SYMMETRIZATION TECHNIQUES IN IMAGE DEBLURRING

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We present a couple of preconditioning techniques that can be used to enhance the performance of iterative regularization methods applied to image deblurring problems with a variety of point spread functions (PSFs) and boundary conditions. More precisely, we first consider the anti-identity preconditioner, which symmetrizes the coefficient matrix associated to problems with zero boundary conditions, allowing the use of MINRES as a regularization method. When considering more sophisticated boundary conditions and strongly nonsymmetric PSFs, the anti-identity preconditioner improves the performance of GMRES. We then consider both stationary and iteration-dependent regularizing circulant preconditioners that, applied in connection with the anti-identity matrix and both standard and flexible Krylov subspaces, speed up the iterations. A theoretical result about the clustering of the eigenvalues of the preconditioned matrices is proved in a special case. The results of many numerical experiments are reported to show the effectiveness of the new preconditiong techniques, including when considering the deblurring of sparse images.