RECONSTRUCTION OF THE INTERNAL STRUCTURE OF AN OBJECT USING THE ART METHOD WITH A MULTI-REGIONAL SPHERICAL GRID MODEL

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Computational tomography is one of the tools for non-destructive testing. This approach is applicable in various fields due to its high informativeness and ability to obtain information about local characteristics of heterogeneous objects. One of the popular algorithms for processing data in computational tomography is the Algebraic Reconstruction Technique (ART) [1], which involves sequential approximation of the solution based on estimating the residual for a series of angular projections. In this process, the values of the reconstructed linear attenuation coefficient in the cells of the counting grid are changed proportionally to their contribution to the ray sum (weighting coefficient).

This paper presents a method for calculating and applying weighting coefficients for counting grids defined in polar, cylindrical, and spherical coordinates. Such an approach allows reducing the required memory volume and decreasing the computation time by calculating and storing a single weight matrix for all projections, as confirmed by the research results presented in this work. Additionally, a multi-regional model is introduced, which utilizes multi-scale counting grids with corresponding weighting coefficients. This approach enables a more detailed reconstruction of the object's regions of interest.

References

1. **Gordon, R.** Algebraic reconstruction techniques (ART) for three dimensional electron microscopy and X ray photography [Text] / R. Gordon, R. Bender, G. T. Herman // J. Theor. Biol. – P. 471–481.