

Region-of-interest tomography from incomplete data

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Analytic two dimensional tomography aims at reconstructing a function from its line integrals, based on the exact inversion of the Radon operator. Until 2002 it was believed that no exact reconstruction was possible if any line integral was missing. Indeed, the reconstructions based on the FBP algorithm, used a non-local filter.

Surprisingly, new results were published in 2002 (see [Clackdoyle et al. 2010], for a review) demonstrating that for some particular cases of incomplete data there exist region-of-interests that could be exactly reconstructed. Since that, two main approaches - that are not equivalent - were developed: the virtual-fan-beam (VFB) approach and the differentiated-back-projection (DBP) approach. Inverse analytic formulae were established for both.

In a first part, we will present the classical approach in 2D tomography reconstruction and will introduce the incomplete data reconstruction problem. Then we will explain why and how the VBP and DBP approaches can solve some incomplete data problem. Numerical results will be shown.

[Clackdoyle et al. 2010]: R. Clackdoyle and M. Defrise, Tomographic Reconstruction in the 21st Century, Region-of-interest reconstruction from incomplete data, IEEE signal processing magazine, p. 60-80, July 2010.

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