

计算机应用

iCluster软件叠前时间偏移模块的优化方法

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摘要 对中国石化石油勘探开发研究院南京石油物探研究所iCluster地震成像软件系统中叠前时间偏移(PSTM)模块进行了性能剖析和调优。PSTM模块中, 进程间通讯很少, 理论上可以得到很好的加速比和可扩展性。由于存在大量的读写磁盘操作, 导致CPU占用率很低, 性能变差, 一旦磁盘读写性能得到了很好的解决, 性能将会大幅提升。此外, 还发展了iCluster PSTM模块的多线程和混合并行方法。SMP集群上, 通过多线程和混合并行方法不仅可以增加单节点的数据处理量, 而且也很好缓解了PSTM模块各进程对IO的竞争。另一方面, 对原始代码中的热点循环进行了优化, 实现了对代码的向量化, 在某工区数据的测试中, 性能提升了36.3%

关键词 [地震资料处理](#); [iCluster](#); [叠前时间偏移](#); [并行算法](#)

PSTM module optimization of iCluster code

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Abstract This paper discussed the parsing and tuning of the performance of PSTM (Pre Stack Time Migration) module of iCluster from SINOPEC Nanjing Institute of Geophysical Prospecting. In this module, there is only a very few inter-process communications. Theoretically it should have a satisfactory speedup ratio and scalability. In reality its performance is disappointing due to too many disk operations. The OpenMP multi-threading version of iCluster PSTM module was developed to take advantage of SMP architecture. After that, MPI+OpenMP parallel paradigm was implemented which show about 29% better performance than the pure MPI paradigm on one node benchmark. Moreover the MPI+OpenMP hybrid parallel paradigm also reduce the I/O competition from different processes. Finally, one hot loop in the original PSTM module which takes the most of running time was successfully vectorized, which improves the performance by 36.3% in a test on a real data set.

Key words [seismic processing](#); [iClusterSTM](#); [parallel algorithm](#)分类号 [P631.443](#)

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