Inducing Self-Selected Human Engagement in Robotic Locomotion Training

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• We describe a technique for shaping human gait using least-effort tendencies
• Adaptive assistance from a robotic orthosis alters the energy-cost landscape
• Subjects self-selected energetically optimal gait parameters
• Results show potential for improving active engagement in robotic therapy
• The role of pelvic rotations in human gait remains uncertain.
• During robotic design, decisions needed on which degrees of freedom (DoF) to permit and actuate, requiring an understanding of the role of each DoF.
• Role for pelvic obliquity in reducing lateral movement of the upper body proposed, hypothesis tested experimentally.
• Pelvic rotations reduced when walking in robotic orthosis.
• Trend for decreased lateral movement with increased pelvic obliquity.

Podium 4.2
Robotic-Locomotor Training as a Tool to Reduce Neuromuscular Abnormality in Spinal Cord Injury
The Application of System Identification and Advanced Longitudinal Modeling

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- Robotic-locomotor training (LOKOMAT) were given to incomplete spinal cord injury subjects.
- Neuromuscular properties of ankle were characterized with system identification technique.
- Growth Mixture and Random Coefficient Regression analyses were used to identify recovery patterns of neuromuscular abnormalities associated with spasticity.
- Results demonstrated that LOKOMAT can effectively reduce neuromuscular abnormalities, with greater improvements for subjects with higher baseline abnormalities.
Development of an Energy Harvesting Backpack and Performance Evaluation

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• Developed a new energy harvesting backpack that integrates motion from both lower limbs into a single mechanical driven train.
• Evaluated the performance and metabolic consequences of this energy harvesting device.
• 5 healthy young adult subjects participated in seven treadmill walking activities conducted at 1.2m/s.
• Metabolic costs were measured in four walking activities: (1). Normal walking. (2). Weight-only. (3). Mechanical engagement. (4). Electrical engagement.
• Device generates 15W electricity during walking.

Podium 4.4
Experimental Effective Shape Control of a Powered Transfemoral Prosthesis

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• The human leg conforms to an effective shape during walking
• The effective shape is a standard measure for gait analysis and prosthesis alignment
• Recent simulations suggest a novel effective shape control strategy could improve robustness and clinical viability of powered prosthetic legs
• We experimentally implement effective shape control on the Vanderbilt leg

Podium 4.5
Modulation of Anticipatory Postural Adjustments of Gait Using a Portable Powered Ankle-Foot Orthosis

M Petrucci, E Hsiao-Wecksler: University of Illinois Urbana-Champaign (UIUC)
C MacKinnon: University of Minnesota (UMN)

- Pilot study was performed to determine the efficacy of using robotic assistance to facilitate gait initiation.
- Powered orthosis helps drive user through the proper sequence of postural adjustments prior to taking a step.
- Results suggest potential application in Parkinson’s disease to help alleviate freezing of gait symptoms.