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利用积分方程的加速迭代算法计算随钻电磁波电阻率测量仪器的响应

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摘要 采用改进型逐次逼近解法(MSAM)和Aitken加速技术相结合的迭代算法计算二维积分方程.该算法将纵向成层原状地层作为背景地层，将计算区域限制在井眼和侵入带内，具有未知量数目少、收敛速度快、计算精度高的优点.利用该算法对随钻电磁波电阻率测量仪器在轴对称二维地层中的响应进行数值模拟.模拟结果显示，幅度衰减曲线和相位移曲线受井眼、侵入和围岩的影响程度不同，二者径向探测深度和垂向分辨率也有差异，利用补偿后的幅度衰减电阻率曲线和相位移电阻率曲线交叉点的坐标可精确确定地层层界面位置.

关键词 积分方程 电磁波电阻率 随钻测量 改进型逐次逼近解法 Aitken加速技术

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Computing electromagnetic wave resistivity MWD tool's response using accelerated iteration algorithm for integral equations

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Abstract The 2D integral equations are computed by an integrated iteration algorithm of modified successive approximation method (MSAM) and Aitken acceleration technique. The longitudinally stratified virgin formation is taken as the background and the computational region is restricted within the borehole and invasion zone in the algorithm, thus the algorithm is qualified for the virtues of small number of unknowns, fast converging speed and high accuracy. The response of the electromagnetic wave resistivity MWD tool in cylindrically symmetrical 2D formation is simulated by the algorithm. The results have shown that the amplitude attenuation and phase shift are affected differently by the borehole, invasion and surrounding shale, and that their radial depth of investigation and vertical resolution are also different. The bed boundary can be accurately located by the crossover point of the compensated amplitude attenuation and phase shift resistivities.

Key words Integral equations; Electromagnetic wave resistivity; Measurement-while-drilling (MWD); Modified successive approximation method (MSAM); Aitken acceleration technique

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