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非稳态地震稀疏反褶积

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A nonstationary perspective on sparse deconvolution

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摘要 尽管稀疏反褶积在一定程度上避免了白噪反射系数序列的假设,还可以带来相位上的改进与调整,但却忽略了由大地滤波作用所造成的地震信号非稳态特征。在融合非稳态反褶积与稀疏反褶积各自优势的基础上,本文提出了一种实现非稳态稀疏反褶积的技术思路,即利用非稳态反褶积在对数时—频域实现地震信号非稳态特征的分析与校正,在此基础上利用稀疏反褶积求解反射系数与地震子波。在实际应用中,以海上叠后地震资料为基础,利用基于柯西约束的非稳态稀疏反褶积分别在单一地震道、简单地层以及构造相对复杂储层段估算地震子波与反射系数,结果表明该方法能获得更加丰富的反射系数信息,增强了原本微弱的反射,改善了地震资料的横向连续性。

关键词: 稀疏反褶积 Gabor反褶积 非稳态 柯西约束

Abstract: Due to the application of specific reflectivity assumptions, sparse deconvolution thus avoids the limitations of the traditional white-reflectivity, and could also bring about phase adjustments and improvements. However, this technique at present is not quite qualified to dealing with the intrinsic nonstationarity of seismic signal, which is caused by earth filtering. For this reason, this paper proposes a nonstationary sparse deconvolution method by incorporating advantages of Gabor deconvolution and sparse deconvolution. In this method, Gabor deconvolution is applied to analyze and compensate the nonstationarity in log spectra while sparse deconvolution is for a better solution of reflectivity and wavelet. Based on a marine poststack dataset, we separately apply the nonstationary sparse deconvolution with Cauchy constraint on a single trace, a simple section and the reef section with complex structures. Results show that nonstationary sparse deconvolution can greatly enrich obtained reflectivity information and enhance weak components. Meanwhile, the lateral continuity is also improved.

Keywords: sparse deconvolution Gabor deconvolution nonstationary Cauchy constraint

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