APPROXIMATE ALGORITHM FOR THE SOLUTION OF DIRECT AND INVERSE PROBLEMS OF LASER-ULTRASOUND TOMOGRAPHY IN 1D AND 2D CASES

Diploma thesis abstract

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New approximate algorithms for the solution of direct and inverse problems of laser-ultrasound tomography for media with low deviations of acoustic impedance were developed. In one-dimensional (1D) case the possibility to excite short unipolar ultrasound pulses by optoacoustic (OA) transformation permit to create a simplified algorithm for acoustic impedance reconstruction. The substance of the algorithm is the following. The medium is separated on imaginary microscopic layers with a constant value of the impedance. The acoustic wave reflection coefficient is reconstructed layer-by-layer; the reconstruction of acoustic impedance distributions is then performed on the basis of Fresnel's formulas. Different models of stratified mediums were considered. It is show that the error of reconstruction is not accumulated from layer to layer.

In 2D case wide-band OA pulses allow to achieve in principle the advanced resolution in the imaging plain in comparison with conventional ultrasound methods. In the case of low acoustic impedance variations the reconstruction of a scattering function can be performed in Born approximation using the back-projection algorithm. Given method application for laser-ultrasound problems using focused broadband piezoreceiver antennas was substantiated. The results of numerical reconstruction of cross sections were demonstrated for different shape objects.

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