Two-Dimensional Direct Current Resistivity Forward Modelling: Finite Element Method

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ABSTRACT

The direct current resistivity method measures the Earth's resistivity by sending a direct current into the Earth and measuring the voltage of the resulting induced currents. The forward modeling routine is used to determine the induced currents from the known conductive Earth and to determine their voltage. A two-dimensional direct current resistivity forward modeling code based on the finite element method was developed. Finite element equations were formulated from Helmholz's equations in Fourier space using linear triangle elements. The solution was obtained using the Cholesky decomposition method. An empirical mixed boundary condition was used at the infinitely distant edges. At least four selected wave numbers based on Xu and others (2000) were used to invert the transform back from the Fourier space to its original Cartesian space to obtain the potential at the surface. The developed forward modeling code was tested by comparing it with the analytical results and RES2DMOD. Numerical examples showed that the developed algorithm was accurate and comparable to commercial software.

KEYWORDS : Direct current resistivity, inverse program, model-space, data- space