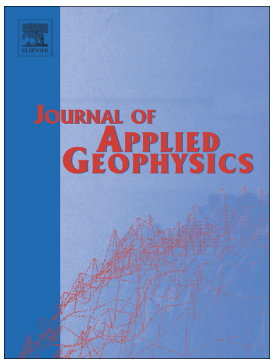

3D electrical resistivity forward modeling using the Kirchhoff's method for solving an equivalent resistor network

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3D electrical resistivity forward modeling using the Kirchhoff's method for solving an equivalent resistor network

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Abstract

There are different approaches to solve the three-dimensional (3D) resistivity model. In this research, a new modeling technique has been developed to solve 3D potential distribution in a resistor network. This method uses the Kirchhoff's law for discretizing a resistor network. This different approach for the 3D resistivity modeling helps to describe an arbitrary 3D model using a resistor network. This method has no singularity constraint, although there is no need to apply any singularity removal techniques. The resistor network can be used for any electrode configuration. The potential distributions at all nodes are simultaneously solved for each injection source. Sensitivity matrix and potential distribution in both models are compared.

Experiments with various physical models and numerical models show the similarity of the method with traditional resistivity modeling. Comparing the result of this approach with other methods shows better sensitivity away from edges. Furthermore, a parallel programming technique is used to improve the processing time. Flexibility and extensibility to build any resistivity model make this approach a powerful modeling tool in 2D and 3D electrical resistivity forward modeling.

Keywords: geophysics; geoelectric; resistivity; Kirchhoff; forward modeling