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ULTRASONIC TOMOGRAPHY – IMAGE RECONSTRUCTION ALGORITHMS

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Abstract. *This paper focuses on image reconstruction algorithms for use in ultrasonic tomography. There are three types of algorithms namely Linear Back Projection, Hybrid Reconstruction and Hybrid Binary Reconstruction that are of interest. The algorithms have been evaluated on ultrasonic tomography system based on several known phantoms and real objects. The performance of the algorithms have been analyzed and discussed at the end of the paper. A recommendation of suitable reconstruction algorithm for liquid/gas flows has also been made at the end of the paper.*
Keywords: Reconstruction algorithm, Ultrasonic tomography, Image processing

1. **Introduction.** Most of tomographic images were derived from back projection algorithm. In order to derive this algorithm which results in the solution to the inverse problem, the forward problem must be solved first.

The forward problem determines the theoretical output of each of the sensors when the sensing area is considered to be two-dimensional. The forward problem can be solved by using the analytical solution of sensitivity maps which produces the sensitivity matrices [1]. The sensitivity distribution can be determined by calculating the ultrasonic energy attenuation at position of each receiver due to obstruction in the object space.

The inverse problem is then to determine from the system response matrix (sensitivity matrices), a complex transformation matrix for converting the measured sensor values into pixel values that is the tomogram.

Most of the work in process tomography has focused on the back projection technique. It is originally developed for the X-ray tomography and it also has the advantages of low computation cost [2]. The measurements obtained at each projected data are the attenuated sensor values due to object space in the image plane. These sensor values are then back projected by multiplying with the corresponding normalized sensitivity maps [3]. The back projected data values are smeared back across the unknown density function