



Workshop Proposal for IEEE ICORR 2015

Type (Half day)

Organizers:

Michelle J Johnson, PhD -IEEE Member

Dr. Johnson is currently Assistant Professor of Physical Medicine and Rehabilitation at the University of Pennsylvania. She has a secondary appointment as an Assistant professor in Bioengineering and is a member of the Mechanical Engineering and Applied Mechanics graduate group. She directs the Rehabilitation Robotic Laboratory located at the Pennsylvania Institute of Rehabilitation Medicine at the University of Pennsylvania, School of Medicine.

Karla Bustamante-Valles, PhD

Dr. Bustamante is a faculty member at Tecnológico de Monterrey (ITESM) in Chihuahua Mexico. She is the director of the Center for Technology and Research in biomedicine at ITESM (*Centro de Tecnología e Investigación en Biomedicina, CTIB*).

Stefano Mazzoleni, PhD-IEEE Member

Dr. Mazzoleni is with the BioRobotics Institute of Scuola Superiore Sant'Anna (Pisa, Italy). Since 2011 he is Coordinator of the "Rehabilitation Bioengineering Laboratory" in Volterra (Italy). He is the co-chair in the IEEE/RAS Technical Committee on "Rehabilitation and Assistive Robotics".

Rui Loureiro, PhD-IEEE Member

Dr. Loureiro is the ASPIRE Senior Lecturer and Head of the Aspire Centre for Rehabilitation Engineering and Assistive Technology (Aspire-CREATE) at the University College London, and Royal National Orthopaedic Hospital, Stanmore, UK. He specialises in advanced robotics and human interactive systems for rehabilitation engineering.

Title: AFFORDABLE REHABILITATION AND ASSISTIVE ROBOTICS FOR LOW RESOURCE SETTINGS AND DEVELOPING COUNTRIES

Theme: Rehabilitation and assistive robotics

Keywords: Rehabilitation, Assistive Technology, Affordable Robots, Low-Middle Income Countries, Global Health

Abstract

Non-communicable diseases, especially cardiovascular diseases, are the leading cause of death and disability in the world. Our long-term goal is to use affordable robotics and assistive technologies to improve the health and function of persons with persistent upper and lower limb disability due to disease or traumatic event occurring in the USA and the developing world. Since access to rehabilitation services and

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associated rehabilitation technologies may not exist outside of major urban areas and many times are not affordable to low income patients, innovative solutions are needed to augment the delivery of rehabilitation care. Assistive devices, telerehabilitation, mobile technologies and robotic technologies can play diverse roles in increasing health and rehabilitation capacity in the developed and developing world. This workshop will discuss health and rehabilitation capacity in developing countries and discuss the opportunity for robotics by highlighting specific examples and strategies for creating affordable therapy and assistive robot systems. Our learning objectives are to increase awareness on the growing disparities between rehabilitation infrastructure and deployment in developed and developing world and provide a forum for discussing these ideas. Talks include case examples of affordable prosthetics, gym-base affordable therapy in Mexico, affordable telemedicine as well as engineering affordable robots for social interaction.

LIST of Speakers

A. *Michelle J. Johnson, PhD, Department of Physical Medicine and Rehabilitation, johnmic@mail.med.upenn.edu*

Health and Rehabilitation Capacity in LMICs/Opportunity for Robotics and Assistive Technologies

Dr. Johnson is currently Assistant professor of physical medicine and rehabilitation at the University of Pennsylvania. She has a secondary appointment as an Assistant professor in Bioengineering and is a member of the Mechanical Engineering and Applied Mechanics graduate group. She has a PhD in Mechanical Engineering, with an emphasis in mechatronics, robotics, and design, from Stanford University. She directs the Rehabilitation Robotic Research and Design Laboratory which specializes in the design, development, and therapeutic use of novel, affordable, intelligent robotic assistants for rehabilitation after brain injury.

B. *Stefano Mazzoleni, PhD, Biorobotics Institute, Scuola Superiore Sant'Anna, stefano.mazzoleni@sssup.it*

Affordable Telemedicine

Stefano Mazzoleni, MSc '02, PhD '07. Since 2002 he is with the BioRobotics Institute of Scuola Superiore Sant'Anna (Pisa, Italy). Since 2011 he is Coordinator of the “Rehabilitation Bioengineering Laboratory” in Volterra (Italy). His research activities are in the field of rehabilitation robotics, assistive technologies, human-machine interaction, motor recovery, and motor control. Since 2012 he is serving as co-chair in the IEEE/RAS Technical Committee on “Rehabilitation and Assistive Robotics”. He has authored/co-authored about 60 peer-reviewed publications in international journals, books and conference proceedings.

