Locality of Reference in Sparse Cholesky Factorization Methods

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Abstract

The poster will present results from a manuscript, co-authored by Elad Rozin, which was submitted to the CSC04 Special Issue of ETNA. However, these results were never presented at a conference.

We analyze the cache efficiency of two high-performance sparse Cholesky factorization algorithms: the multifrontal algorithm and the left-looking algorithm. Our theoretical analysis shows that while both algorithms sometimes enjoy a high level of data reuse in the cache, they are incomparable: there are matrices on which one is cache efficient and the other is not, and vice versa. The theoretical analysis is backed up by detailed experimental evidence, which shows that our theoretical analyses do predict cache-miss rates and performance in practice, even though the theory uses a fairly simple cache model. We also show, experimentally, that on matrices arising from finite-element structural analysis, the left-looking algorithm consistently outperforms the multifrontal algorithm. Finally, we also show that there are matrices where the multifrontal algorithm may require significantly more memory than the left-looking algorithm. On the other hand, the left-looking algorithm never uses more memory than the multifrontal one.

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