

Position Registration from Voltage Measurements

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Abstract

We are interested in determining the position of an electrode within a bounded homogeneous region B . Across this region we apply three orthogonal voltage potentials, and for each potential collect data corresponding to voltages at the probe. Were the fields linear, the positions of the probe could be read directly from the voltage data. Unfortunately, the unknown conductivity of the medium surrounding B induces non-linear fields, and the problem becomes an inverse problem for which the objective is to determine the probe positions and the fields.

To approach this task, we model each field as linear plus a perturbation term with a low order expansion in a known harmonic basis. We then propose and analyze an iterative algorithm to solve the problem in a least-squares sense, focusing on the behavior of the solution in the limit as the number of measurements becomes large. The method is assessed on simulated data.