Electronic Transactions on Numerical Analysis.
Volume 20, pp. 139-153, 2005.

ISSN 1068-9613.

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A NONNEGATIVELY CONSTRAINED TRUST REGION ALGORITHM FOR THE RESTORATION OF IMAGES WITH AN UNKNOWN BLUR [*]

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Abstract. We consider a large-scale optimization problem with nonnegativity constraints that arises in an application of phase diversity to astronomical imaging. We develop a cost function that incorporates information about the statistics of atmospheric turbulence, and we use Tikhonov regularization to induce stability. We introduce an efficient and easily implementable algorithm that intersperses gradient projection iterations with iterations from a well-known, unconstrained Newton/trust region method. Due to the large size of our problem and to the fact that our cost function is not convex, we approximately solve the trust region subproblem via the Steihaug-Toint truncated CG iteration. Iterations from the trust region algorithm are restricted to the inactive variables. We also present a highly effective preconditioner that dramatically speeds up the convergence of our algorithm. A numerical comparison using real data between our method and another standard large-scale, bound constrained optimization algorithm is presented.

Key words. constrained optimization, phase diversity, astronomical imaging

AMS subject classifications. 65K10, 65F22

[*]Received January 13, 2004. Accepted for publication May 9, 2005. Recommended by D. Calvetti.
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