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正则化偏移成像的全局优化快速算法

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A fast global optimization algorithm for regularized migration imaging

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摘要 目前,偏移后的地震剖面往往只是一个地质构造图像,还不能为后续的岩性分析和油气储层属性的提取提供更精确的信息.为了得到高分辨率真振幅的图像,建议采用正则化偏移成像方法.针对本问题数据规模大和正演算子矩阵稀疏的特点,提出采用一种新的算法——无记忆拟牛顿-模拟退火法对偏移算子方程进行求解.该方法综合了无记忆拟牛顿法优良的局部搜索能力以及模拟退火法的全局最优性质.用该方法得到的全局最优解不仅成像位置正确,还能提供更准确的振幅及其他属性信息.通过理论模型试算和实际资料处理,表明在正演算子准确的情况下,该方法能减弱Kirchhoff偏移的假象,得出接近真实的反射系数分布.因此,该方法在地震成像方面是有实际应用前景的.

关键词: 偏移 正则化 无记忆拟牛顿法 模拟退火法

Abstract: At the present, seismic migration usually only yields an image of the positions of geological structures, and it cannot supply more accurate information for subsequent lithology analysis and attributes extraction. To get an image with high resolution and true amplitude, we suggest that regularized migration imaging should be used. Since the amount of cost for solving the problem is huge and the kernel matrix is sparse, we propose a new hybrid algorithm which is called Memoryless Quasi-Newton-Simulated Annealing Method. The algorithm not only shows as good performance in searching a local optimized solution as memoryless quasi-Newton method does, but also reaches the global optimized solution just as simulated annealing algorithm does. The global optimized solution obtained by this method not only gets the right positions, but also contains more reliable information for amplitude and other attributes. Theoretic simulations and field data applications are performed. It reveals that the proposed algorithm can attenuate the migration artifacts and provide a better frequency distribution of estimated reflectivity when a proper seismic modeling operator is constructed. Therefore, the proposed algorithm is very promising for seismic imaging.

Keywords: Migration Regularization Memoryless Quasi-Newton method Simulated annealing algorithm

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