Electrical capacitance tomography: principles, techniques and applications

Synopsis:

Electrical capacitance tomography system is useful for obtaining information about spatial distribution of a mixture of dielectric materials inside a vessel. This study is aimed to obtain real-time monitoring of the composition of liquid mixture in conveying pipeline. ECT is a non-invasive, non-intrusive and non-destructive technique that can measure the flow level inside a pipeline. In order to increase the image resolution and produce accurate result of current tomography research, a study on 16-electrodes sensor ECT system has been developed. The developed system has the mobility to be assembled and moved from a pipeline to another. The intelligent on-board mobility sensor technique has never been applied on an ECT system, it is a new technique and investigation of the ECT system. The system however can be assembled in different diameters of pipelines, and the number of the electrodes sensors can be reduced according to the different sizes of the pipelines without the need to redesign the electrodes sensors. In order to reduce the cost of an ECT system, Universal Serial Bus technology (USB) has been used as data transfering method. The final target of a tomography system is to control process and output of the pipeline and therefore a very high speed measurement and data transferring method is required to monitor the materials that flow inside the pipeline. In this case, a high speed data processing rate for data acquisition system and a high speed data reconstruction and image display system have been developed. As a result, a microcontroller that supports full-speed USB data transfer rate has been designed as the central control unit. The reconstruction image process in the PC was written using programming platform Visual Basic 6.0. The information obtained in the PC can be reconstructed using linear back projection algorithm. In order to improve data result, iterative algorithm has been implemented in this system in order to obtain a precise image of the flow in the pipeline.