Neural Engineering for Brain-Machine Interface: Mechanisms for Direct and Indirect Robotic Control

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**Abstract**

A major thrust in brain machine interface (BMI) is to establish a robust, *bi-directional* direct link between the central nervous system (CNS) and artificial devices (e.g., medical implants, artificial organs, neural stimulators, robotic hands, etc.) for cybernetic interface and treatment of a range of neurodegenerative conditions. Significant effort has centered on support of motor control through external devices and direct stimulation through implanted electrodes in the brain, ideally supporting paralyzed or neurally damaged patients by bypassing damaged regions of the brain.

The talk will review current research thrusts of the Biomechatronics Laboratory at Imperial College London in brain machine interfaces. Work highlighted will include mapping human emotional response to cooperative robots, prosthetic and cybernetic interfaces for robotic control, and signal decoding of deep brain implants for quantification of motion artifacts based on neural signal mapping.
Speaker bio:
Ravi Vaidyanathan is a Senior Lecturer in Bio-Mechatronics at Imperial College London, UK and a Research Professor in Systems Engineering at the US Naval Postgraduate School. He completed his Ph.D. in biologically inspired systems at Case Western Reserve University and subsequently worked in industry, holding directorships in control systems and medical engineering. Dr. Vaidyanathan has led more than 20 separate research programs supported in USA, Singapore, and UK, authored over 100 refereed publications, and is a named inventor two pending patents. His research in biorobotics has been recognized internationally with awards from SAGE journals, the Institute of Electrical and Electronics Engineers (IEEE), American Institute of Aeronautics and Astronautics (AIAA), and the Robotics Society of Japan (RSJ), including: SAGE Best Paper (Journal of Systems and Control Engineering), the Hyper-Human Tech Research Award (presented by the Robotics Society of Japan), ‘Best Paper’ at the IEEE International Conference on Intelligent Robots and Systems (IROS), and being a finalist for the New Technology Foundation Research Award on Entertainment Robots and Systems (2007) awarded by the IEEE and the RSJ in recognition of the most innovative research in robotics from 1987-2007. Revolutionary aspects of his research have also been featured by several news groups including: the BBC, New Scientist Magazine, The Engineer Magazine, Inc. Magazine, IEEE Institute, Yahoo News, Flight Global Magazine, The Times of India, The Hindu, The Discovery Channel, and the Tokyo Broadcasting Company and have been invited for presentation at to the US Pentagon and the UK Parliament.

Dr. Vaidyanathan holds honorary academic posts at the University of Bristol (UK), the US Naval Postgraduate School (USA), Case Western Reserve University (USA) and Anna University (India), and is currently co-chair of the IEEE Robotics and Automation Society Technical Advisory Committee on Biorobotics. His current research interests include biomechatronics, neural interface, and micro electro-mechanical sensing systems.