

Title: Brain-Computer Interfaces Using Light: Present and Future

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Abstract: Functional near-infrared spectroscopy (fNIRS) is an emerging non-invasive brain imaging technique and measures brain activities by means of near-infrared light of 650-950 nm wavelengths. The major advantages of fNIRS are its low cost, portability, and good temporal resolution as a plausible solution to real-time imaging. Recent research had showed the great potential of fNIRS as a tool for brain-computer interfaces. The general linear model (GLM) is most popular and is a common method for analysis of functional MRI data, but it has certain limitations in the case of optical signals. In this talk, the existing methods for fNIRS signals are reviewed and some recent advances are discussed. Some examples of brain-machine interfaces are also illustrated. Finally, a feedback control concept of human brain will be proposed, in which fMRI, EEG, fNIRS are considered as sensors and rTMS and tDCS are considered as actuators.

Lab website [Http://cogno.pusan.ac.kr](http://cogno.pusan.ac.kr)

Biography:



Keum-Shik Hong received his B.S. degree in Mechanical Design and Production Engineering from Seoul National University in 1979, his M.S. degree in Mechanical Engineering from Columbia University, New York, in 1987, and both an M.S. degree in Applied Mathematics and a Ph.D. in Mechanical Engineering from the University of Illinois at Urbana-Champaign (UIUC) in 1991. Dr. Hong joined the School of Mechanical Engineering at Pusan National University (PNU) in 1993. In 2009, under the auspices of the World Class University Program of the Ministry of Education, Science and Technology (MEST) of Korea, he established the Department of Cogno-Mechatronics Engineering, PNU.

Dr. Hong serves as Editor-in-Chief of the International Journal of Control, Automation, and Systems, and served as Editor-in-Chief of the *Journal of Mechanical Science and Technology* (2008-2011), and as Associate Editor of *Automatica* (2000-2006). He also serves as AEs for the Frontiers in Neurorobotics and the Brain-Computer Interfaces. He has also been General Secretary of the Asian Control Association (2006-2008), and was Organizing Chair of the ICROS-SICE International Joint Conference 2009, Fukuoka, Japan. He is a past president

of the Institute of Control, Robotics and Systems. He is President-Elect of Asian Control Association.

He is an IEEE Fellow, a Fellow of the Korean Academy of Science and Technology, an ICROS Fellow, a Member of the National Academy of Engineering of Korea, and many other societies. His Integrated Dynamics and Control Engineering Laboratory was designated a National Research Laboratory by the MEST of Korea in 2003. He is the Director of the Institute of Advanced Construction and Conveying Machinery. Dr. Hong's current research interests include brain-computer interface, nonlinear systems theory, adaptive control, distributed parameter systems, autonomous systems, and innovative control applications in brain engineering.