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Inverse Problems in Applied Sciences

Practical inverse problems in Tomography

K. Joost Batenburg

Centrum Wiskunde & Informatica (CWI)

joost.batenburg@cwi.nl

Abstract:
Recent developments in X-ray scanning and electron microscopy have resulted in a wide range of new tomography problems which need to be solved by a combination of mathematics and computation. Despite the vast theoretical knowledge that is available about inverse problems in tomography, translating this knowledge into practical, robust algorithms is still a major challenge. In this lecture I will discuss obstacles and solutions involved in making advanced tomography algorithms practical.
One of the key challenges is to obtain accurate reconstructions from a limited set of measurements (a small number of projections, limited angular range, etc.). Translating numerical algorithms for such problems into into a software implementation that can be applied effectively to large experimental datasets is not straightforward, as practical data sets are often very large (fully-3D) and there impose substantial scalability requirements on the algorithms used. Moreover, a broad range of geometrical projection configurations is used in modern experiments, which must be supported by the software [1, 2].

References

[1] W.J. Palenstijn, K.J. Batenburg, and J. Sijbers, *The ASTRA tomography toolbox*, 13th International Conference on Computational and Mathematical Methods in Science and Engineering, CMMSE, (2013).

[2] W.J. Palenstijn, K.J. Batenburg, and J. Sijbers, *Performance improvements for iterative electron tomography reconstruction using graphics processing units (GPUs).*, Journal of Structural Biology, **176(2)** (2011), 250–253.