MEDICAL IMAGING BY MAGNETIC INDUCTION TOMOGRAPHY: PRESENT LIMITATIONS

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Magnetic induction tomography (MIT) is one of a family of techniques for measuring the passive electrical properties of biological tissues, principally the electrical conductivity. In MIT, eddy currents are induced in the tissue by a magnetic field from an excitation coil and the secondary magnetic field due to the eddy currents is measured by an array of sensor coils. An image of the internal conductivity distribution can be reconstructed from these signals. MIT has a number of potential advantages over its better-known sister technique, EIT, in that it does not require direct contact with the tissue and that the coils are fixed in known positions. These advantages have however proved elusive. Like EIT, MIT is a so-called 'soft-field' technique, meaning that the spatial distribution of sensitivity is dependent on the unknown conductivities. Consequently, the MIT problem is highly ill-posed, if anything even more so than EIT, so the inverse solution requires regularization. A number of methods have been proposed for this but the choice of the level of regularization often still has to be partly subjective. Other prior information can be used to constrain the solution, such as by specifying the allowable conductivity range and defining the tissue/air boundary by some independent means, such as by an optical method. With simulated noiseless measurements, a full non-linear solution of the inverse problem has been demonstrated, resulting in recovery of simple conductivity distributions. From practical MIT measurements this has not yet proved possible, but researchers have demonstrated difference imaging, either in time or in frequency, again for simple conductivity distributions. For more realistic conductivity distributions, again in simulation, such as with a 12-tissue model of the head containing cerebral haemorrhage, an image of the lesion can be obtained. However, there is much room for improvement in image quality before the MIT method will be suitable for clinical use.