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一种边缘保持的地震数据插值方法

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An edge-preserving seismic data interpolation method

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摘要 在地震数据处理中,地震数据插值方法常常用来解决地震数据空间采样率低和不规则的问题.本文提出了一种基于边缘保持滤波器的地震数据插值方法.在该方法中,对于一个1D信号,逐点滑动一个处理窗口,将信号分成多个信号片段.对于某一个待恢复的缺失采样点,存在多个包含(或邻近)该采样点的信号片段可以用来估计它.采用多项式来拟合这些信号片段,并选择拟合误差最小的信号片段估计此缺失采样点,达到边缘保持的目的.对于2D地震信号,先沿不同方向扫描抽取1D信号,然后采用上述1D边缘保持插值算法分别进行处理,得到沿不同方向的插值结果.对于任一待插值采样点,选取对应拟合误差最小的方向的插值结果作为最后输出的2D数据的插值结果.理论模型和实际资料的处理结果表明,所提方法具有保边缘、抗假频及能够进行不规则数据重建等特点,既能有效的实现不规则地震数据的重建,又能很好的保持原有数据的边缘特征.

关键词 插值, 不规则地震数据, 边缘保持, 最小拟合误差, 抗假频

Abstract： In seismic processing, the problems of low or irregular space sampling are solved by seismic interpolation techniques. In this paper, we propose an edge-preserving seismic interpolation method. For a 1D signal, many signal segments are extracted by a processing window sliding along the signal sequence. For one missing data sample, there are a lot of signal segments, including or closing to it, which can be used to recover it. These signal segments are approximated by polynomials, in order to preserve the edges, the one with the minimum fitting error is used to estimate the missing data sample. For 2D seismic data, a lot of 1D signals are extracted along a specified direction firstly, and then an interpolation result is obtained by applying above 1D edge-preserving interpolation method on all these 1D signals. For one possible direction, one interpolation result is achieved. For one missing data sample in this 2D data, among the above interpolation results, the one with the minimum fitting error is selected as the final output. Applications with synthetic and real data sets show that the proposed method is edge-preserving, anti-aliasing, and can be used to reconstruct irregular seismic data effectively.

Keywords Interpolation, Irregular seismic data, Edge-preserving, Minimum fitting error, Anti-aliasing

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