



PADOVA  
neuroscience  
CENTER

DNS



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

2 NOVEMBER 2023, 3:00 pm

SALA SEMINARI VIMM

(Via Giuseppe Orus 2, Padova)

# SEMINARS

con il patrocinio del Dipartimento di Neuroscienze – DNS dell'Università di  
Padova

**A talk by Paolo Bonato (Spaulding Rehabilitation Hospital, Boston MA)**

## **PRECISION REHABILITATION INTERVENTIONS IN NEUROLOGICAL PATIENTS UNDERGOING ROBOT-ASSISTED MOTOR TRAINING**

In this talk, we will review the use of robotics in rehabilitation medicine with a focus on retraining motor function in patients with neurological conditions ranging from stroke to cerebral palsy. We will argue that the prediction of patients' response to robot-assisted motor training should account for the mechanisms underlying the short-term and long-term response of each patient to the forces generated by the robot. The problem will be framed in the context of motor adaptation, defined as the process by which subjects respond to the forces exerted by the robot via a motor plan aimed to counter the effects of such forces. We will present experimental evidence in support of the hypothesis that, during robot-assisted gait training, the generation of a motor response to the robot is observed only if the forces exerted by the robot are processed by the central nervous system as challenging the dynamic stability of the subject. We will discuss how the analysis of muscle synergies could shed light on the characteristics of motor adaptation. Experimental results will be presented showing preliminary evidence of a feedback and feedforward response to robot-exerted forces that could be used in future studies to predict the ability of patients to display a positive response to the rehabilitation intervention. Results of a pilot study will be presented to demonstrate changes in muscle synergies associated with clinical outcomes of robot-assisted gait training. Finally, we will present preliminary results on sensory augmentation techniques aimed to boost (and potentially restore) the ability of patients to generate a motor adaptation to robot-exerted forces hence providing an opportunity to retrain the ability of patients to generate new or modify existing motor plans.

## Biography

Paolo Bonato, Ph.D., serves as Director of the Motion Analysis Laboratory at Spaulding Rehabilitation Hospital, Boston MA. He is an Associate Professor in the Department of Physical Medicine and Rehabilitation at Harvard Medical School. He holds Adjunct Faculty appointments at Massachusetts Institute of Technology, the MGH Institute of Health Professions, and Boston University College of Health & Rehabilitation Sciences. He has held Adjunct Faculty positions at the Wyss Institute at Harvard University, Northeastern University, the University of Ireland Galway, and the University of Melbourne.

His research work is focused on the development of rehabilitation technologies with special emphasis on wearable technology and robotics. Dr. Bonato served as the Founding Editor-in-Chief of Journal on NeuroEngineering and Rehabilitation. He serves as a Member of the Advisory Board of the IEEE Journal of Biomedical and Health Informatics and as Associate Editor of the IEEE Journal of Translational Engineering in Health and Medicine. Also, he serves as the Founding Editor-in-Chief of the IEEE Open Journal of Engineering in Medicine and Biology. Dr. Bonato served as an Elected Member of the IEEE Engineering in Medicine and Biology Society (EMBS) AdCom (2007-2010) and as IEEE EMBS Vice President for Publications (2013-2016). He served as President of the International Society of Electrophysiology and Kinesiology (2008-2010).

He received the M.S. degree in electrical engineering from Politecnico di Torino, Turin, Italy in 1989 and the Ph.D. degree in biomedical engineering from Universita` di Roma "La Sapienza" in 1995.