An algorithm for data inversion in electromagnetic sounding

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The purpose of this work is to detect or infer, by non destructive investigation of soil properties, inhomogeneities in the ground or the presence of particular conductive substances such as metals, minerals and other geological structures. A nonlinear model is used to describe the interaction of an electromagnetic field with the soil.

Starting from electromagnetic data collected by a ground conductivity meter (GPR), we reconstruct the electrical conductivity of the soil with respect to depth, with a regularized Gauss-Newton method. We propose an inversion method, based on the low-rank approximation of the Jacobian of the nonlinear model, which depends on a relaxation parameter and a regularization parameter chosen by automatic procedures.

We will difference two cases:

1. The first one will be the one in which we let the magnetic permeability take the same value in every layer of the soil.
2. The second one will be the one in which the magnetic permeability is different in each layer.

Then, this algorithm has been tested by numerical experiments on synthetic data sets.

References