Hybrid algorithm for inverse DC/AC resistivity logging measurement simulations

*M. Paszyński[1], E. Gajda-Zagórska[1], M. Smołka[1], R. Schaefer[1], D. Pardo[2]

[1]AGH University of Science and Technology, Krakow, Poland.
[2]The University of the Basque Country, UPV/EHU and Ikerbasque, Bilbao, Spain.

*Corresponding author: maciej.paszynski@AGH.EDU.PL

We present a hybrid algorithm for solving inverse 3D resistivity logging measurement simulation problem with DC and AC tools in deviated wells. The term "simulation of measurements" is widely used by the geophysical community. A quantity of interest, voltage, is measured at a receiver electrode located in the logging instrument. Computer simulations are used to explain obtained measurements. We solve the inverse problem with goal-oriented *hp* adaptive finite element method interfaced with Hierarchical Genetic Search (HGS) algorithm during a global step and Conjugated Gradient (CG) algorithm in a local step. The global search HGS algorithm generates starting points for local search CG algorithm. We conclude the presentation with numerical experiments for DC/AC problems. The HGS algorithm finds six starting points for CG algorithm with 5-11 genetic steps, and the CG algorithm converges to local minima between 12-14 iterations. Thus, the local minima can be found with 17-25 direct problem evaluations.

Keywords: inverse algorithms, resistivity logging measurement simulations, goal-oriented hp adaptive finite element method, hierarchical genetic search