# An efficient multigrid technique for 3D electromagnetic modeling in general anisotropic conductivity media

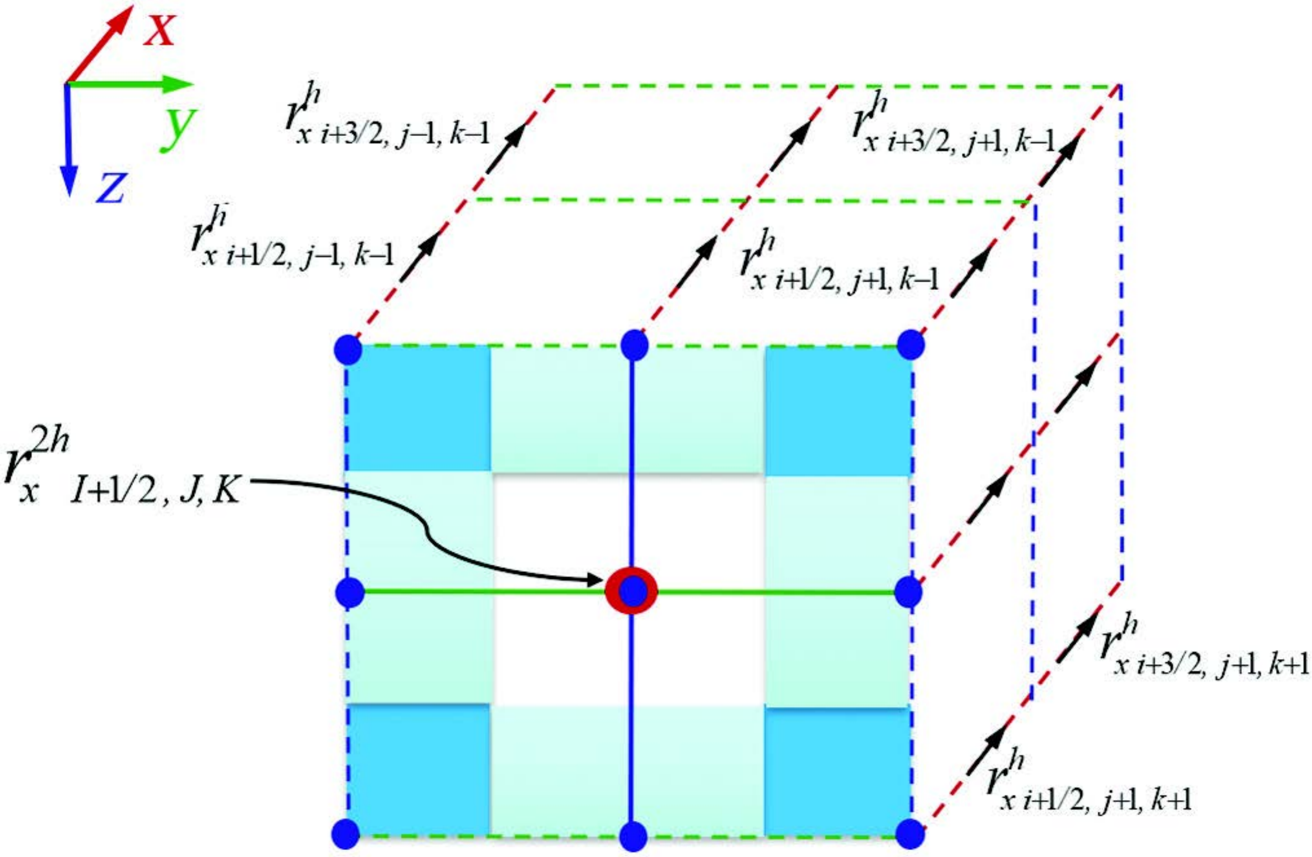
*Jian Li[1,2], Jianxin Liu[1,2], Yasuo Ogawa[3], Rongwen Guo[1,2], Yongfei Wang[1], Gangqiang Yang[1]

1. Central South University, School of Geosciences and Info-Physics, Changsha, China, 2. Central South University, Hunan Key Laboratory of Nonferrous Resources and Geological Hazards Exploration, Changsha, China, 3. Tokyo Institute of Technology, Volcanic Fluid Research Center, Tokyo, Japan

The magnetotelluric (MT) is the main method to study the electrical structure of the subsurface employing natural alternating electromagnetic fields, which has the characteristics of large penetration depth and high resolution, and is widely used in hydrocarbon exploration, geothermal investigations, ore-deposit surveys and deep structure mapping. In recent years, a large body of literature has focused on conductivity anisotropy on the earth.
MT forward modeling is an effective tool for analyzing the electromagnetic field in anisotropic conductivity media. However, the modeling of full anisotropy has not been well solved, as the boundary problem of electromagnetic fields is much more complex than that of isotropic media. As a result, the effect of conductivity anisotropy is often neglected when interpreting electromagnetic data. In order to provide a reasonable interpretation of MT data in anisotropic media, it is necessary to investigate effective modeling techniques for electromagnetic fields and to invoke the technique several times during the 3D inversion. In addition, the condition number of the coefficient matrix is worsened by the difference in conductivity and a large number of grids, which non-linearly increases the computation time of traditional iterative solvers. The Multigrid (MG) algorithm is widely used for solving electromagnetic equations due to its efficiency. However, the existing isotropic MG algorithm cannot be used directly for solving the electromagnetic field in anisotropic media.
In this paper, the original discrete grid is coarsened several times in the MG scheme. Then the linear equations are constructed under different degrees of coarsened grids. The smoothing algorithm is invoked multiple times to solve the equations, significantly improving computational efficiency.

Keywords: Magnetotelluric, Numerical modeling, Multigrid solver, Anisotropic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