

## YMC2004 TALK ABSTRACT

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Title: GRiTS: Global Re-indexing for Triangular (Tetrahedral) Simplices

### Description:

GRiTS is a project started in the Winter of 2003. I gave a talk on it in May to our math department - below are the slides I used.

### Description of Research:

Finite Elements is one of the most popular approaches for finding numerical solutions of PDEs. For problems arising in complex engineering and scientific applications, the number of variables can easily reach millions or even billions. To reduce the associated computational time, one of the most popular approaches is parallel computation, in which the computational load is spread over hundreds of processors. Even with decreasing latency of networks, one major challenge is the data transmission. To distribute the amount of computational work evenly over processors (load balancing), ParMETIS, a hypergraph partitioning package, is used in conjunction with several mapping algorithms which were created. This research introduces various algorithms for mapping a hypergraph to a Finite Element mesh, which are able to reduce computational time by preventing stalling and reducing network communication. Analysis of each algorithm and experimental results demonstrate as much as a 35% speed up in computations.

### Paper Abstract:

In this paper, we describe and analyze a number of index filters associated with graph partitioning. A heuristic filter based on two level adjacency and random sampling demonstrated the best performance. A numerical study using a parallel finite elements flow solver (ViTLES) and the parallel graph partitioning package ParMETIS is included.

The slides I used can be found at:

<http://filebox.vt.edu/~gboquet/grits.pdf>

I preliminary paper can be found at:

<http://filebox.vt.edu/~gboquet/paper.pdf>