Numerical Linear Algebra and Applications

Nonlinear least-squares problems: a regularized approach for the large scale underdetermined case

Federica Pes[a], Lothar Reichel[b], Giuseppe Rodriguez[a]

[a] Department of Mathematics and Computer Science, University of Cagliari, (Italy)
[b] Department of Mathematical Sciences, Kent State University, (USA)
federica.pes@unica.it, reichel@math.kent.edu, rodriguez@unica.it

In this work, we will describe a regularized Gauss–Newton method for the computation of the minimal-norm solution to underdetermined nonlinear least-squares problems [1, 2]. The approximate solution of the iterative method is obtained from that of Gauss–Newton by adding a correction vector, and depends on two relaxation parameters which are automatically estimated. We will focus on medium and large scale problems. In this case, the iterative method projects each linearized step in a suitable Krylov space. Numerical experiments concerning imaging science will be presented to illustrate the performance of the method.

References

[1] F. Pes, G. Rodriguez, *The minimal-norm Gauss-Newton method and some of its regularized variants*, Electron. Trans. Numer. Anal., 53 (2020), pp. 459–480.

[2] F. Pes, G. Rodriguez, *A doubly relaxed minimal-norm Gauss–Newton method for underdetermined nonlinear least-squares problems*, Appl. Numer. Math., 171 (2022), pp. 233–248.