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D. C. Sorensen* (sorensen@rice.edu), Dept. Computational and Applied Math., Rice University, 6100 S. Main, Houston, TX 77030, and **M. Rojas**. *Efficient Numerical Methods for Least-Norm Regularization*. Preliminary report.

The problem

$$\min_{\mathbf{x}} \|\mathbf{x}\|, \quad s.t. \quad \|\mathbf{b} - \mathbf{Ax}\| \leq \epsilon$$

arises in the regularization of discrete forms of ill-posed problems when an estimate of the noise level in the data is available. After deriving necessary and sufficient optimality conditions for this problem, we propose two different classes of algorithms: a factorization-based algorithm for small to medium problems, and matrix-free iterations for the large-scale case. Numerical results illustrating the performance of the methods demonstrate that both classes of algorithms are efficient, robust, and accurate. An interesting feature of our formulation is that there is no situation corresponding to the so-called hard case that occurs in the standard trust-region subproblem. Neither small singular values nor vanishing coefficients present any difficulty to solving the relevant secular equations. (Received January 20, 2010)