2016

A review of image reconstruction methods in electrical capacitance tomography

Nombo, Josiah

J. Math. Comput. Sci.

A review of image reconstruction methods in electrical capacitance tomography

Josiah Nombo, Alfred Mwambela, Michael Kisangiri

DOI: http://scik.org

Abstract

In this paper, we review image reconstruction methods and their suitability in electrical capacitance tomography measurement system. These methods can be grouped into direct and iterative methods. Direct methods include Linear back projection, Singular value decomposition, and Tikhonov regularization. Iterative methods are further divided into algebraic and optimization methods. Algebraic reconstruction methods include iterative linear back projection, iterative Tikhonov, Landweber iteration, simultaneously algebraic reconstruction, and model$ - $based reconstruction. Optimization methods include fuzzy mathematical modeling, genetic algorithms, artificial neural networks, generalized vector sampled pattern matching, total variation regularization, regularized total least squares, extended Tikhonov regularization, simulated annealing, compressed sensing principle, population entropy, adaptive differential evolution, least$ - $squares support vector machine, and self-adaptive particle swarm optimization. Some of these methods have been examined through experiments and their comparative analysis have been given. Results show that iterative methods generate high quality images compared with non-iterative ones when evaluated over full component fraction range. However, iterative methods are computationally expensive, and hence used for research and off-line investigations rather than for on-line process monitoring.

Keywords: Electrical capacitance tomography; Inverse problem; Image reconstruction.