A level set method for shape reconstruction in electromagnetic cross-borehole tomography

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Abstract

In geophysical applications, it is often the case that the shapes of some obstacles in the earth (e.g. pollutant plumes) have to be monitored from electromagnetic data. These problems can be considered as (ill-posed) nonlinear inverse problems, where typically iterative solution techniques and some regularization are required. Starting from some simple initial guess for the shapes, these shapes evolve during the reconstruction process in order to minimize a suitably chosen cost functional. Since the geometries of the hidden objects can be quite complicated and are not known a priori, a solution algorithm has to be able to model changes in the geometries and in the topologies of these objects during the reconstruction process reliably. We have developed a shape reconstruction algorithm which uses a level set representation for modelling the evolving shapes during the reconstructions. The algorithm, as well as the results of various numerical experiments, are discussed in the talk.