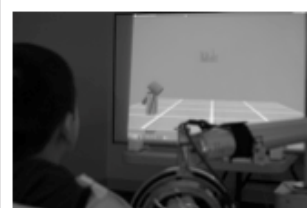
- Children with CP and adults with CVA
- Training UE with the same robot
- Children learned skills slower.
- Children made larger overall changes.
- All subjects made real world improvements

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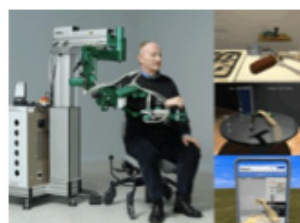
- Robot assisted ADL training
- Patient is supported by a cooperative controller
- Required arm support is learned online

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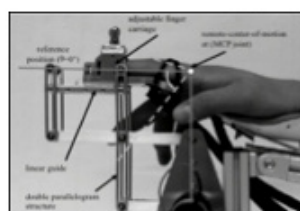
- Platform to assess and treat sensory deficits
- 3 types of stimuli at the palm and index finger
- Displacement at the MCP joint, pressure, vibration
- First study on sensory thresholds of MCP movement
- JND of 2.46° was determined for MCP joint angle

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
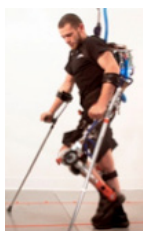

- Robot-assisted exercise in healthy/ SCI subject
- Analysis of EMG activity of four leg's muscl
- High muscular recruitment (actively cooperatin
- Treadmill exercise without robot support

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
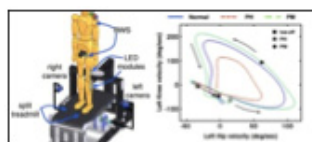- Evaluation in an experiment with nine subjects

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
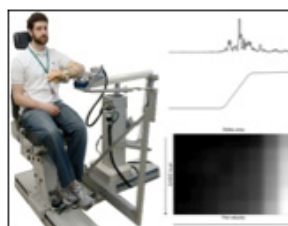*Lorenzo Masia, Giulio Sandini and Pietro Morasso*

- 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
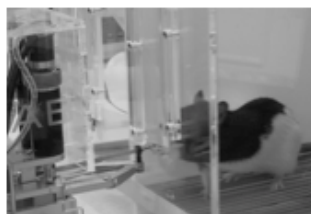

- Design and evaluation of a 3-DOF robotic device
- Controlled training and quantitative assessment
- Dynamic interaction in repeatable tasks
- Investigation of motor learning in stroke rats
- Rats trained to grasp, pull and rotate handle

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
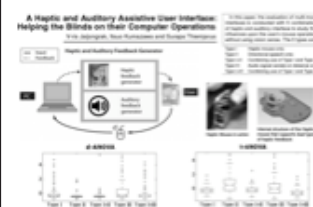
- Haptic Mouse
- Assistive Device
- Assistive Application

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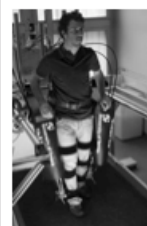
- Motor primitive to assist walking
- Adaptive controller based on oscillators
- Trajectory-free assistance
- Reduction of metabolic cost
- Movement prediction

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
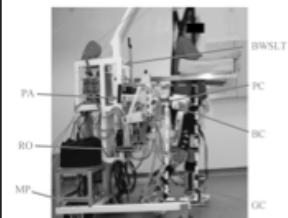
- Rehabilitation
- Over-ground walking training
- Gait device

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
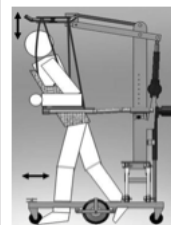
- Gait rehabilitation
- EMG
- OFf-loading level

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
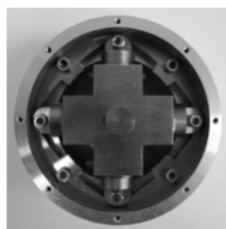
Poster Session 2 - B4

