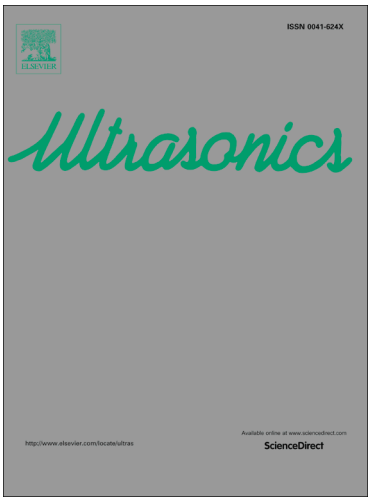

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Error Analysis of Speed of Sound Reconstruction in Ultrasound Limited Angle Transmission Tomography

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Abstract

We have investigated limited angle transmission tomography to estimate speed of sound (SOS) distributions for breast cancer detection. That requires both accurate delineations of major tissues, in this case by segmentation of prior B-mode images, and calibration of the relative positions of the opposed transducers. Experimental sensitivity evaluation of the reconstructions with respect to segmentation and calibration errors is difficult with our current system. Therefore, parametric studies of SOS errors in our bent-ray reconstructions were simulated. They included mis-segmentation of an object of interest or a nearby object, and miscalibration of relative transducer positions in 3D. Close correspondence of reconstruction accuracy was verified in the simplest case, a cylindrical object in homogeneous background with induced segmentation and calibration inaccuracies. Simulated mis-segmentation in object size and lateral location produced maximum SOS errors of 6.3% within 10 mm diameter change and 9.1% within 5 mm shift, respectively. Modest errors in assumed transducer separation produced the maximum SOS error from miscalibrations (57.3% within 5 mm shift), still, correction of this type of error can easily be achieved in the clinic. This study should aid in designing adequate transducer mounts and calibration procedures, and in specification of B-mode image quality and segmentation algorithms

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