Domain Decomposition and Symmetric Eigenvalue problems

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Abstract

In this lecture, we consider several approaches for solving large symmetric eigenvalue problems when the operator is defined via a domain decomposition technique. We focus primarily on those methods that are most suitable for parallel computing platforms. We assume that the operator is defined on the union of overlapping subdomains. Further, we assume that for each subdomain it is possible to compute eigenpairs of the restriction operator. The eigenvalues sought could be at either end of the spectrum or in the interior as well. We outline the difficulties encountered when using some of the most common approaches for handling the symmetric eigenvalue problem, and describe in detail our preferred scheme for refining a set of approximate eigenpairs [1, 2, 3]. In addition, we describe an alternative scheme based on the Lanczos algorithm without reorthogonalization but with a special procedure for discarding spurious eigenvalues. We compare our solvers with the Lanczos scheme with full and partial reorthogonalization using a shift-and-invert procedure. We conclude with a summary outlining the relative advantages or flaws of these approaches.

REFERENCES

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