Convergence Stories of Algebraic Iterative Reconstruction

Per Christian Hansen[1]

Kaczmarz's and Cimmino's methods are examples of algebraic iterative reconstruction methods, primarily used to solve discretized inverse problems in computed tomography. They are very flexible because the underlying system $Ax = b$ requires no assumption about the scanning geometry, and it is easy to incorporate convex constraints (e.g., box constraints). Their success in computing regularized solutions is due to a mechanism called semi-convergence.

While the asymptotic convergence for noise-free data is well understood, there are surprising few theoretical results related to the convergence for real-world problems with noisy data and model errors. For the same reason, we lack efficient and robust stopping rules that terminate the iterations at the point of semi-convergence.

In this talk I will survey some recent results related to the convergence and semi-convergence of various algebraic iterative reconstruction methods, both (block) row and (block) column versions, and I will illustrate the results with numerical results.

[1] Technical University of Denmark, Department of Applied Mathematics and Computer Science
pcha@dtu.dk