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

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Abstract

An explicit series solution is proposed for the inversion of the spheri- cal 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 Lapla- cian are explicitly known. Such are the surfaces of a cube, 64257;nite cylinder, half-sphere, etc. The simplest measurement surface is that of a cube. For the latter case we present a fast reconstruction algorithm that reconsrtucts 3-D images thousands times faster than the backpro jection-type methods.