



ME Seminar



Design and control of Brain Computer Interface (BCI) based hand exoskeletons for stroke rehabilitation

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ABSTRACT

Persons suffering from loss of hand functions caused by stroke have driven a surge in the development of wearable assistive devices like exoskeletons. It is known that stroke sufferers can gain much enhanced upper limb movement recovery with active physical practice (via an exoskeleton) in conjunction with motor imagery practice (via a BCI). The talk will present aspects of mechanical design of hand exoskeletons that are based on emulating the human joints varying axis of rotation. The hand exoskeleton is actuated by a BCI and controlled via an assist-as-required controller. The BCI uses machine learning based algorithms for sensor fusion of EEG, EMG and IMU signals for the detection of human motion intent. The hand exoskeleton and the BCI operate in closed loop thus engaging the hand and brain during therapy. Results of pilot trials and the advantages and limitation of a BCI as a human-machine interface will be explored.

ABOUT THE SPEAKER

Prof. Ashish Dutta obtained his PhD in Systems Engineering from Akita University, Japan, M.Tech from Jadavpur University and B.Tech from NIT Calicut. From 1994 to 2000 he was with the Bhabha Atomic Research Center where he worked on telemanipulator design and control for nuclear applications. Since 2002 he is with IIT Kanpur, India where he is currently a professor and head of the department of mechanical department. He was also a visiting professor in Nagoya University, Japan in 2006 and is currently a visiting professor at Kyushu Institute of Technology, Japan (2019 -). His research interests are in the areas of humanoid robotics, intelligent control systems and BCI based rehabilitation engineering. Prof. Dutta has also served as advisory board member of ISRO Chandrayan II Lunar mission (2009), ISRO Gagananyan manned mission 2020, member of 'Task force on AI' of the Ministry of Commerce and Industry (2017) Govt of India, Secretary of The Robotics Society of India (2011-2017), etc.



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