

A PROJECTION METHOD FOR UNDERDETERMINED LINEAR LEAST-SQUARES PROBLEMS

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In this talk, we describe a projection method for the computation of the minimal- L -norm solution of underdetermined linear least-squares problems. The method consists of an initial projection of the problem which takes into account the null space of L . A solution method that expresses the solution subspace as the direct sum of the null space of L and its orthogonal complement has been introduced in [1] for the solution of large linear discrete ill-posed problems. It has been applied in [2] coupled to the truncated SVD, and it has been employed in [3, 4] in iterative methods for solving large scale Tikhonov minimization problems with a linear regularization operator in general form. We show the reason why the method cannot be applied in conjunction with the GSVD and we propose an approach to overcome this issue. Numerical experiments demonstrate the performance of the method.

References

- [1] J. Baglama, L. Reichel, *Decomposition methods for large linear discrete ill-posed problems*, J. Comput. Appl. Math., 198 (2007), pp. 332–343.
- [2] S. Morigi, L. Reichel, F. Sgallari, *A truncated projected SVD method for linear discrete ill-posed problems*, Numer. Algorithms, 43 (2006), pp. 197–213.
- [3] M. E. Hochstenbach, L. Reichel, *An iterative method for Tikhonov regularization with a general linear regularization operator*, J. Integral Equ. Appl., 22 (2010), pp. 465–482.
- [4] Y. Park, L. Reichel, G. Rodriguez, X. Yu, *Parameter determination for Tikhonov regularization problems in general form*, J. Comput. Appl. Math., 343 (2018), pp. 12–25.