Frame-Based Adaptive Strategies for Iteratively Solving Linear Ill-posed Inverse Problems

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Abstract:

In this talk we present a frame-based adaptive algorithm for approximating the generalized solution of a linear inverse and ill-posed problem. Inspired by an adaptive concept, which was suggested by R. Stevenson and designed to solve well-posed operator equations, we suggest modifications/extensions on the scheme that allow also the application to ill-posed inverse problems. The adaptivity concept applied in the scheme is based on the best N-term approximation in the coefficient space.

The structure of the adaptive algorithm suggests two possible extensions: First, stabilize the ill-posed problem via Tikhonov's method (which is known to be a regualirization method) in order to obtain a well-posed operator equation which then allows the application of the Stevenson's adaptive concept in its original form. Second, construct a stopping criterion for Stevenson's adaptive iteration such that the iteration itself becomes a regularization procedure. For both extensions of the method, regularization properties and optimality results are shown.

The applicability of the proposed regularization methods is verified by adaptively inverting the linear Radon transform.