CG Versus MINRES: An Empirical Comparison

D. C.-L. Fong[1] **and M. A. Saunders**[2]

Abstract: For iterative solution of symmetric systems $Ax = b$, the conjugate gradient method (CG) is commonly used when A is positive definite, while the minimal residual method (MINRES) is typically reserved for indefinite systems. We investigate the sequence of solutions generated by each method and suggest that even if A is positive definite, MINRES may be preferable to CG if iterations are to be terminated early.

The classic symmetric positive-definite system comes from the full-rank least-squares (LS) problem $\min \|Ax - b\|$. Specialization of CG and MINRES to the associated normal equation $A^TAx = A^Tb$ leads to LSQR and LSMR respectively. We will include numerical comparisons of these two LS solvers because they motivated this retrospective study of CG versus MINRES.

[1] Institute for Computational and Mathematical Engineering
Stanford University, Stanford, CA 94305-4042, USA
clfong@stanford.edu

[2] Systems Optimization Laboratory, Department of Management Science and Engineering
Stanford University, Stanford, CA 94305-4026, USA
saunders@stanford.edu