
COLIN GILMORE, University of Manitoba, Winnipeg, Manitoba, Canada
An Overview of The Electromagnetic Inverse Problem with Biomedical Applications

Electromagnetic inversion and imaging as applied to the problems associated with biomedical imaging are described and reviewed. The mathematics of the electromagnetic inverse scattering problem will be outlined, as well as the basic problems of non-linearity, ill-posedness and non-uniqueness. Different inversion methods, such as linear and non-linear optimization will be discussed.

In particular, we will consider a non-linear inversion algorithm known as the Contrast Source Inversion (CSI) method. The CSI method formulates the inversion problem as an optimization problem which allows for non-constant velocities within the biological tissue and take into account multiple scattering. While slightly more mathematically complicated than linear inversion methods, these algorithms offer the possibility of reconstructing the quantitative material parameter values, such as permittivity and conductivity, within the biological material.

Computational results for 2D breast models are presented and show that the CSI algorithm provides a promising technique for biomedical imaging.