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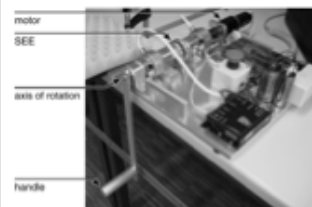
- adaptive assistance of cyclical movements
- simple sensing
- robustness analysis
- motor primitive
- model-based predictions

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)
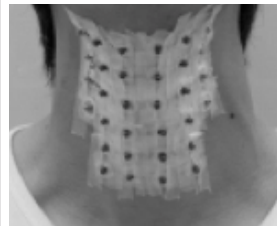
Poster Session 2 - B7

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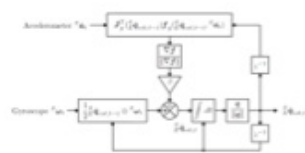
- Quaternion estimation for IMUs and MARG sensors
- Computational inexpensive
- Patient motion tracking

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
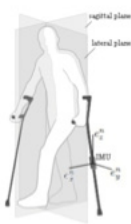
Poster Session 2 - B12

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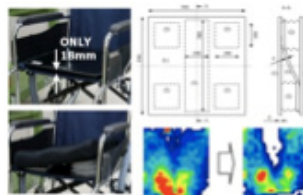
- Depressurization Motion Assistance System
- Thin Design, Low Cost and Easy to Use.
- Our System Assists based on the Patient's Will

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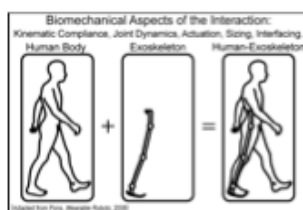
- Exoskeletons supplement limb function in humans
- Aspects of leg mechanics and design are presented
- Design specifications of prototypes are discussed
- Evaluation of proposed designs is often lacking
- Gaps and how those might be filled are discussed

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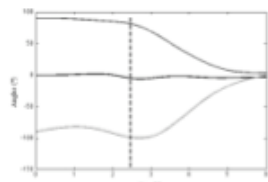
- Sit to stand motion
- Optimization of trunk movement
- Application in paraplegic patients

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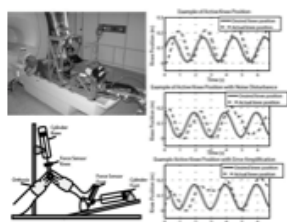
- Based on Howlland's transconductance amp circuit
- Up to 32 independent stimulation channels
- Portable, specially designed to use it within WR

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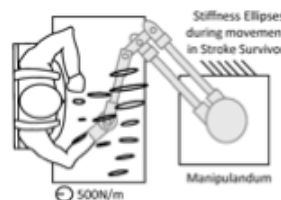
- New technique assessing stiffness during movement
- Stiffness decreases with robot mediated training
- How does the Ashworth relate to stiffness?

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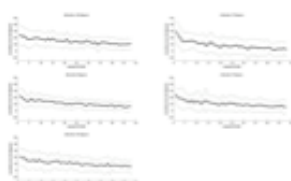
- Robotics is increasingly used in rehabilitation
- Effect reaching direction on visuomotor learning
- Different amount of adaptation to one direction
- Role of feedback and corrections mechanisms

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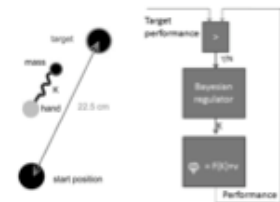
- Adaptive procedure to select assistance
- No need of an accurate model of learning
- Task: control of a virtual object
- The task difficulty increases as learning proceeds
- Useful to promote also neuromotor recovery

Poster Session 2 - B35

Startle Reduces Recall of a Recently Learned Internal Model
Zachary Wright, James Patton and Venn Ravichandran
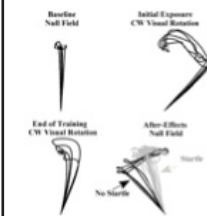
- Startle probes preparation responses in humans
- Introduces startle into adaptation paradigm
- Startle reduces after-effects of adaptation
- Startle reduces performance of learned task
- Multiple nueral centers involved in learning

