

A series solution and a fast algorithm for the inversion of the spherical mean Radon transform

Leonid Kunyansky

University of Arizona, Tucson

An explicit series solution is proposed for the inversion of the spherical mean Radon transform. Such an inversion is required in problems of thermo- and photo- acoustic tomography. Closed-form inversion formulae are currently known only for the case when the centers of the integration spheres lie on a sphere surrounding the support of the unknown function, or on certain unbounded surfaces.

Our approach results in an explicit series solution for bounded measuring surfaces enclosing regions for which the eigenfunctions of the Dirichlet Laplacian are explicitly known. Such are the surfaces of a cube, finite cylinder, half-sphere, etc. The simplest measurement surface is that of a cube. For the latter case we present a fast reconstruction algorithm that reconstructs 3-D images thousands times faster than the backprojection-type methods.