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正交水平磁偶源的电磁场分布规律

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The electromagnetic field distribution generated from the orthogonal horizontal magnetic dipole source

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摘要 正交水平磁偶源是模拟天然场源的较好人工源,可以方便地实现可控源高频大地电磁张量测量.正交水平磁偶源的电磁场分布规律是野外工作布置的理论基础,为此计算了均匀大地模型正交水平磁偶源的电磁场.计算结果表明:电磁场水平分量在各个象限都有一相对低值带,对应的标量视电阻率形成了畸变带,但张量视电阻率畸变带消失;张量视电阻率曲线形态显示出近区的低阻、过渡区的高阻隆起和远区趋于真值的规律.通过野外试验验证理论计算结果,在无法准确确定地下介质电阻率参数的情况下,以天然电磁场计算的电阻率为参照对比研究了正交水平磁偶源电磁场的分布规律.试验结果表明:正交水平磁偶源与电偶源的电磁场同样的存在近区、过渡区和远区;在远区,正交水平磁偶源与测点的相对位置对张量测量结果几乎没有影响,即在远区可以在任何方位测量;正交水平磁偶源的布置要考虑收发距的影响,保证测量在远区进行.

关键词: 正交水平磁偶源 张量测量 张量视电阻率 浅层勘探

Abstract: The orthogonal horizontal magnetic dipole source simulates the natural electromagnetic field well, it conveniently realizes the tensor survey of controlled electromagnetic source in a high frequency band. The field distribution of orthogonal horizontal magnetic dipole source in homogeneous isotropic medium is computed. The result indicates that the horizontal components of the electromagnetic field show a belt of relatively low value in each quadrant, the scalar apparent resistivity shows a distortion belt in the same position, while the tensor apparent resistivity doesn't show distortion belt; The tensor apparent resistivity is low in the near zone and high in the transition region, and tends to the true value in the far zone. Field experiment was carried out to confirm the numerical result. As the true resistivity of test location is unknown, the test result of orthogonal horizontal magnetic dipole source is contrasted to that of the natural electromagnetic field. The result shows that, similar to the electric dipole source, the field of orthogonal horizontal magnetic dipole source also has a near zone, a transition zone, and a far zone. In the far zone, the relative distance of the source and survey station has no effect on the measurement result, namely, in the far zone measurement can be done in any azimuth. So the influence of separation should be considered to ensure that the measuring is in the far zone.

Keywords: Orthogonal horizontal magnetic dipole source Tensor measurement Tensor apparent resistivity Shallow exploration

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