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## 数学形态滤波与大地电磁噪声压制

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Mathematical morphology filtering and noise suppression of magnetotelluric sounding data

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摘要

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**摘要** 数学形态滤波是一种新型的非线性滤波方法.介绍了形态学滤波的基本原理,针对大地电磁信号表现出的非线性、非平稳性和非最小相位特性,综合结构元素特征我们提出一种基于数学形态滤波的大地电磁噪声压制方法.为了有效抑制目标信号中的噪声干扰及修正统计偏倚现象,通过选用合理的结构元素及形态开-闭、闭-开组合,将正、负结构元素级联构造组合广义形态滤波器对实测大地电磁信号进行噪声压制.实验结果表明,该方法是切实可行的,有效地剔除了大尺度干扰及基线漂移,较好地还原了大地电磁信号的原始特征,修正了标准形态算子所产生的统计偏倚现象,去噪精度高.该方法计算速度快,具有潜在优势,为矿集区海量大地电磁信号与强干扰的分离提供了一条新的途径,应用前景广阔.

**关键词** 数学形态滤波, 结构元素, 非线性滤波, 大地电磁, 噪声压制

**Abstract:** Mathematical morphology filtering is a new non-linear filtering method. The basic principle of morphology filtering was introduced in this paper. Considering that magnetotelluric signals are non-linear, non-stationary, and non-minimum phase and taking into account the properties of structuring elements, we proposed a new method based on mathematical morphology filtering for noise suppression of magnetotelluric sounding data. In order to effectively suppress the noise interference of target signal and correct for statistical dominance phenomenon, we chose reasonable structuring elements and the combination of morphological open-closing and close-opening to construct the combination generalized morphology filtering. The filtering is composed of cascade positive and negative structuring elements, and its purpose is to suppress noise of actual magnetotelluric sounding data. Experimental results indicate that the proposed method is feasible and can effectively eliminate larger scale disturbance and baseline drift of magnetotelluric. In addition, the proposed method can better restore the original features of magnetotelluric, amend the statistical dominance phenomenon produced by standard morphological operators, and has better precision. The method is faster and has potential advantages, which provides a new way for massive magnetotelluric signal and strong interference separation in ore district, moreover, it has broad application prospects.

**Keywords** Mathematical morphology filtering, Structuring element, Non-linear filtering, Magnetotelluric sounding, Noise suppression

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