

# Recovering the electrical conductivity of the soil via linear integral equations

Patricia Díaz de Alba<sup>1</sup>, Luisa Fermo<sup>2</sup>, Giuseppe Rodriguez<sup>2</sup>

<sup>1</sup>Department of Civil, Environmental, and Architectural Engineering, University of Cagliari, Piazza d'Armi 1, 09123 Cagliari, Italy

<sup>2</sup>Department of Mathematics and Computer Science, University of Cagliari, Viale Merello 92, 09123 Cagliari, Italy

---

## Abstract

This work investigates a linear model that involves integral equations of the first kind defined on the positive semiaxes used to describe the interaction of an electromagnetic field with the soil [3]. The aim is to detect, by non destructive investigation of soil properties, inhomogeneities in the ground as well as the presence of particular conductive substances.

To find the solution of the problem, we propose different numerical methods based on splines, Bernstein polynomials or Laguerre orthogonal polynomials combined with some suitable regularization techniques as the Truncated Singular Value Decomposition and Tikhonov regularization [1, 2].

Finally, we compare the results obtained by each method mentioned above on synthetic data sets.

---

## References

- [1] P. C. Hansen. *Rank-Deficient and Discrete Ill-Posed Problems*, SIAM, Philadelphia, 1998.
- [2] R. Kress. *Linear Integral Equation*, Springer, 1999.
- [3] J. D. McNeill. *Electromagnetic terrain conductivity measurement at low induction numbers*, Technical Report TN-6 Geonics Limited, 1980.