

Reconstructing a Function from its V-line Radon Transform in a Disc

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Several novel imaging modalities proposed during the last couple of years are based on a mathematical model, which uses the V-line Radon transform (VRT). This transform, sometimes also called broken-ray Radon transform, integrates a function along V-shaped piecewise linear trajectories composed of two intervals in the plane with a common endpoint. Image reconstruction problems in these modalities require inversion of the VRT.

In this work we present two different exact methods of inverting the VRT of functions supported in a disc of arbitrary radius. In both cases we use a two-dimensional restriction of VRT data, with the incident rays normal to the boundary of the disc, and a fixed breaking angle. The first inversion formula employs a connection of the ordinary Radon transform and VRT in the circular geometry of data acquisition, and requires a full data set. The second one is based on Fourier expansion techniques, and can be used even in certain cases of image reconstruction from incomplete data.