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Proof of Correctness for Sparse Tiling of Gauss-Seidel

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Abstract

Gauss-Seidel is an iterative computation used for solving a set of simultaneous linear equations, $A\vec{u} = \vec{f}$. If the matrix A uses a sparse matrix representation, storing only nonzeros, then the data dependences in the computation arise from A's nonzero structure. We use this structure to schedule the computation at runtime using a technique called *full sparse tiling*. The sparse tiled computation exhibits better data locality and therefore improved performance. This paper gives a complete proof that a serial schedule for full sparse tiled Gauss-Seidel generates results equivalent to those that a typical Gauss-Seidel computation produces. We also provide implementation and correctness details for full sparse tiling with reduced worst-case complexity.

A copy of this technical report can be obtained by sending a request to mstrout@cs.ucsd.edu or by visiting http://www.cs.ucsd.edu/~mstrout.