ALGEBRAIC MULTIGRID METHOD FOR 3D DC RESISTIVITY MODELLING

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Despite the seemingly ever growing power of computers, inversions of full 3D DC resistivity data are still challenging and time-consuming. Since the inversion processes are based on forward modeling, the speed up of the 3D DC resistivity modeling processes is always an interesting topic. As an iterative solver for discretized large linear equation systems, Multigrid (MG) methods are known for their high convergence rate which is independent to the number of grid nodes. However, when applied to 3D DC resistivity modeling, this attractive property may be affected by high conductivity contrasts. Algebraic Multigrid (AMG) method, based on matrix-dependent operators, can be used to retrieve this problem. The equation of continuity with mixed boundary conditions for 3D DC resistivity modelling is discretized using a standard 7-point finite difference scheme on the finest level with non-equidistant grids. Secondary potential approach is used to remove the singularities on the right-hand-side. Some forward modelling caculations are carried out with an AMG code named AMG1R5, which was made publically available in the mid-1980s. Three underground models, a three-layer model, a vertical contact model and a cubic model, are investigated. The affections of grid sizes and conductivity contrasts to the convergence rate and computational costs are under investigation. Comparing with the ICCG method, a widely used iterative method in 3D DC resistivity modeling, AMG method shows its superior performance just as expected.

Algebraic Multigrid, 3D DC resistivity modeling

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