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基于遗传算法的CSAMT最小构造反演

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摘要　利用遗传算法进行不考虑近场校正的全场资料CSAMT反演研究.遗传算法属于全局最优化方法，具有对初始模型依赖小，不易陷入局部极值的优点，然而，当未知数较多时，多解性仍是该方法的瓶颈.为了减小多层反演的多解性，在反演中引入最小构造约束，针对CSAMT的遗传算法反演问题定义了最小构造目标函数，经过模型试验找到了其具体表达式，并找到了适合CSAMT资料反演的拉格朗日乘子的最佳取值μ=0.5，实现了基于遗传算法的CSAMT最小构造反演.利用H、A、K、Q和HKH、KHA模型对方法进行了数值试验，在无噪和加入10％噪声情况下，反演结果与模型一致；加入20％噪声后，反演仍取得良好结果，与理论模型基本吻合.将该方法用于水平层状地层和横向变化地层的实测资料反演，结果与地质资料吻合.不同的计算实例表明了该方法的有效性.

关键词　可控源音频大地电磁法　遗传算法　最小构造反演　拟合

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The application of Genetic Algorithm to CSAMT inversion for minimum structure

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Abstract We apply Genetic Algorithm to invert CSAMT data. Here, we invert both apparent resistivity and phase data which contain the near-field, transition zone field and the far-field without any correction. Genetic Algorithm is one kind of global optimization method with less dependence on initial model and more ability to find the best solution, but when the unknowns are too many then the non-uniqueness of solution is still a problem. When we use a multi-layer model in the inversion CSAMT does not yield a unique solution. In order to reduce the temptation to over interpret the data and to eliminate arbitrary discontinuities in simple layered models, we employ minimum structure to constrain the inversion result. We have defined minimum structure function for the CSAMT inversion based on genetic algorithm, and have found the optimal value of the Lagrange multiplier μ=0.5. The designed models are H, A, K, Q and HKH, KHA. When the data is without noise or with 10% noise, the resulting resistivity models fit the true models well. When the data contains 20% noise, the inversion result is also good. The method has been used for field data processing, the result was good. Both synthetic and field data examples indicate that the method is effective.

Key words CSAMT; Genetic Algorithm; Minimum structure inversion; Fitting

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