Some New Results for Shape Reconstruction in 3D Low-frequency Electromagnetic Induction Tomography Using Level Sets

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Recently the application of low-frequency electromagnetic fields has been discussed for probing geophysical test sites over distances of up to several hundred metres. This can be used for example in petroleum engineering for characterizing a reservoir, or in environmental imaging applications for tracking pollutant plumes above the ground-water table. The mathematical treatment of these problems is quite challenging since 2D approximations typically yield only very poor results, and the problems are furthermore severely ill-posed. Therefore, the problems need to be treated as fully 3Dinversion problems from relatively few data for the system of Maxwells equations. We will present and discuss some new developments for a shape reconstruction approach which is able to reconstruct in a stable way geophysical structures from few low-frequency electromagnetic data. The method is based on an artificial evolution of a level set function characterizing the unknown shapes. Numerical examples in 3D are presented for shape reconstructions from synthetically created data with different types of noise added.