



A Scalable Parallel Preconditioned Sparse Linear System Solver

M. Manguoglu, M. Sathe, O. Schenk, Ahmed Sameh

► To cite this version:

M. Manguoglu, M. Sathe, O. Schenk, Ahmed Sameh. A Scalable Parallel Preconditioned Sparse Linear System Solver. International Conference On Preconditioning Techniques For Scientific And Industrial Applications, Preconditioning 2011, May 2011, Bordeaux, France. inria-00591085

HAL Id: inria-00591085

<https://inria.hal.science/inria-00591085>

Submitted on 6 May 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A Scalable Parallel Preconditioned Sparse Linear System Solver

List of authors:

M. Manguoglu¹ M. Sathe O. Schenk² A. Sameh³

Achieving high parallel scalability of sparse linear system solvers implemented on large-scale computing platforms comprised of tens of thousands of multicore processors is a task that offers many challenges. Towards achieving such a solver, we extract an effective banded (sparse within the band) preconditioner for use with an outer Krylov subspace method. The extraction of such banded preconditioners is made possible via a fast parallel reordering scheme based on the computation of the Fiedler vector of the weighted Laplacian of the corresponding sparse matrix under consideration. Solving systems involving these banded preconditioners (narrow-banded, generalized-banded, or wide-banded) is accomplished via members of the SPIKE family of solvers. The resulting hybrid parallel sparse system solver, P-SPIKE (for Pardiso-Spike), is made quite scalable via a specialized version of the sparse direct solver Pardiso. We show that our solver is quite competitive in performance and robustness compared to current parallel direct solvers, as well as Krylov subspace methods preconditioned via: (i) approximate LU-factorization, and (ii) algebraic multigrid schemes.

¹Department of Computer Engineering, Middle East Technical University, Ankara, Turkey

²Department of Computer Science, University of Basel, Switzerland

³Department of Computer Science, Purdue University, U.S.A.