

Sensor modeling for portable Electrical Capacitance Tomography system using simulation by COMSOL Multiphysics

Abstract

This work presents the development process for modeling a 16-segmented portable ECT (Electrical Capacitance Tomography) sensor (using FEM software package COMSOL Multiphysics). The physical sensors are 3D dimensional but it has been common to model the slice or the cross-section in 2D. This project shows the modeling approach for 2D and 3D geometries, the linear Finite Element method (FEM) using COMSOL Multiphysics is developed in order to obtain the capacitance between electrodes when an electric field is applied and to obtain the permittivity distribution inside the closed pipe from the sensor. Generated phantoms and measured values are presented for empty and annular pattern. The sensor model will be used to simulate a real sensor. Simulation is verified using phantoms with different sizes and at different locations inside the 16 electrode sensor space. Simulation and initial experimental results illustrate the capability of the system presented. Result due to increasing the size of permittivity of the dielectric material and their effect on the reconstructed image in Electrical Capacitance Tomography system are also discussed. The ECT model is representative by existing hardware, portable ECT, PROTOM Research Group UTM, Malaysia.