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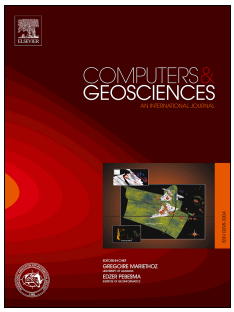

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Finite-element time-domain modeling of electromagnetic data in general dispersive medium using adaptive Padé series

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Abstract

The induced polarization (IP) method has been widely used in geophysical exploration to identify the chargeable targets such as mineral deposits. The inversion of the IP data requires modeling the IP response of 3D dispersive conductive structures. We have developed an edge-based finite-element time-domain (FETD) modeling method to simulate the electromagnetic(EM) fields in 3D dispersive medium. We solve the vector Helmholtz equation for total electric field using the edge-based finite-element method with an unstructured tetrahedral mesh. We adopt the backward propagation Euler method, which is unconditionally stable, with semi-adaptive time stepping for the time domain discretization. We use the direct solver based on a sparse LU decomposition to solve the system of equations. We consider the Cole-Cole model in order to take into account the frequency-dependent conductivity dispersion. The Cole-Cole conductivity model in frequency domain is expanded using a truncated Padé series with adaptive selection of the center frequency of the series for early and late time. This approach can significantly increase the accuracy of FETD

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