Adrianna Gillman
Per-Gunnar Martinsson
Gregory Beylkin

Fast direct solvers for elliptic partial differential equations

Develop linear scaling direct solvers for the linear systems that arise from the discretization of elliptic partial differential equations. The planned research will make use of potential theory and randomized linear algebra to efficicently form low rank factorizations needed for a hierarchical factorization of the dense matrices of interest. A variant of the Sherman-Morrison formula will be developed to create an approximation of the inverse. The resulting methods will be applied to discretized integral equations for elliptic and Helmholtz problems and to accelerate sparse solvers for finite element discretizations.

Advisor will meet with mentee once a week but will be available for question via email and can arrange additional meetings if needed. The mentor will meet with the mentee twice a semester to check in on progress and offer outside guidance but additional meetings can be added if needed.

P (( ) ( ), ( ) ( ),
, .)

The candidate will submit papers to journals such as the Journal of Computational Physics and will give talks at conferences. Conferences to be attended include SIAM CSE, ICIAM, SIAM Annual, and SIAM Numerical Linear Algebra. The first paper should be submitted to the Journal of Computational Physics by the begining of the fourth year.

A

The comprehensive exam should take place by the fall of 2010 and the dissertation defense will take place in the spring of 2011.

A (. ., A
100% , A 50%)

50% research effort in AY09/10, and 100% research effort in AY10/11

D

A D

M D