An introduction of two differential excitation potentials technique in electrical capacitance tomography

Abstract

The investigation of this work is to analyse the sensitivity distributions using single and two differential excitation potentials techniques in order to improve the situation of: (1) non-uniform sensitivity distribution; (2) less sensitivity in the central area, and (3) non-linear change in the ECT (electrical capacitance tomography) system. Forward modelling using COMSOL Multiphysics is developed in order to obtain an algorithm to quantify the image reconstruction. The forward model developed is to simulate the changes incapacitance between opposing electrodes and the permittivity of the dielectric material due to the increasing of the diameter of a higher permittivity insert when two differential excitation potentials were injected. The MATLAB simulation is used to obtain the sensitivity distribution inside the closed pipe from the sensor. By using the MATLAB software, the forward model conditions are placed on the image plane to estimate the results. Generated phantoms and measured values are presented. Simulation is verified using available experimental data through the existing system, sixteen-segmented ECT sensor electrodes. By using this technique, the linear relationship between the capacitances measured and the permittivity dramatically improved, and the sensitivity distribution for an opposing electrode pair was increased; thus giving a slight increase in the sensitivity distribution in a central area. Simulation and initial experimental results illustrate the capability of the technique presented