
Sherry Li
**Performance Analysis of Coarse Solvers for Algebraic
Multigrid on Leading Multicore Architectures**

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We present performance of a novel multigrid code using higher order elements to discretize the PDEs and element-agglomeration AMGe methods which improve the coarsening process over the traditional AMG and have guaranteed approximation property. Another novelty is to use a randomized HSS low-rank sparse factorization method as a coarse grid solver, which provides powerful and flexible coarse solver for numerically challenging problems.

In addition to scaling study, we present a comparative analysis of the impact of the coarse grid solver on the AMG performance. Here, we compare the PCG method and the HSS sparse factorization method. We contrast the performance of our solver on one 12-core socket of a Cray XC30 machine with performance on a 60-core Intel Xeon Phi coprocessor. To obtain peak performance, we optimized the code to take full advantage of fine-grained parallelism and made it thread-friendly for high thread count. We also developed a bounds-and-bottlenecks performance model of the solver which we used to guide us through the optimization effort. We carried out performance tuning in the solver's large parameter space. As a result, significant speedups were obtained on both machines.