Design of impedance measurement module for an EEG and EIT integrated system

Harsh Sohal, Hun Wi, Tong In Oh ‖, Eung Je Woo

Impedance Imaging Research Center and Department of Biomedical Engineering, Kyung Hee University, South Korea

Abstract. Electrical impedance tomography (EIT) has been performed with the electroencephalogram (EEG) in order to decrease errors associated with the inverse problem due to unknown conductivity distribution in the brain. EIT has the potential to produce images for detecting epileptic seizures or brain activities as means of complementary to EEG. Since EEG signal is generated from internal sources in the brain and EIT voltage signal is induced from externally injected current, the measurement system requires high temporal resolution to measure fast EIT signals and high resolution ADC for small EEG signals in order to measure EEG signals concurrent with EIT signals. We proposed the new design of EEG and EIT integrated system based on multi-channel of upgraded impedance measurement module (IMM3). IMM3 was adopted a direct digital synthesizer(DDS) to generate injection current avoided the harmonic frequency of brain signals. Using internal PLL, we could generate fast acquisition timing signal for EIT mearuement. We used the 24 bit ADC with 2.5 MSPS measurement speed. Real and imaginary components of EIT signal could be calculated by the phase sensitive demodulation or FFT method. EEG data was decimated to improve the signal quality and reduced the data amounts for recording. Other features were inherited from previous IMM2.5 included operation mode for external triggering and cascaded connection with EIT systems, the self-calibration to maintain the performance, multiplexing, and phase sensitive demodulation. In this paper, we will describe the design of the IMM3 for EEG and EIT intergrated system in detail and present the basic performance indexes of tested module. It will be assembled to configure a multi-channel EEG and EIT integrated system.

‖ To whom correspondence should be addressed (tioh@khu.ac.kr)