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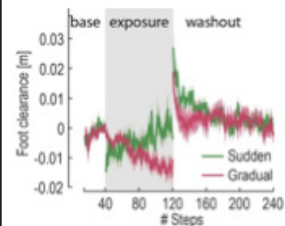
- Motor learning principles are increasingly used in
- Assess effect of different dynamic perturbations o
- Gradually introduced perturbation results in less
- In contrast to results from reaching adaptation

Poster Session 2 - B40

Task Difficulty Adjustment in Biocooperative Rehabilitation Using Psychophysiological Responses
*Domen Novak, Matjaž Mihelj, Jaka Ziherl, Andrej Olenšek and Marko Munih*
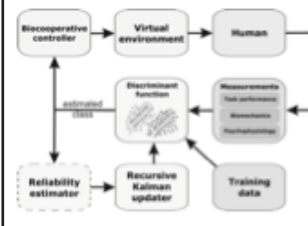
- psychophysiological feedback loop
- identify whether task is too easy or too hard
- discriminant analysis used for data fusion
- online adaptation of data fusion rules
- tested with 34 healthy subjects and 17 patients

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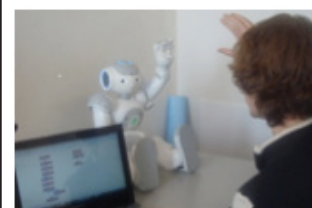
- Develop scenarios for training children with ASD
- End-user programming for therapists with a robot
- Platform consists of NAO robot and TiViPE software
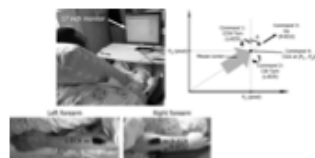- Online community of therapists and engineers

Poster Session 2 - B42

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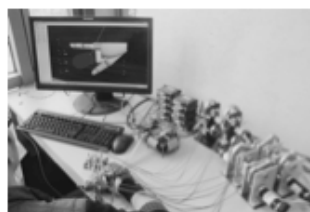*Changmok Choi, ByeongCheol Rim and Jung Kim*

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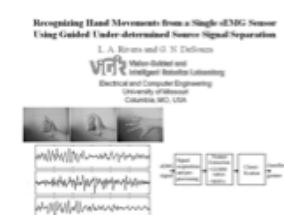
- Pattern recognition using sEMG signals
- New ICA-based source signal separation technique
- Single sEMG source
- Only two features and a simple distance classifier

Poster Session 3 - B7

Analysis of Elbow-Joints Misalignment in Upper-Limb Exoskeleton
Matteo Malosio, Nicola Pedrocchi, Federico Vicentini and Lorenzo Molinari Tosatti
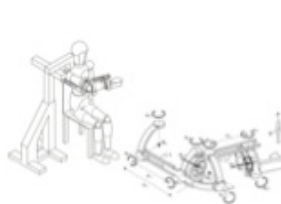
- Elbow singularity-free exoskeleton
- Elbow joints misalignment effects analysis
- Compliances and cuffs controllability relapses
- Benefits for therapies and range of motions

Poster Session 3 - B8

Jointless Structure and Under-Actuation Mechanism for Compact Hand Exoskeleton

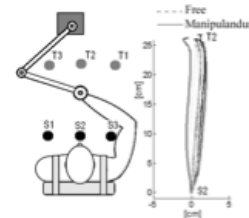*HyunKi In, Kyu-Jin Cho, KyuRi Kim and BumSuk Lee*

- 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
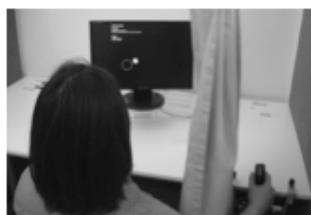
Nayan Kakoty and Shyamanta Hazarika

- 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 aug-mentation 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
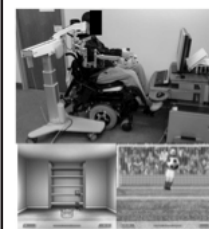

- Pilot study of Armeo® Spring (Hocoma, AG) in SCI.
- 12 cervical traumatic in-patients (multi-center).
- GRASSP and ARAT used to measure functional change.
- Subjects with some hand function benefited most.

