# Inverse source problems in electroencephalography (EEG)

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**Résumé**

We will discuss brain source estimation issues from electroencephalography (EEG) data [1], arising in neurosciences and medical imaging. This is an inverse problem for a conductivity partial di erential equation (PDE) with source term in divergence form, of which the electrical potential is solution. Such issues arise in many physical problems related to non-destructive inspection, in particular for electromagnetic phenomena modelled by Maxwell's equations, under quasi-static assumptions. We consider classical spherical models of the head made of consecutive layers for the brain, the skull, and the scalp, each layer having a constant electrical conductivity. The conductivity PDE can then be formulated as Laplace and Laplace-Poisson equations in each layer, with appropriate transmission conditions at interfaces. EEG data are provided on part of the scalp by electrodes, as pointwise values of the electrical potential, from which an unknown pointwise dipolar source term is to be recovered inside the brain. The rst data transmission (cortical mapping) step consists in transmitting the available data from the scalp to the cortex, through the skull. The second step consists in recovering the source term supported within the brain from those transmitted data. These are ill-posed inverse problems, that need to be regularized, then algorithmically and computationaly solved. They could be formulated as best constrained approximation issues in suitable function spaces that become well-posedness (uniqueness, smoothness, stability of the solution). We then constructively solve for these issues. Numerical illustrations will be provided, from numerical and actual data, obtained from the software FindSources3D [2]. [1]] M. Clerc, J. Leblond, J.-P. Marmorat, T. Papadopoulo, Source localization in EEG using rational approximation on plane sections, Inverse Problems, 28, 055018, 2012 [2] FindSources3D, http://www-sop.inria.fr/apics/FindSources3D/

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