C. *Karla Bustamante-Valles, PhD, Department of Bioengineering, ITESM, Chihuahua, Mexico, karla.bustamante@itesm.mx*

Affordable Technologies in a Robot Gym in Mexico

Dr. Karla Bustamante is a faculty member at ITESM in Chihuahua Mexico. She is the director of the Center for Technology and Research in biomedicine at ITESM (*Centro de Tecnologia e Investigacion en Biomedicina, CTIB*). Dr. Bustamante also has a part time position as Research Assistant Professor at Marquette University OREC – Orthopedic and Rehabilitation Engineering Center. The CTIB in Chihuahua has directed its efforts in building research projects that will help to solve critical healthcare issues in Mexico. Dr. Bustamante received her bachelor's degree in Electronic Engineering at the Public University *Instituto Tecnológico de Chihuahua*.

D. *John-John Cabibihan, PhD, Mechanical and Industrial Engineering Department, Qatar University, john.cabibihan@qu.edu.qa*

Affordable Prosthetics

John-John Cabibihan received his PhD in the area of biomedical robotics from the Scuola Superiore Sant'Anna, Pisa, Italy in 2007. He is presently an Assistant Professor at the Mechanical and Industrial Engineering Department of Qatar University. He serves at the Editorial Boards of the International Journal of Social Robotics, International Journal of Advanced Robotics Systems, Frontiers in Bionics and Biomimetics, and Computational Cognitive Science. He was a past Chair of the IEEE Systems, Man and Cybernetics Society, Singapore Chapter (terms: 2011 and 2012).

E. *Dr. Rui C.V. Loureiro, B.Eng. (HONS), M.Sc., Ph.D., MIET, MIEEE, ASPIRE Senior Lecturer, Head of Centre, R.Loureiro@ucl.ac.uk*

Engineering affordable rehab anchored on social interactions

Dr. Loureiro is the ASPIRE Senior Lecturer and Head of the Aspire Centre for Rehabilitation Engineering and Assistive Technology (Aspire-CREATE) at the University College London, and Royal National Orthopaedic Hospital, Stanmore, UK. He specialises in advanced robotics and human interactive systems for rehabilitation engineering. Dr Loureiro has pioneered work in stroke rehabilitation and movement disorders and has a wealth of experience with both the design of rehabilitation technologies and clinical assessment of such aids at the acute, sub-acute and chronic phases of recovery. At the new Aspire-

CREATE centre his research focuses on whole-body rehabilitation paradigms facilitating the development of therapies translating to functional independence, the understanding of spinal-cortical re-organisation in stroke, SCI and following amputation, and on the development of robots that assist when needed.

F. Redwan M. Alqasemi, PhD, Kyle B. Reed, PhD, Rajiv Dubey, PhD, Mechanical Engineering, University of South Florida, alqasemi@usf.edu; kylereed@usf.edu; dubey@usf.edu

Low-Cost Technology Solutions for rehabilitation and assistance of Persons with Disabilities

Redwan M. Alqasemi holds a PhD degree in Mechanical Engineering and is currently a research professor at the USF's Mechanical Engineering Department and a lead researcher at the Center for Assistive, Rehabilitation and Robotics Technologies (CARRT). He has published more than 100 technical papers in national and international journals and conferences in the field of robotics.

Kyle B. Reed is an Assistant Professor of Mechanical Engineering at the University of South Florida. His research interests include haptics, rehabilitation engineering, human-machine interaction, robotics, and engineering education. He received the B.S. degree in Mechanical Engineering from the University of Tennessee in 2001 and the M.S. and Ph.D. degrees in Mechanical Engineering from Northwestern University in 2004 and 2007, respectively. He was a postdoctoral fellow in the Laboratory for Computational Sensing and Robotics at Johns Hopkins University. More information about him and his research can be found at his lab website: <http://reedlab.eng.usf.edu>

Rajiv V. Dubey is a Professor and Chair of the Department of Mechanical Engineering in the College of Engineering. He is also the Director of the Center for Assistive and Rehabilitation Robotics Technologies (CARRT). He received his Bachelor's degree in Mechanical Engineering from the Indian Institute of Technology, Bombay, and Master's and Doctoral degrees in Mechanical Engineering from Clemson University. His research interests include rehabilitation robotics and telemanipulation systems; haptic interfaces and assistive devices for persons with disabilities; rehabilitation engineering; robotic/telerobotic applications in healthcare, space and undersea, nuclear waste management; and prosthetics and orthotics. He has published over one hundred articles in prestigious journals and conference proceedings. He has directed over fifty PhD dissertations and MS theses. He has served on several review panels for the National Science Foundation and was the associate editor of the IEEE Journal on Robotics and Automation from 1989 to 1997. He has been actively involved in organizing major robotics conferences and technical sessions. He is a Fellow of the American Society of Mechanical Engineers.

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