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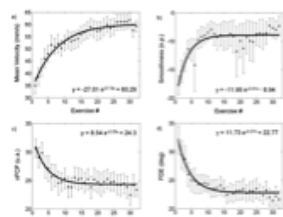
- Robot-aided Neurorehabilitation
- Analysis of movement kinematics and kinetics
- Modeling time course of recovery
- Modeling clinical variables by performance

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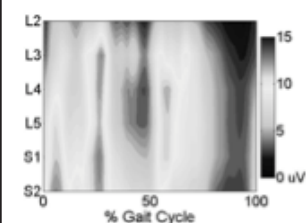
- Quantitative representation of MN activity
- Spinal maps in post-stroke patients
- Implications for rehabilitation

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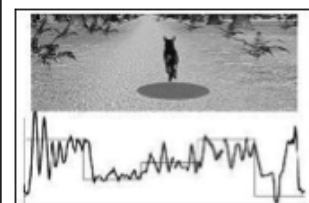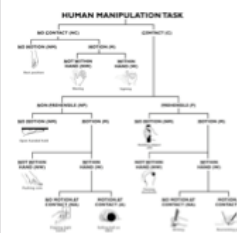
- VR-enriched robot-assisted gait rehabilitation
- Bilateral and unilateral modes to control VR
- Evaluation of paretic and non-paretic leg activity
- Successful control and increase of motor output

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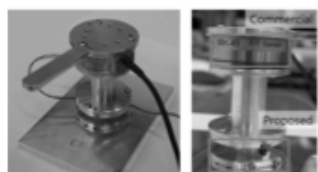
- Alpha-prototype of a novel pediatric ankle robot
- Recovery of ankle function in children with CP
- Pilot data with healthy children are presented

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
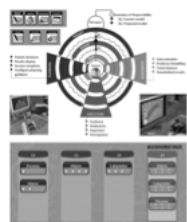

- Integrated solutions for rehabilitation are needed
- Cyclic and iterative rehab model proposed
- Patient training autonomy extended to sessions
- Usability in display of assessment tasks discussed
- Preliminary telerehabilitation platform evaluated

Poster Session 3 - B21

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

*Nese Tufekciler, Edwin Asseldonk and Herman van der Kooij*
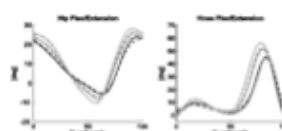
- Velocity-dependent reference trajectories
- Regression analysis of key parameters
- Constructing trajectories by fitting splines

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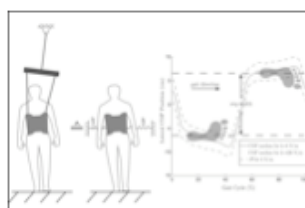
- Balance training enhances robotic gait therapy.
- Subjects walked loaded with additional mass.
- Step width decreased with increasing added mass.
- Body weight support reduces balance challenge

Poster Session 3 - B23

River Multimodal Scenario for Rehabilitation Robotics

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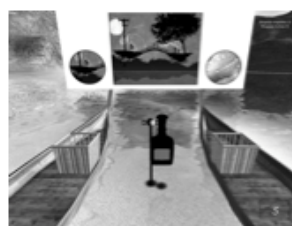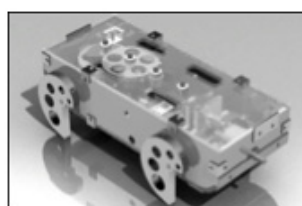

- Motor rehabilitation task and cognitive challenge
- Haptic, video and audio modalities
- Adaptive assistance, voice instructions
- Two clinical evaluations, 16 + 6 stroke patients

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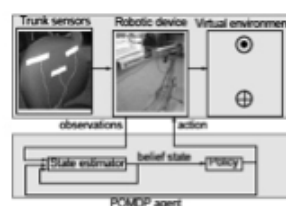
- We present a rehabilitation robot that uses POMDPs
- The POMDP estimates the user's belief state
- An action generates a target to be reached
- Using haptics the system gives adpative feedback
- Simulation results of performance are presented

