INTERPRETATION OF TRANSFORMED QUANTITIES OF POTENTIAL FIELDS: THE CASE OF LINEAR/NONLINEAR INVERSION

V. Paoletti*, **H. B. Bingham**, M. A. Abbas†, and M. Fedi*
Department of Mechanical Engineering
Technical University of Denmark
Lyngby, Denmark
hbb@mek.dtu.dk.

We propose an approach for the nonlinear constrained inversion of quantities derived from nonlinear transformations of potential field data. Among these quantities, the Normalized Source Strength (NSS, e.g., [1]) and the Total Gradient (TG, [2]) are always non-negative and minimally affected by the direction of the source's remanent magnetization. Our Generalized Singular Value Decomposition analysis on the NSS and TG problems shows that the inversion of quantities deriving from nonlinear transformations of potential field data by a linear algorithm introduces non-negligible errors, which make regularization necessary. Despite that, the linear inversion approach of NSS and TG is often used in the literature without investigating its theoretical and practical limits. We here employ a nonlinear iterative approach for constrained inversion of TG which leads to more reliable reconstructions of the subsurface density/magnetization distribution. The method has some similarities to the one developed by [3]. The linearization of the problem at each iteration allows monitoring the depth resolution of the inversion models and the influence of errors through monitoring tools normally used for linear problems, such as the Picard Plot.

References

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*Department of Earth, Environment and Resources Science, University of Naples Federico II, Complesso di Monte S. Angelo, Naples, Italy, email: {fedi , paoletti}@unina.it

†Geology Department, South Valley University, Qena, Egypt, e-mail: mahmoud.ahmed1@sci.svu.edu.eg