Improving Convergence and Reducing Complexity in Algebraic Multigrid through a Root-node Method

Luke Olson

Computer Science,
University of Illinois at Urbana-Champaign,
USA
lukeo@illinois.edu

Recent approaches to improving multigrid convergence through modified coarsening and enhanced interpolation have shown to be effective in a general setting (e.g. complex, non-Hermitian, and indefinite). Yet, the the resulting multigrid hierarchies may exhibit higher complexities than necessary. In this talk we outline a root-node based approach to multigrid, which can be viewed as a hybrid of classical and aggregation based multigrid methods. This allows both point-wise decisions in the setup while retaining the framework of aggregation. We give an overview of root-node multigrid using interpolation based on energy minimization and show how the complexity of the multigrid cycle is controlled through selective filtering by utilizing a root-node. The method yields improved interpolation (and convergence), while limiting the total work of the cycle with minimal tuning of parameters. We present several numerical results in support and discuss directions for further theoretical and numerical development.