# GAUSS–NEWTON TYPE METHOD FOR SOLVING NONLINEAR LEAST-SQUARES PROBLEMS

FEDERICA PES

Nonlinear least-squares problems have applications in many fields of science and engineering, for example, if a physical system is modeled by a nonlinear function, the unknown parameters can be estimated by fitting experimental observations by a least-squares approach. The Gauss–Newton method is a classical algorithm typically used for solving nonlinear least-squares problems. In this work, we present a Gauss–Newton type method for the computation of the minimal-norm solution, which relies on two relaxation parameters to ensure convergence. In particular, we show that the iteration of *minimal-norm Gauss–Newton method* is obtained from that of Gauss–Newton by adding a correction vector. To ensure convergence it is fundamental to control the step length for the Gauss–Newton iteration, as well as to control the step length for this correction term. When the nonlinear function is ill-conditioned, we consider some regularization techniques for the solution. Numerical experiments are presented to illustrate the performance of the algorithm. This is a joint work with Giuseppe Rodriguez [1, 2].

## References

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

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

University of Cagliari
*Email address*: federica.pes@unica.it