Poster Session 3 - B32

Computer Vision-Based Classification of Hand Grip Variations in Neurorehabilitation
Jose Zariffa and John Steeves
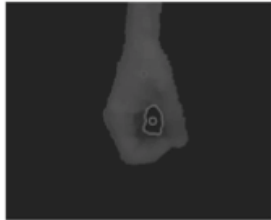
- Computer vision is used to identify hand postures.
- 3 postures relevant to ADLs were discriminated.
- The overall classification success rate was 91.2%.
- This has applications to rehab robots with VR.

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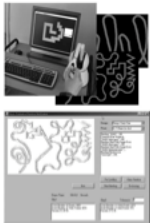
- Eye-Hand Coordination Robotic Therapy
- Design of Haptic Tasks with Assistance Algorithms
- Evaluation Function for Performance Analysis

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
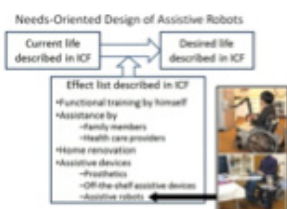*Ali Pehlivan, Ozkan Celik and Marcia O'Malley*

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

Poster Session 3 - B42

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
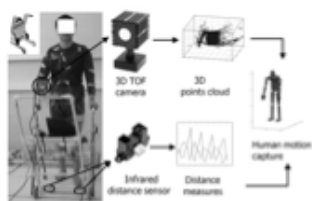
Poster Session 4 - B1

Kinematics Analysis of Sit-To-Stand Assistive Device for the Elderly and Disabled
Inho Kim, Hyunseok Yang, Woonghee Cho and Gyunghwan Yuk
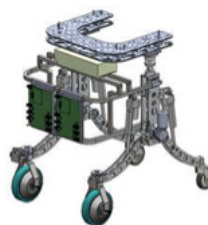
- Introduce a robotic sit-to-stand supporting system
- Kinematics Analysis of the system
- Demonstrate feasibility of the system

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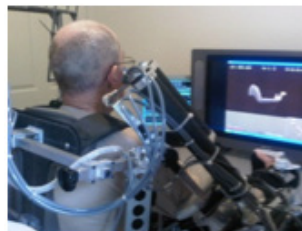
- wearable exoskeleton for arm
- at home robot assisted therapy
- task based therapy mode
- patient operated stroke therapy

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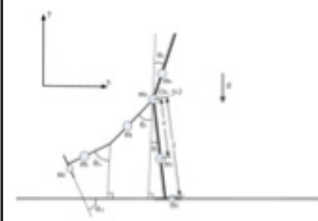*Yoshiaki Hayashi and Kazuo Kiguchi*
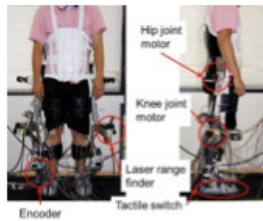
- Perception-assist is applied to a lower-limb power
- The robot tries to modify the user's motion automa
- ZMP is taken into account

Poster Session 4 - B9

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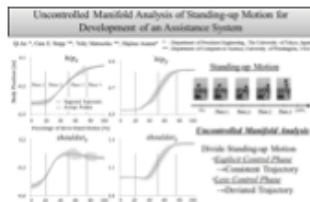*Yan Huang and Qining Wang*

- 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
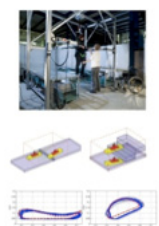*Marta Kordasz, Krzysztof Kuczkowski and Piotr Sauer*

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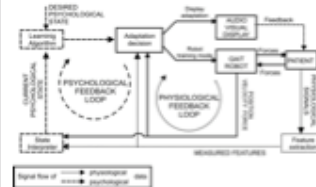
- Gait robots are used in stroke rehabilitation
- Robots do not yet react compliantly to the patient
- Solution: bio-cooperative control (BCC)
- BCC incorporates patient in control loop
- Possible on physiological and psychological level

