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高阶seislet变换及其在随机噪声消除中的应用

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High-order seislet transform and its application of random noise attenuation

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摘要 Seislet变换是一种小波类数学变换方法，主要根据不同小波级数上地震同相轴的局部倾角的不同来分析数据·一般意义上，测线方向上的离散小波变换（DWT）是一种特殊的零局部地震倾角的seislet变换·早期的工作基于低阶版本的离散小波变换来构建seislet变换，在本文中，通过使用Cohen-Daubechies-Feauveau (CDF) 9/7双正交小波变换（常用于JPEG2000压缩标准）作为框架，扩展高阶seislet变换方法·通过分析理论模型和实际数据的处理结果，并对比傅里叶变换、离散小波变换和低阶seislet变换，高阶seislet变换可以为地震数据提供更好的压缩比·因此更加适用于地震数据去噪处理·

关键词 高阶seislet变换， 随机噪声， 局部地震倾角， 双正交小波变换， 压缩比

Abstract：The seislet transform is a wavelet-like transform that analyzes seismic data by following variable slopes of seismic events across different scales. It generalizes the discrete wavelet transform (DWT) in the sense that DWT in the lateral direction is simply the seislet transform with zero slopes. An earlier work used low-order versions of DWT to construct the seislet transform. In this work, we extend this approach to a higher order, using the Cohen-Daubechies-Feauveau 9/7 biorthogonal wavelet transform   (the   basis for the JPEG2000 compression scheme) as a template. Using synthetic and field-data examples, we demonstrate that the new transform can provide a better compression rate for seismic events than the Fourier transform, DWT, or the low-order seislet transform. Therefore, the high-order seislet transform can be more suitable for data processing tasks such as data regularization and noise attenuation.

Keywords High-order seislet transform, Random noise, Seismic local slopes, Biorthogonal wavelet transform, Compression ratio

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