

# Identifying a conductive sphere by time-domain electromagnetic data via Prony-like methods

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

<sup>1</sup> Department of Mathematics, University of Salerno,  
via Giovanni Paolo II, 132 84084 Fisciano (Salerno), Italy  
`pdiazdealba@unisa.it`

<sup>2</sup> Department of Mathematics and Computer Science, University of Cagliari,  
via Ospedale 72 09124 Cagliari, Italy  
`{fermo,federica.pes,rodriguez}@unica.it`

## Abstract

We consider a homogeneous sphere with radius  $r_s$ , magnetic permeability  $\mu_s$ , and electrical conductivity  $\sigma_s$ , immersed in a uniform time-varying electromagnetic field. The impulsive response of the system can be modeled by an exponential sum of the type

$$\varphi(t) = \sum_{n=1}^{\infty} c_n e^{-d_n t},$$

whose coefficients and exponents depend on the parameters  $r_s$ ,  $\mu_s$ , and  $\sigma_s$ . Prony-like methods allow one to identify the physical parameters of the sphere, starting from time-domain electromagnetic data. In this talk, we discuss several numerical implementations of such methods and illustrate the effectiveness of the approaches through numerical experiments.

**Keywords:** Electromagnetic induction, time domain electromagnetic (TDEM) method, exponential sums, Prony-like methods,.

## References

1. Wait, J. R.: A conducting sphere in a time varying magnetic field, *Geophysics* 16(4) (1951) 666–672.
2. G. P. Deidda, P. Díaz De Alba, L. Fermo, and G. Rodriguez: Time domain electromagnetic response of a conductive and magnetic permeable sphere via exponential sums, In 21st International Conference on Computational Science and Its Applications (ICCSA), Cagliari, Italy, 13-16 Sept. 2021. DOI: 10.1109/ICCSA54496.2021.00020