



The University of Chicago  
Departments of Computer Science,  
Mathematics, and Statistics

## Scientific and Statistical Computing Seminar

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### Randomized Direct Solvers and Their Applications

**FRIDAY, March 2, 2012, at 3:30 PM**

133 Eckhart Hall, 5734 S. University Avenue.

### ABSTRACT

We propose some new structured direct solvers for large linear systems, using randomization and other techniques. The work involves new flexible methods to exploit structures in large matrix computations. Our randomized structured techniques provide both higher efficiency and better applicability than some existing structured methods. New efficient ways are developed to conveniently perform various complex operations which are difficult in standard rank-structured solvers. Our new solvers have nearly linear complexity for various types of large linear systems.

We also study the following issues:

1. Develop matrix-free structured solvers.
2. Update a structured factorization when few matrix entries change.
3. Relaxed rank requirements in structured solvers. We show the feasibility of our methods for solving various difficult problems, especially high dimensional ones.
4. Develop effective preconditioners for problems without significant rank structures. We analyze the criterion for compressing off-diagonal blocks so as to achieve nearly optimal effectiveness and efficiency in our preconditioner.

Applications of the techniques to least squares, eigenvalue problems, PDE solutions, seismic imaging problems will shown.

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