A Two-Grid Alternate Strip-Based Domain Decomposition Strategy in Two-Dimensions

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Abstract: The *Two-Grid Alternate Strip-Based Domain Decomposition Strategy* designs efficient preconditioners with good parallelism properties, for the discrete systems which arise from the finite element approximation of symmetric elliptic boundary value problems in two dimensional Euclidean spaces. This new approach offers an alternative methodology which draws upon the strengths of both overlapping and non-overlapping domain decomposition techniques. The key ingredients are the alternate strip-based-solvers introduced in [1], which generate algorithms in two-stages and allow the use of efficient subdomain preconditioners such as a two-grid V or W cycle. Each strip is a union of non-overlapping subdomains and the global interface between subdomains is partitioned as a union of edges between strips (which include also all the vertex points) and edges between subdomains which belong to the same strip (inside strips, the interface edges do not contain their end points). We emphasise that a novel feature of our approach is that at each stage the direction of the strips changes and with it, the coupling between vertex points and edges. The new strategy extends in a straightforward manner to the three dimensional case.

The presentation is based on the Ph.D. research of L.A.M. under the supervision of Dr. A.W. Craig. Part of this work has been submitted for publication, as [CM1], or is in preparation for submission, as [2] and [3].

[1] A. W. Craig and L.A. Mihai, *A class of alternate strip-based-solvers for elliptic PDE's*, submitted.

[2] A.W. Craig and L.A. Mihai, *A class of alternate strip-based iterative substructuring algorithms for elliptic PDE's in two dimensions*, in preparation.

[3] A.W. Craig and L.A. Mihai, *A class of alternate strip-based iterative substructuring algorithms for elliptic PDE's in three dimensions*, in preparation.

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