Interface detection using Electrical Resistance Tomography with a novel methodology, probe design and reconstruction algorithm.

Authorship: J. Ritson[1], K. Primrose[1], C. Qui[1].

jonathan.ritson@itoms.com [1]Industrial Tomography Systems Plc, Manchester, UK,

Abstract

Interface detection is a key process in a number of industries and research areas where often little quantitative information is known about the interface position. Alternative methods of interface detection often have their own limitations depending on the methodology, with radiation methods representing a hazard for implementation and optical/acoustic methods being unable to cope with opaque/high solid concentration systems. ERT has been successfully used in the past in both research and industrial environments for detecting interfaces between liquid/air, organic/aqueous and between supernatant liquids and suspended solids.

Previous work in using linear ERT probes has been based around simple reconstruction methods such as Linear Back Projection which can offer qualitative information on interface positions but are not specifically designed for the purpose and are therefore subject to inaccuracies. Little work has been done into changing sensor design or measurement methodology to improve interface detection so this represents a new area.

This paper presents the design of a novel probe and the implementation of a new sensing methodology to improve the quality of data produced for two phase systems. This new methodology has been used to resolve the position of interfaces in two and three phase systems and has been tested with material commonly used in industry.

A parametric reconstruction method has also been developed alongside an operation GUI. The algorithm has been optimized to find the positions of the two phases and then calculate the gradient across the zone of separation. This has been used to determine the height of an interface in a two phase system and the gradient across the interface for settling/separating systems. Results from a number of systems are presented which have applications in finding cloud height in suspensions, concentration gradients during separations and others. These applications are highly relevant to the nuclear reprocessing, petrochem, biotech and consumer product industries.

Keywords: Electrical Resistance Tomography (ERT), Sensor design, Reconstruction algorithm, interface detection, suspensions, separations

Contact Author's Information:

Name: Jonathan Ritson
Address: Speaker's House, 39, Deansgate, Manchester, M3 2BA
Phone number: +44 (0)161 838 9082
e-mail address: jonathan.ritson@itoms.com

Presenting Author's Information:

As above: Yes

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