On Additive Schwarz Methods for Parallel Adaptive Finite Elements

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Abstract: Domain decomposition is a popular approach to solve PDEs in parallel on supercomputers. In this approach, a PDE is split into coupled subproblems on smaller subdomains forming a partition of the original domain. Based on the type of the partition, a domain decomposition method can be categorized as an overlapping or non-overlapping method. In this talk, we study additive Schwarz methods in a new context: parallel adaptivity. We will show that within this new context, it is advantageous to use local adaptive meshes in overlapping regions. As these adaptive meshes can be almost as coarse as the starting coarse mesh outside of the corresponding local subdomains, the width of the overlap can be larger than the usual minimal (small) overlap. We will consider the case where the overlap is of the same size with the subdomains (weak overlap) and the case where the overlap is the whole domain (full domain overlap). Our analysis indicates that these two variants delivery optimal rates of convergence that do not depend on the mesh sizes or the number of subdomains. Numerical results are provided to support our theoretical findings.

References

[1] Sébastien Loisel and Hieu Nguyen. A Comparison of Additive Schwarz Preconditioners for Parallel Adaptive Finite Elements, in: T. Dickopf et al. (eds.) Domain Decomposition Methods in Science and Engineering XXII. *Lecture Notes in Computational Science and Engineering*, 104:345–354, 2016.

[2] Sébastien Loisel and Hieu Nguyen. An optimal Schwarz preconditioner for a class of parallel adaptive finite elements. *Journal of Computational and Applied Mathematics*, 321:90–107, 2017.

[3] Sébastien Loisel and Hieu Nguyen. On the Convergence Analysis of An Optimal Additive Schwarz Method for Parallel Adaptive Finite Elements. submitted 2017.

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