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1 Nonlinear Inversion of Resistivity Sounding Data for 1-D Earth Models Using the Neighbourhood
2 Algorithm

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11
12 **Abstract**

13 To reduce ambiguity related to nonlinearities in the resistivity model-data relationships, an
14 efficient direct-search scheme employing the Neighbourhood Algorithm (NA) was implemented
15 to solve the 1-D resistivity problem. In addition to finding a range of best-fit models which are
16 more likely to be global minimums, this method investigates the entire multi-dimensional
17 model space and provides additional information about the posterior model covariance matrix,
18 marginal probability density function and an ensemble of acceptable models. This provides new
19 insights into how well the model parameters are constrained and make assessing trade-offs
20 between them possible, thus avoiding some common interpretation pitfalls. The efficacy of the
21 newly developed program is tested by inverting both synthetic (noisy and noise-free) data and
22 field data from other authors employing different inversion methods so as to provide a good
23 base for comparative performance. In all cases, the inverted model parameters were in good
24 agreement with the true and recovered model parameters from other methods and remarkably
25 correlate with the available borehole litho-log and known geology for the field dataset. The NA
26 method has proven to be useful whilst a good starting model is not available and the reduced
27 number of unknowns in the 1-D resistivity inverse problem makes it an attractive alternative to
28 the linearized methods. Hence, it is concluded that the newly developed program offers an
29 excellent complementary tool for the global inversion of the layered resistivity structure.

30 **Keywords:** Geoelectrical Sounding; Neighbourhood Algorithm; VES; Schlumberger Array;
31 Electrical Resistivity.

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