三维三分量CSAMT法有限元正演模拟研究初探

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摘要　首先从麦克斯韦方程出发，用伽里金方法推导了三维三分量CSAMT法的有限元方程.在研究过程中，认识到加入散度条件的必要性，在公式中强加了散度条件，提高了解的完备性.其次将成功应用于二维线源频率域电磁法有限元模拟中的两种技术推广到三维中，一是边界条件统一采用一阶吸收边界，使线源产生的电磁波在边界上按波的传播规律被吸收，以降低平面波假设造成的影响；二是总体系数矩阵的存储，用两个二维数组分别记录总体系数矩阵的非零元素及其在总体结点编号中所处的位置，使总体系数矩阵的存储量达到最小的同时，物理意义明确，迭代求解时迅速简便.最后用均匀半空间模型进行了验证.

关键词　三维三分量,CSAMT法,有限元正演,总体系数矩阵存储,散度条件

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Preliminary study on 3D3C CSAMT method modeling using finite element method

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Abstract The finite element equation of 3D3C CSAMT electric field is derived from Maxwell equations using Galerkin method. The divergence condition is added forcedly to the electric field boundary value problem after knowing its necessity, which makes the solution correct. Two kinds of technique are extended to 3D CSAMT method modeling, which are used successfully in 2D electromagnetic modeling with line source in frequency domain. One of them is that the first order absorption border condition is applied to the outside boundary, which can avoid the error caused by plane wave assumption and by the artificial boundary of calculation area. The other is about how to store the total coefficient matrix，we design two arrays to store the total coefficient matrix with non-zero elements and the corresponding node matrix respectively, which reduce the consumption of memory, at the same time, whose meaning is simple and easy to be understood, and it is convenient to solve FEM equations set by using iteration method. At last the theory is tested by the response of half homogeneous space model.

Key words 3D3C   CSAMT method   finite element modeling   storing the total coefficient matrix divergence condition

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