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Optimized Schwarz methods for high-order spectral elements

In this presentation, it is shown how a small modification of the RAS, MS and AS-aug preconditioners at the algebraic level, motivated by optimized Schwarz methods defined at the continuous level, leads to a significant reduction in the iteration count of the iterative Krylov solver. Numerical experiments on the modified Helmholtz equation using a model problem and a next generation spectral element general circulation model on the sphere, illustrate the effectiveness of this new approach. Experimentally, it is observed that the best condition number attainable in 2D (without coarse solver), for a non-overlapping decomposition, is $\sqrt{N}$ where N is the order of the polynomial basis employed. The performance of the method on the Blue gene/L supercomputer is investigated.

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