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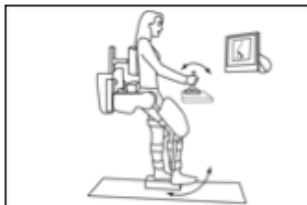
- Quantitative assessment of sensory deficits needed
- Used Lokomat to assess leg proprioception
- Tested remembered and visual presentation paradigm
- Lokomat feasible tool to measure proprioception

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
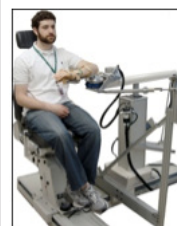
Poster Session 4 - B20

The Basic Mechanics of Bipedal Walking Lead to Asymmetric Behavior
Robert Gregg IV, Amir Degani, Yasin Dhaher and Kevin Lynch
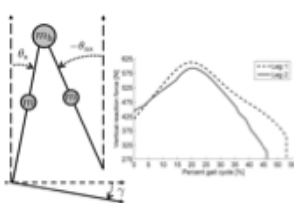
- Able-bodied gait asymmetry is subject of debate
- Passive biped mechanics facilitate asymmetry
- We examine kinetic and stability variables
- Asymmetric gaits can be more stable than symmetric
- GRF impulses suggest functional asymmetry

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
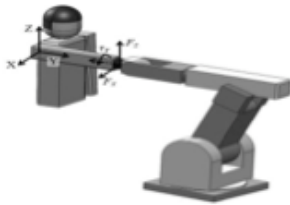- Upper Extremity Rehabilitation
- Abnormal Muscle Synergies

Poster Session 4 - B22

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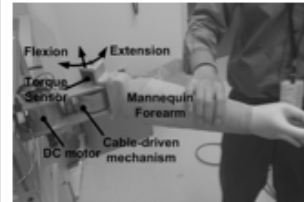*Kyungbin Park and Pyung Hun Chang*

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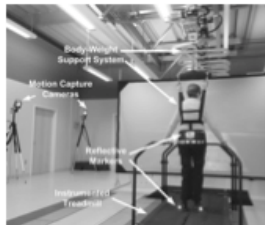
- What is Cause of Freezing of Gait in PD?
- Walking platform where patients walk naturally
- Developed Treadmill Speed Adaptation Control+ VR
- More responsive and reliable control was achieved
- The VR-based platform coule evoke FOG in PD

Poster Session 4 - B27

Wrist and Finger Torque Sensor for the Quantification of Upper Limb Motor Impairments Following Brain Injury
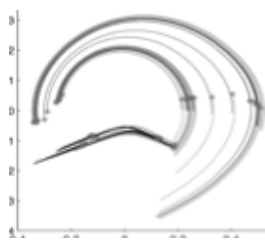*Arno Stienen, Theresa Sukal Moulton, Laura Miller and Julius Dewald*
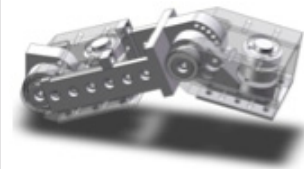
- Hard and Wrist Torque Sensing
- Impairment Diagnostic after Brain Injury
- Upper Extremity Rehabilitation

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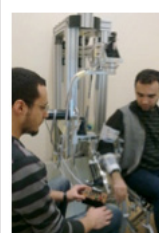
- A robot-assisted rehabilitation system RehabRoby
- Control architecture for RehabRoby
- Evaluation of proprioceptive sense
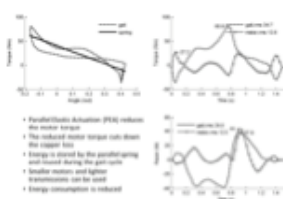- Evaluation of usability of RehabRoby

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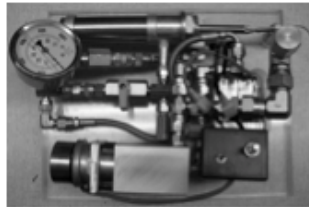
- Untethered orthotics need small actuators
- Fluid power has high force-to-weight
- Fluid power has high power-to-weight
- High-pressure hydraulics lighter than motor

