Electrical impedance tomography with fuzzy logic classification in lung image reconstruction

ABSTRACT

Electrical Impedance Tomography (EIT) estimates the electrical impedance distribution within a medium and produces cross-sectional images of an admittivity distribution inside an electrically conducting object. EIT in biomedicine application was first applied in lung due to it being large organs that allow large conductivity changes and is a promising technique since it allows continuous monitoring of the ventilation distribution. This study aims to explore the potential EIT technique in medical applications, with strategies to enhance the image reconstruction of the lung images. Performance of the enhanced image reconstruction is analyzed through simulation on the thorax Finite Element Model (FEM) based on a thorax CT image generated using NETGEN Mesher. To integrate and simulate EIT image of the thorax model, data are obtained from the forward and inverse model. Graz consensus Reconstruction algorithm for EIT (GREIT) technique is then applied as the consensus linear reconstruction algorithm for lung EIT images. Subsequently, the involvement of 3D imaging opens the opportunity to explore more electrode placement strategies for enhancement in image reconstruction. Performance of the reconstructed images based on electrode numbers and placement strategies are analyzed using the five figures of merits and classified into poor, average and good using Fuzzy Logic (FL). From the analysis, planar-offset configuration with 16-electrodes outperforms all others while planar configuration with 16-electrodes followed closely.