



## **Junichi HORI, Dr. Eng.**

Professor

Program: Electrical and Information Engineering

Area: Human Sciences and Assistive Technology

Undergraduate: Dept. of Biocybernetics

<http://www.eng.niigata-u.ac.jp/~hori/>

### **Professional Expertise**

In 1988 he joined the staff of the Department of Information Engineering, Niigata University, as a research associate. Since 1997, he has been an Associate Professor. In 1999-2000, he was a Visiting Scholar in University of Illinois at Chicago, USA.

### **Research Fields of Interest**

#### **High-Fidelity Biomedical Measurement**

The real-time restoration of nonstationary biomedical signals under additive noise was investigated. A couple of restoration filters, composed of a series of this model, was developed. These filters restored band-limited approximations to their original signals in real-time. These methods were applied to catheter manometers, ambulatory electrocardiographs, thermodilution sensors, and X-ray images.

#### **Human Brain Mapping**

To obtain high resolution brain electrical activity, the cortical dipole distributions or cortical potential maps was estimated by solving the EEG inverse problem. Various spatial inverse filters incorporated with the signal and noise covariance were applied to the human experimental data such as visual evoked potential, movement-related potential, and so on.

#### **Biosignal Interface**

To accomplish the new modality of communication, the human interfaces using the biosignals such as electroencephalogram (EEG), electrooculogram (EOG), and electromyogram (EMG) were investigated. Brain machine interface base on EEG and the communication device using eye movements or face movements were developed.



### **Education**

1996: Dr. Eng. in Computer Science, Tokyo Institute of Technology, Japan

1988: M.E. in Information Engineering, Niigata University, Japan

1986: B.E. in Information Engineering, Niigata University, Japan

## Professional Societies and Activities

1. Senior member of IEEE Engineering in Medicine and Biology Society
2. Member of International Society for Bioelectromagnetism
3. Member of Japan Society of Medical Electronics and Biological Engineering
4. Member of Institute of Electronics, Information and Communication Engineers of Japan
5. Member of Institute of Electrical Engineers of Japan
6. Member of Human Interface Society
7. Member of Japanese Human Brain Mapping
8. Member of Japanese Society for Wellbeing Science and Assistive Technology

## Awards

1. Hori, J.: "Improvement of Frequency Characteristics of Biomedical Measurement Systems by Means of Natural Observation Method," Young Investigator Awards in 5th Japanese Society of Medical Electronics and Biological Engineering, Oct. 1990.
2. Maeda, Y., Nakamura, Y., Shimizu, T., Hori, J., and Hayashi, T.: "The prize for Educations in Faculty of Engineering, Niigata University, Personal computer course program for visually disabled aiming at student's practical education and social contribution by community association, 2006.3.

## Major Publications

### Papers

- [1] Hori, J., Saitoh, Y., Kiryu, T., Asakawa, T., Tamura, K. and Iijima, T.: "Improvement of the frequency responses in an ambulatory ECG system by the natural observation method," *Frontiers Med. & Biol. Eng.*, vol.2, no.2, pp.137-145, 1990.
- [2] Hori, J., Saitoh, Y., Kiryu, T., and Iijima, T.: "Automatic correction of left-ventricular pressure waveform using the natural observation method," *IEICE Trans. Info. & Syst.*, vol.E75-D, no.6, pp.909-915, Nov. 1992.
- [3] Hori, J., Saitoh, Y. and Kiryu, T.: "Improvement of the time-domain response of a thermodilution sensor by the natural observation system," *IEICE Trans. Fundamentals*, vol.E77-A, no.5, pp.784-791, May 1994.
- [3] Hori, J., Saitoh, Y., and Kiryu, T.: "Real-time restoration of nonstationary biomedical signals under additive noises," *IEICE Trans. Info. & Syst.*, vol.E82-D, no.10, pp. 1409-1416, Oct 1999.
- [4] Hori, J., Saitoh, Y., Kiryu, T., Okamoto, K., and Sakai, K.: "Band-suppressed restoration of X-ray images blurred by body movement," *Methods Inform. Med.*, vol.39, no.2, pp.130-133, 2000.
- [5] Hori, J. and He, B.: "Equivalent dipole source imaging of brain electric activity by means of parametric projection filter," *Annals Biomed. Eng.*, vol.29, no.5, pp. 436-445, May 2001.
- [6] Hori, J. and He, B.: "EEG Cortical potential imaging of brain electrical activity by means of parametric projection filters," *IEICE Trans. Info. & Syst.*, vol.E86-D, no.9, pp.1909-1920, 2003.
- [7] Hori, J. Lian, J. and He, B.: "Cortical potential imaging of brain electrical activity by means of parametric projection filter," *Methods Inf. Med.*, vol.43, no.1, pp.66-69, 2004.
- [8] Hori, J., Aiba, M., and He, B.: "Spatio-temporal dipole source imaging of brain electrical activity by means of

time-varying parametric projection filter," *IEEE Trans. Biomed.*

*Eng.*, vol.51, no.5, pp.768-777, May 2004.

[9] Hori, J., Sakano, K., and Saitoh, Y.: "Development of a communication support device controlled by eye movements and voluntary eye blink," *IEICE Trans. Info. & Syst.*, vol.E89-D, no.6, pp.1790-1797, Jun. 2006.

[10] Hori, J., Miwa, T., Ohshima, T., and He, B.: "Cortical dipole imaging of movement-related potentials by means of parametric inverse filters incorporating with signal and noise covariance," *Methods Inf. Med.*, vol.46, no.2, pp.242-246, 2007.

[11] Hori, J. and Aoki, N., "Equivalent dipole sources localization using cortical dipole layer imaging and independent component analysis," *Int. J. Bioelectromagnetism*, vol.10, no.2, pp.100-110, 2008.

[12] Hori, J., Sunaga, K., and Watanabe, S.: "Signal and noise covariance estimation based on ICA for high-resolution cortical dipole imaging," *IEICE Trans. Info. & Syst.*, vol.E93-D, no.9, pp.2626-2634, 2010.

[13] Hori, J. and Koide, T.: "Three-dimensional cortical dipole imaging of brain electrical activity considering spherical and median plane," *IEEJ Trans. Electrical Electronic Eng.*, vol.6, supplement 1, pp.S42-S49, 2011.

[14] Hori, J. and Watanabe, Y.: "Cortical dipole imaging for multiple signal sources considering time-varying non-uniform noise," *IEEJ Trans. Electronics, Inf. Systems*, vol.131, no.11, 2011 (accepted).

### Book Chapters

- [1] He, B., Hori, J., and Babiloni, F. 2006. "Electroencephalography (EEG): Inverse Problems In: Akay, M. ed. Wiley Encyclopedia of Biomedical Engineering vol. 2," John Wiley and Sons, pp. 1355-1363.