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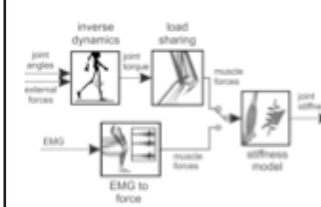
- Motivation: variable-stiffness knee prostheses
- Goal: quantitative stiffness estimates during gait
- Model-based method using gait lab measurements
- No need to apply joint perturbations
- Validation by isometric perturbation measurements

Poster Session 5 - B4

Ground Adaptive Standing Controller for a Powered Transfemoral Prosthesis
*Brian Lawson, Huseyin Varol and Michael Goldfarb*
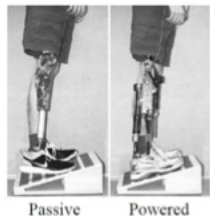
- Ground adaptive standing controller
- Comprehensive standing behavior on unlevel terrain
- Orientation tracking using an IMU
- +/- 1 degree ground slope estimation in real-time
- Biomechanical joint impedances for standing

Poster Session 5 - B5

Performance Characteristics of Anthropomorphic Prosthetic Hands
*Joseph Belter and Aaron Dollar*
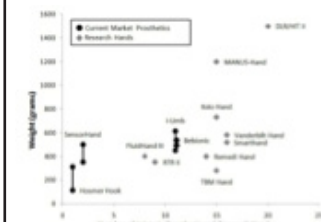
- No current hand performance standards exist
- A survey of published hand data was complied
- Data can be used to formulate performance ranges
- Specific testing methods for hands are desired

Poster Session 5 - B6

Vibrotactile Sensory Substitution in Multi-Fingered Hand Prostheses: Evaluation Studies
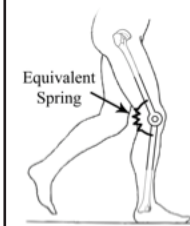*Marco D'Alonzo, Christian Cipriani and Maria Chiara Carrozza*
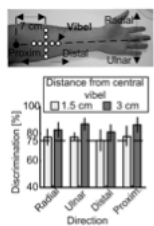
- New vibrotactile sensory substitution system
- Variation of both amplitude and frequency
- Discrimination experiments with healthy subjects

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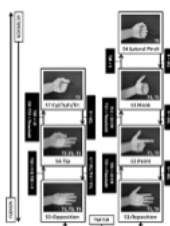
- Multigrasp Myoelectric Control
- Nine Possible Postures
- Direct, Proportional Control of Motion
- Average Transition Completion Rate: 99.2%
- Average Transition Completion Time: 1.49 sec.

Poster Session 5 - B9

A Configuration Dependent Muscle Model for the Myoelectric Control of a Transfemoral Prosthesis
Carl Hoover and Kevin Fite
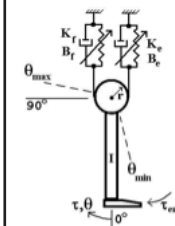
- Active-Knee Transfemoral Prosthesis
- Myoelectric Impedance Control
- Antagonist Pair Coactivation Model
- Angle-Dependent Moment Arm Muscle Model

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
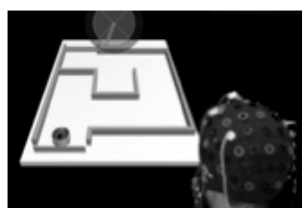
- Virtual and real environments
- Audio-cued control interface
- Two mental states mapped into four commands
- "Non-control" and "Intentional control" states
- Usability sopported by the results

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
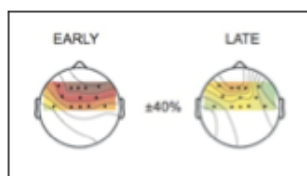
- EEG activity during skill acquisition
- EEG correlates of learning and task difficulty
- EEG correlates of successful/unsuccessful trials
- EEG to monitor/regulate motor learning/recovery

