An iterative multigrid regularization method for Toeplitz discrete ill-posed problems

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Iterative regularization multigrid methods have been successful applied to signal/image deblurring problems. When zero-Dirichlet boundary conditions are imposed the deblurring has a Toeplitz structure and it is potentially full. A crucial task of a multilevel strategy is to preserve the Toeplitz structure at the coarse levels which can be exploited to obtain fast computations. The smoother has to be an iterative regularization method. The grid transfer operator should preserve the regularization property of the smoother.

In this talk we improve the iterative multigrid method proposed in [1] introducing a wavelet soft-thresholding denoising post-smoother. Such post-smoother preserves the edges and avoids the noise amplification that is the cause of the semi-convergence of iterative regularization methods. The resulting iterative multigrid method stabilizes the iteration so that and imprecise (over) estimate of the stopping iteration does not have a deleterious effect on the computed solution.

References

[1] M. Donatelli and S. Serra Capizzano, *On the regularizing power of multigrid-type algorithms*, SIAM J. Sci. Comput., 27–6 (2006), pp. 2053–2076.