# Studying the Elemental Resistivity Profile of Electrical Impedance Tomography (EIT) Images to Assess the Reconstructed Image Quality

Tushar Kanti Bera and Nagaraju J.

Department of Instrumentation and Applied Physics,
Indian Institute of Science, Bangalore-560012, India
solarjnr@isu.iisc.ernet.in

**Abstract.** Studying of elemental resistivity profile of reconstructed images in Electrical Impedance Tomography (EIT) is essential to assess its image quality, reconstruction process and the systems performance. Visual assessment of the impedance images must not be accepted as the ultimate and sufficient judgment criteria for reconstruction efficiency of the tomograph. To identify the best image quality in EIT reconstruction, resistivity images are reconstructed from the simulated data using Electrical Impedance Diffuse Optical Reconstruction Software (EIDORS) and their elemental resistivity profiles are analyzed with image analyzing parameters. Results show that the image analyzing parameters are essential to assess the reconstructed images more technically, qualitatively and quantitatively.

**Keywords:** Electrical Impedance Tomography (EIT), EIDORS, Image Analysis, Image Analyzing Parameters, Impedance Images, Phantom, Resistivity Images.

## 1 Introduction

Studying of impedance reconstruction in Electrical Impedance Tomography (EIT) [1] using boundary data of phantoms [2] is essential to assess the performance of EIT systems (Fig. 1) for its validation, calibration and comparison purposes. Boundary data errors and the errors produced by reconstruction algorithm in practical EIT-systems make the reconstruction study difficult and complex in real case. Reconstruction accuracy is mainly reduced due to the poor boundary data containing a numbers errors [3], [4] contributed by phantom, surface electrodes [5], instrumentation and the data acquisition system [6]. Boundary data errors are responsible for poor image quality and incorrect reconstruction which may mislead our EIT study producing a lot of wrong information.

Insufficient image analysis method leads to incorrect information which may make our image interpretation more difficult in EIT study. Visual assessment of the impedance images must not be accepted as the ultimate and sufficient judgment criterion for image analysis in EIT reconstruction. Image blurring is

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a visual and relative characteristics of reconstructed image and is required to interpret an EIT image in some aspects but it is not sufficient for proper assessment of reconstructed images. In this context some image analysing techniques essential for assessing the reconstructed images in 2D-EIT are proposed and the corresponding image analyzing parameters are studied. Impedance images are reconstructed from simulated boundary data and the reconstructed images are analysed by image analyzing parameters. Mean Inhomogeneity Resistivity ($IR_{Mean}$), Mean Background Resistivity ($BR_{Mean}$), Contrast to Noise Ratio ($CNR$), Percentage of Contrast Recovery ($PCR$) and Diametric Resistivity Profile ($DRP$) are calculated from the elemental resistivity profile and the images are analyzed.

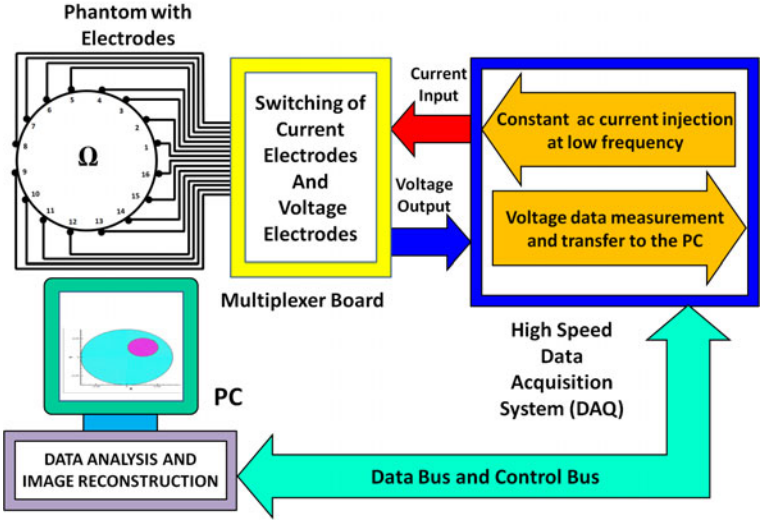


**Fig. 1.** Schematic of an EIT System

## 2 Materials and Methods

### 2.1 Boundary Data Simulation

Simulated boundary data are generated for two different phantom geometries. Phantom 1 is designed with a circular domain (150 mm diameter) containing a circular inhomogeneity (40 mm diameter) near electrode number 1. Phantom 2 is designed with a circular domain of 150 mm diameter and contains a circular inhomogeneity (60 mm diameter) near electrode number 3. For both the phantoms, the resistivity of the inhomogeneity is taken as $33\Omega$m where as the homogeneous background resistivity is set at $2.5\Omega$m. Boundary data generated for circular inhomogeneity by simulating a constant current (1 mA r.m.s.) using opposite current injection protocol [7] and the resistivity images are reconstructed using Electrical Impedance Diffuse Optical Reconstruction Software (EIDORS) [8].