Poster Session 5 - B26

Nonlinear and Nonstationary Framework for Feature Extraction and Classification of Motor Imagery
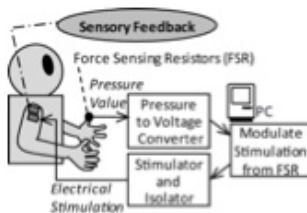*Dalila Trad, Tarik Al Ani, E. Monacelli, S. Delaplace and M. Jemni*

- 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
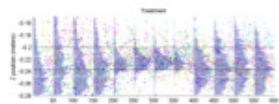- Utilize cutaneous electrical stimulation
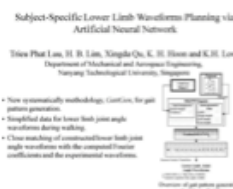
Poster Session 5 - B28

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
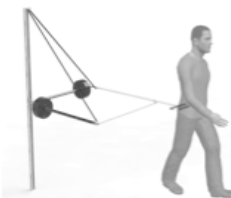
- Gait-training robots must display a low inertia
- We applied inertias to the pelvis during gait
- anterior inertias > 4kg had a significant effect
- lateral inertias < 6 kg had no significant effect

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
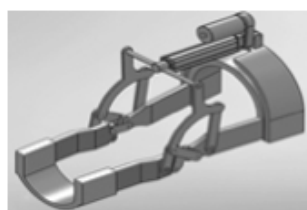
- The design of the exoskeleton CPM
- For Knee rehabilitation device
- Create a design based on human knee joint

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
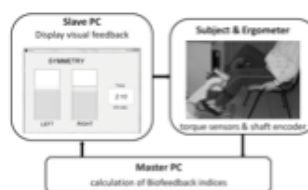
- Design of a biofeedback pedaling training
- Feasibility study on 3 chronic stroke patients
- Significant decrease of pedaling unbalance
- Some modifications on the gait kinematic pattern
- Is there a carry-over effect from cycling to gait?

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
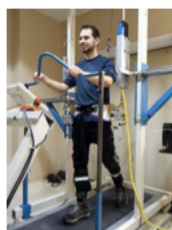
- Robotic Gait Rehabilitation Trainer
- Targets secondary gait deviations
- Generates force field with impedance control
- Human Machine Interface transfers forces to pelvis
- Can affect pelvic obliquity during gait

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
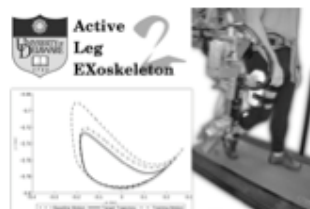
- reaching and grasping task
- subacute and chronic stroke groups + controls
- psychophysiological measurements
- kinematic + static parameters

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
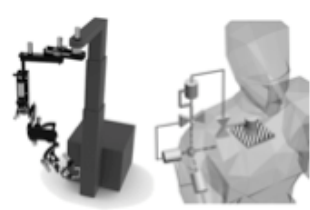
- Shoulder mechanism considering the shoulder girdle
- Mimic natural motion of human shoulder
- Increase workspace for rehabilitation
- Does not require additional adjustment

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
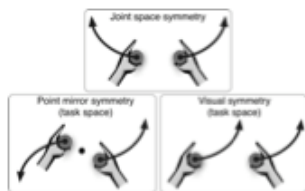
- Bimanual could be used for low cost rehabilitation
- We performed a bimanual haptic tracking task
- Compared different symmetry modes and stiffness
- Two modes significantly easier than the third mode
- High stiffnesses lead to better neural duplication

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
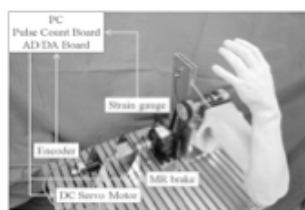
- physical therapy
- patient simulator
- rehabilitation trainee

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
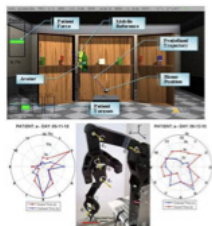
- Upper limb rehabilitation with active exoskeleton
- Design of a triggered gain control strategy
- Clinical and performance-based evaluation

Poster Session 5 - B42