On the spectral approximation in nonlinear least-squares problems: theoretical and computational results*

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Abstract

In this work we propose a new regularization scheme for the Gauss-Newton step based on spectral approximation of the residual Hessians. The resulting spectral regularization parameter may be seen as an adaptive choice of the Levenberg-Marquardt parameter based on already computed first-order derivatives. Furthermore, the regularized model compensates the flatness or too steep nature of the Gauss-Newton model and tries to mimic the curvature of the Newton's one along the generated directions. The local convergence analysis was established and we ensure the global convergence of the method with a nonmonotone line search strategy. Comparative numerical experiments with consolidated routines for nonlinear least-squares problems put the approach into perspective, indicating its effectiveness in two collections of problems from the literature.

Keywords. Nonlinear least squares; spectral parameter; Levenberg-Marquardt; nonmonotone line search.

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