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# 基于Dreamlet变换的地震数据压缩理论与方法

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## Dreamlet compression of seismic data

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摘要 为达到更加有效地表示地震数据的目的,仅仅将地震数据当作普通的图像数据处理是远远不够的,地震数据中蕴含的地震波的运动学特性也应作为重要因素而被考虑到.本文讨论了利用Dreamlet变换方法实现地震数据压缩的方法,并针对地震数据本身所蕴含的频散关系特性进一步提出了多尺度Dreamlet变换压缩方法.Dreamlet变换由2个一维局部谐波变换的张量积构成,它在提供地震波场时间-空间局部化性质的同时可以保留波场的运动学特性.通过对二维SEG/EAGE叠前、叠后数据的算例说明了Dreamlet变换用于地震数据压缩的有效性.利用压缩后的数据进行成像的结果更表明,与Curvelet变换方法相比,Dreamlet与多尺度Dreamlet方法可以提供更高的压缩比;在相同压缩比的条件下,使用Dreamlet与多尺度Dreamlet方法压缩重建后的数据进行成像能更好地保留成像结果中的重要结构.

关键词 Dreamlet变换, 局部谐和基, 数据压缩, 偏移成像, Curvelet变换

Abstract: For sparse representation of seismic data, simply treating the seismic data as picture is not enough, considering the physical feature of the seismic data in the procedure is needed as well. In this paper, we first study the seismic data sparse representation using the Dreamlet transform. Combining with the dispersion relationship, we then extend the Dreamlet transform to a multi-scale version. The Dreamlet transform is the tensor product of two 1D local harmonic transforms, which can preserve the wave properties in seismic data while providing local information in both time and space domain. 2D SEG-EAGE salt model synthetic poststack and prestack data sets are used to demonstrate the validity of both the Dreamlet transform methods. Using the reconstructed data for migration, we can still obtain a high quality image of the sub-salt structure in 2D SEG-EAGE salt model. Meanwhile, numerical tests on 2D SEG-EAGE salt model synthetic prestack data show the potential in propagating the wavefield and imaging directly and efficiently in the Dreamlet domain. The Dreamlet method can outperform the Curvelet method especially for high compression ratios.

Keywords Dreamlet transform, Local harmonic basis, Data compression, Migration imaging, Curvelet transform

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