

水平层状介质中基于DTA的三维电磁波逆散射快速模拟算法

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摘要 为提高水平层状介质中三维电磁波散射和逆散射数值模拟的效率,在对角张量近似(DTA)的基础上根据不同回代方式得到了求解积分方程的DTA1和DTA2两种近似. 这两种近似可以作为计算积分方程稳定型双共轭梯度快速Fourier变换(BCGS-FFT)算法的初始猜测值和预条件因子, 从而形成效率更高的混合DTA-BCGS算法. 散射实例说明了DTA2的高精度和混合DTA-BCGS算法尤其是混合DTA2-BCGS算法的高效率. 由于DTA2近似程度更高, 将DTA2与变型Born迭代反演方法(DBIM)相结合形成了一种对三维异常体进行重构的快速电磁波逆散射技术. 文中的逆散射实例说明所开发的逆散射技术对重构水平层状介质中的任意三维异常体是非常有效的.

关键词 [积分方程](#), [对角张量近似\(DTA\)](#), [稳定型双共轭梯度](#), [快速Fourier变换](#), [水平层状介质](#), [逆散射](#), [变型Born迭代方法\(DBIM\)](#)

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Fast algorithm for simulating 3-D electromagnetic inverse scattering in horizontally stratified medium via DTA

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**Abstract** Two kinds of approximations called DTA1 and DTA2 for integral equations are obtained according to different back substituting method on the basis of diagonal tensor approximation (DTA) in order to improve the efficiency for simulating 3-D electromagnetic scattering and inverse scattering in horizontally stratified medium. The approximations can be used as the initial guess and pre-conditioner in the stabilized biconjugate-gradient fast Fourier transform (BCGS-FFT) algorithm for computing integral equations, and hence a hybrid DTA-BCGS algorithm with higher efficiency is formed. Numerical scattering examples have shown the high accuracy of DTA2 and the high efficiency of hybrid DTA-BCGS algorithm, especially of hybrid DTA2-BCGS. Since DTA2 has a much higher accuracy, it is combined with distorted Born iterative inversion method (DBIM) and a fast electromagnetic inverse scattering technique is formed to reconstruct 3-D inhomogeneous objects. Numerical inverse scattering examples have demonstrated the efficiency of the inverse scattering technique in reconstructing arbitrary 3-D inhomogeneous objects in horizontally stratified medium.

**Key words** [Integral equations](#) [Diagonal tensor approximation \(DTA\)](#) [Stabilized biconjugate-gradient](#) [Fast Fourier transform](#) [Horizontally stratified medium](#) [Inverse scattering](#) [Distorted Born iterative method \(DBIM\)](#)

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