# Mathematical framework for Electrical Tissue Property Imaging using MRI

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**ABSTRACT**

Tomographic imaging of electrical tissue properties including the conductivity and permittivity has made the rapid advance with the latest developments of new magnetic resonance imaging (MRI) techniques such as Magnetic Resonance Electrical Impedance Tomography (MREIT) and Electrical Property Imaging (EPT). When a biological subject is under the influence of an external electric field, local changes of its electrical tissue properties become sources of magnetic field perturbations, which can be detected from MR signals. Controlling the external excitation and measuring the responses using an MRI scanner, we can formulate the imaging problem as an inverse problem, where the tissue properties are unknowns to be recovered from acquired MR signals. The inverse problem is nonlinear involving Maxwell's equations and Bloch equation incorporated in the data acquisition process. Each method for visualizing internal conductivity and permittivity distributions has its own methodological limitations, and is restricted to image only a part of the ensemble mean tissue structures or states. Hence, it would be desirable to expand the imaging capability of each method by complementing the other. This talk focuses on the recent progress of MREIT and discusses its distinct features compared to other imaging methods. This talk is based on the recent review article with Eung Je Woo (to appear in a special issue of IEEE TBME celebrating the 60 years history).