

IMPROVING THE PARALLEL SCALABILITY OF SMOOTHED AGGREGATION ALGEBRAIC MULTIGRID

Majid Rasouli, Hari Sundar

School of Computing, Univeristy of Utah

October 9, 2017

Abstract

Algebraic multigrid (AMG) has been a popular method for solving linear systems of elliptic partial differential equations, especially for large sparse systems. This work introduces an algebraic multigrid solver, Saena, in which the sparsity of the matrix is being exploited in a new way to reduce the amount of communication required for sparse matrix-vector multiplication (SpMV) and sparse matrix-matrix multiplication. Furthermore, another reduction in communication has been applied during creating the aggregation in the coarsening procedure. Numerical comparisons of Saena with GAMG (PETSc) demonstrate the scalability and efficiency of this method.

Keywords: Algebraic Multigrid, SpMV

- 1 Introduction
- 2 Algebraic Multigrid
- 3 Experiments and Results
- 4 Future Work

References

- [1] Nathan Bell, Steven Dalton, and Luke N Olson. Exposing fine-grained parallelism in algebraic multigrid methods. *SIAM Journal on Scientific Computing*, 34(4):C123–C152, 2012.
- [2] Amanda Bienz, Robert D Falgout, William Gropp, Luke N Olson, and Jacob B Schroder. Reducing parallel communication in algebraic multigrid through sparsification. *SIAM Journal on Scientific Computing*, 38(5):S332–S357, 2016.
- [3] Eran Treister and Irad Yavneh. Non-galerkin multigrid based on sparsified smoothed aggregation. *SIAM Journal on Scientific Computing*, 37(1):A30–A54, 2015.