ELECTRICAL IMPEDANCE TOMOGRAPHY AND MAGNETIC RESONANCE EIT

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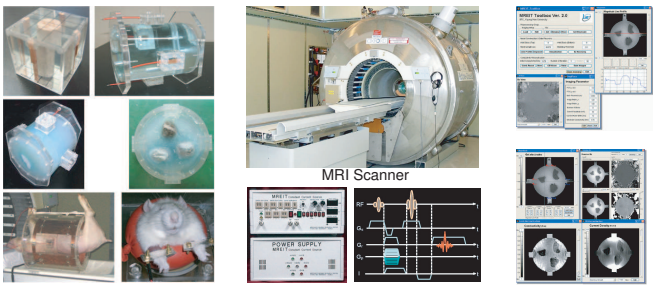
Abstract. Magnetic Resonance Electrical Impedance Tomography (MREIT) is a new medical imaging technique combining Electrical Impedance Tomography (EIT) and Magnetic Resonance Imaging (MRI). Noting that EIT suffers from the ill-posed nature of the corresponding inverse problem, we introduce MREIT which utilizes internal information on the one component of the induced magnetic field in addition to the boundary current-voltage measurements to produce three-dimensional images of conductivity and current density distributions.

Since 2000, imaging techniques in MREIT have been advanced rapidly and now are at the stage of animal experiments. In both EIT and MREIT, we inject currents through electrodes placed on the surface of a subject. While EIT is limited by the boundary measurements of current-voltage data, MREIT utilizes the internal magnetic flux density data obtained using a Magnetic Resonance Imaging (MRI) scanner. This is the main reason why MREIT could eliminate the ill-posedness of EIT. The disadvantages of MREIT over EIT may include the lack of portability, potentially long imaging time and requirement of an expensive MRI scanner.

In this talk, we begin with reviewing EIT in order to provide the rationale of pursuing MREIT research that requires an expensive MRI scanner. Then, recent progress in MREIT providing conductivity and current density images with a high spatial resolution and accuracy will be presented including mathematical theory, algorithms, and experimental methods. With numerous potential applications in mind, some future researches in MREIT and EIT will be proposed.



MREIT system at Impedance Imaging Research Center in Korea and image reconstruction software