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基于遗传算法的大地电磁阻抗张量分解方法研究

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An improved GB decomposition method based on genetic algorithm

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摘要 本文针对Groom-Bailey分解法在消除地表电性不均匀体对MT数据的畸变效应时存在的问题引入遗传算法,对基于传统线性最优化方法的GB分解算法进行改进,提出基于遗传算法的大地电磁阻抗张量分解方法.通过对理论合成数据以及三维/二维模型正演数据的分解试验,并且对青藏高原北缘阿尔金断裂地区实际MT数据进行分解处理,证明了基于遗传算法的GB分解能够更加有效地校正三维/二维情况下近地表三维电性不均匀体所造成的畸变影响.最后,在已有算法基础上,研究了基于遗传算法的多频率GB分解算法和MT数据静校正算法,并通过实际MT数据的处理证明了这些算法的有效性.

关键词 大地电磁, 阻抗张量, 地质构造走向, GB分解, 遗传算法, 多点多频, 静校正

Abstract: The galvanic distortion analysis approach advocated by Groom and Bailey has become the most adopted method. As proposed by Groom and Bailey,one must determine the appropriate frequency-independent telluric distortion parameters and geoelectrical strike direction by fitting the seven-parameter model on a frequency-by-frequency and site-by-site basis independently. Although this approach has the attraction that one gains a more intimate understanding of the data set,it is rather easy to be tapped into a local minimum before reaching the global minimum by using a traditional optimization methods (e.g. Least square method or Gauss Newton method) when conducting the repetitive application. In this paper,we improved GB decomposition method by Genetic Algorithm firstly,then tested the reliability of this new GB decomposition method by decomposing the synthetic data and data generated by forward modeling. Lastly,we applied it into the studying of the structure strike of an area in Northern Qinghai Tibetan Plateau and obtained results consistent with the results of previous geological and geophysical work. What's more, multifrequency GB decomposition and MT static shift correction method have also been studied and their validity has been verified by practical MT data test.

Keywords Magnetotelluric sounding, Impedance tensor, Geoelectrical strike direction, GB decomposition method, Genetic algorithm, Multi-frequency, Static shift

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