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分形插值地震数据重建方法研究

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摘要 对分形插值方法作了较详细的探讨，给出了分形插值函数的显式表达方式，同时给出了垂直比例因子的局部显式表达式，旨在提高地震道插值重建的精度及突出局部信息，并从单道地震图的角度分析其在地震道插值重建中的应用效果.利用该方法对理论模型和济阳坳陷实际地震台站资料进行了重建处理，结果表明，分形插值重建的地震道是原始地震道的良好近似，缺失道的振幅和相位都得到了很好的恢复.该法克服了随机分形插值方法必须进行多步迭代的弱点，提高了计算效率.通过对单道地震图插值重建结果的分析，说明了本文分形插值方法具有较高的精度和较高的效率，有深入研究的潜力.本文提出的显式分形插值方法既能够突出地震道数据的局部信息，又较好地保持了地震道数据的总体变化趋势.

关键词 迭代函数系统 仿射变换 显式分形插值 垂直比例因子 地震数据重建

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Seismic data reconstruction with fractal interpolation

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Abstract In order to improve the accuracy of the reconstructed seismic data, this paper makes a detailed investigation into the fractal interpolation method on the basis of the former work, and analyzes theoretically a special kind of fractal interpolation function. The explicit presentation of the fractal interpolation function is applied and the locally explicit expression for the vertical scaling factors has been put forward. At the same time the interpolating accuracy has been investigated from the point of accordingly seismic traces. The influence of the vertical scaling factors to the precision of the fractal interpolation has been investigated. The numerical experiments demonstrate that the interpolating residual is in proportion to the exponent function with increasing vertical scaling factors. This explicit fractal interpolation method avoids the iteration that is inevitable in traditional interpolation method, and then it improves the computational efficiency. By analyzing the theoretical seismograms and the reconstructed seismograms and the differences between them, the numerical results demonstrate that the fractal interpolation method put forward here has high accuracy and efficiency, the most node error is no more than 3% with respect to the numerical computation. The method not only makes the local information obvious but also preserves the overall characteristics well of the data investigated.

Key words Iterated Function Systems (IFS);Affine transform;Explicit fractal interpolation;Vertical scaling factors;Seismic data reconstruction

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