Numerical Analysis and Scientific Computing Seminar

Signal Processing Approach To Obtain A Direct Multi-grid Solver

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Abstract: Modifications of the conventional muti-grid algorithm are explored to avoid the use of smoothing iterations. In the full multi-grid algorithm, classical smoothing iterations (e.g. Gauss-Seidel) reduce high-frequency components of the error and a coarse-grid approach reduces the low-frequency components of the error. The problem here is that two methods with different structures are being combined, which introduces additional complexity in the convergence analysis of multi-grid methods. Then, the idea is to avoid the use of smoothing iterations by using different inter-grid configurations. In an analogy with perfect reconstruction filters, a configuration of inter-grid operators is found such that the approximation error is completely cancelled after one iteration of the algorithm. The main assumption for this configuration to work is a particular aliasing pattern in the eigen-vectors of the linear system. Examples and simulations are presented to evaluate the performance of the new algorithm.

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