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位场垂向梯度最佳自比值的边界检测技术

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Edge detection in potential fields using optimal auto-ratio of vertical gradient

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摘要

位场梯度换算在地质体边界检测中有着重要的应用.但传统的梯度算法易受干扰影响,计算稳定性差,且很难在复杂的叠加异常中识别出小型地质体的边界.鉴于此,本文给出了自比值的定义,提出了能够处理高阶导数的位场垂向梯度最佳自比值的边界检测方法,阐述了方法的数学含义和物理意义.模型试验表明,垂向梯度最佳自比值算法不仅计算稳定性强,而且能清晰地检测出传统梯度算法无法检测的模型体边界.在地质条件复杂的鸭绿江盆地的重力异常实例应用中,垂向三阶导数最佳自比值计算结果识别出的构造边界与实际地质体分布有着较好的对应关系,这不但与前人的工作成果互为佐证,而且自比值圈定的负异常分布区能较好地反映出浑江煤田的工作范围.

关键词   梯度算法,   边界检测,   噪声干扰,   垂向梯度,   最佳自比值

Abstract：

Derivative calculation of potential-field is widely used in edge detection of geologic bodies. However, the traditional gradient methods are susceptible to noise disturbance, and lead to the unstability of the results. Besides, the edges of small-sized geologic bodies are difficult to be detected because of superimposed anomaly. In this paper, we give the definition of auto-ratio and present a new method for edge detection by using optimal auto-ratio of vertical derivative, and elaborate mathematical implication and physical meaning of this method. Model test shows that optimal auto-ratio of vertical gradient has the ability to strongly suppress noise disturbance and can accurately detect the edges of geologic bodies which cannot be recognized by traditional edge detection methods. In application, we choose gravity anomaly of Yalujiang basin whose geological conditions are very complex to test the optimal auto-ratio method. It is shown that the optimal auto-ratio of third-order vertical derivative recognizes tectonic boundaries which have good correspondence with distribution characteristics of geologic bodies. The result is a case in point verifying former research results, and the auto-ratio delineates negative gravity anomaly zones which can preferably reflect the work area of Hunjiang coalfield.

Keywords Gradient algorithm,   Edge detection,   Noise disturbance,   Vertical gradient,   Optimal auto-ratio

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