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基于迭代去噪的多源地震混合采集数据分离

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Separation of multi-source blended seismic acquisition data by iterative denoising

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摘要

多源地震混合采集采用随机线性编码方式同时激发多个震源,检波器连续接收地震信号,获得波场混叠的炮记录.该采集技术能够显著提升采集效率和成像质量,其实现关键在于炮分离,即将相互混叠的多源波场数据彼此分离,获得传统采集的单炮记录.最小平方算法只能得到伪分离记录,不能去除混叠噪声.在高混合度的混叠数据中,混叠噪声的能量往往数倍于有效信号,炮分离难度倍增.但在伪分离记录中,该噪声在除共炮点道集以外的其它时域均为随机分布.本文研究提出了一种多时域组合迭代去噪的炮分离技术:通过运用多级中值滤波与Curvelet阈值迭代去噪算法,在不同时域根据混叠噪声特性采用相应的去噪手段,并设计迭代算法优化炮分离结果.实际资料处理结果证明:将本方法应用于高混合度的混叠数据,无论是分离质量还是计算效率,都有明显提升.

关键词 多源地震混合采集, 混叠数据, 混叠噪声, 混合度, 炮分离, 多级中值滤波

Abstract：

In multi-source blended seismic acquisition, different sources are shot in an overlapping fashion with certain time delays and blended records are acquired, so that both acquisition efficiency and image quality can be significantly improved. Deblending is the procedure of recovering data as if they were acquired in the conventional survey. A simple least-squares procedure is only able to get pseudodeblend results, where the blending noises cannot be removed. In high blending factor data, the blending noises are usually several times higher than the useful signals, which multiply the difficulty of source separation. Fortunately in pseudodeblend records, these noises are only coherent in the common source domain, but incoherent in other domains. For this character, multilevel median filter and Curvelet threshold iteration denoising are jointly used in this paper, and a new source separation method based on the iterative denoising in different domains is introduced. Depending on the different character of blending noises in different domains, corresponding denoising method is utilized, and an iteration method is designed for the optimization. While dealing with numerical blended real dataset, ideal results could be produced after only a few iterations, which verify that our method can largely improve the separation quality and calculation efficiency.

Keywords Multi-source blended seismic acquisition, Blended data, Blending noise, Blending factor, Deblending, Multilevel median filter

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