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POCS联合改进的Jitter采样理论曲波域地震数据重建

王本锋[1,2], 陈小宏[1,2], 李景叶[1,2], 张华[1,3]

1. 中国石油大学(北京)油气资源与探测国家重点实验室, 北京 102249;
2. 中国石油大学(北京)海洋石油勘探国家工程实验室, 北京 102249;
3. 东华理工大学放射性地质与勘探技术国防重点学科实验室, 江西抚州 344000

Seismic data reconstruction based on POCS and improved Jittered sampling in the curvelet domain

Wang Benfeng[1,2], Chen Xiaohong[1,2], Li Jingye[1,2], Zhang Hua[1,3]

1. State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum(Beijing), Beijing 102249, China;
2. National Engineering Laboratory for Offshore Oil Exploration, China University of Petroleum(Beijing), Beijing 102249, China;
3. Key Laboratory of Fundamental Science on Radioactive Geology and Exploration Technology, East China Institute of Technology, Fuzhou, Jiangxi 344000, China

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摘要 由于采集条件的限制及后续处理中废炮废道的剔除,使得地震数据成为不完整数据体,这将影响后续地震资料的处理及反演,因此有必要进行地震数据重建。本文结合曲波变换和凸集投影(POCS)方法对不规则地震数据进行重建:对比分析不同阈值模型对二维地震数据重建结果及收敛速度的影响,采用改进的指数阈值模型(q=0.5)和改进的Jitter欠采样方法在频率域对每一有效频率切片进行二维重建,最终实现三维地震数据重建,并有效地提高了计算效率。在迭代过程中,定义了新的误差函数公式,从而在保证重建质量的同时有效地结束迭代,再次提高了计算效率。模拟数据分析和实际数据处理结果均验证了方法的有效性。

关键词： 地震数据重建 曲波变换 凸集投影(POCS) 阈值模型 改进的Jitter采样

Abstract： Due to acquisition limitations and dead trace eliminations, seismic data in spatial coordinates are irregularly sampled,which affects the performances of seismic data processing or inversion. Thus, seismic data reconstruction is an essential procedure. We propose a new data reconstruction approach in this paper. Firstly, we reconstruct irregularly sampled seismic data based on curvelet transform and Project onto Convex Sets (POCS). Then, we analyze influence of different threshold models on reconstruction performance and convergence ratio for 2D data, and improve exponential threshold model (q=0.5) with improved Jittered under-sampling is used to reconstruct every effective frequency slice in the frequency domain. Finally, we reconstruct 3D seismic data. A novel reconstruction error function is defined during iterations, which can effectively terminate the iterations to gain higher efficiency as well as guarantee high reconstruction performance. Synthetic and real data tests prove the validity of the proposed approach.

Keywords： seismic data reconstruction curvelet transform project onto convex sets (POCS) threshold model improved Jittered sampling

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About author: 王本锋 博士研究生,1986年生;2010年本科毕业于中国石油大学(华东)信息与计算科学专业,即被推荐免试入中国石油大学(北京)攻读地球探测与信息技术专业硕士学位,2012年被推荐提前攻读该校地质资源与地质工程专业博士学位;现主要从事基于反演的地震资料高分辨率处理及相关工作。

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