

A SURVEY OF ROBUST PRECONDITIONING METHODS

Owe Axelsson

University of Nijmegen, NL

Abstract

Iterative solution methods and preconditioners of various type exist but, so far, none can be said to be fully robust. We are primarily concerned with preconditioning methods for elliptic boundary value problems. Several methods, such as multigrid, domain decomposition, and alternating direction methods work efficiently for certain model type problems and provide then a convergence rate which is bounded irrespective of the size of the problem, i.e., they have an optimal order of computational complexity. The behaviour for more general problems, however, may degrade significantly. This holds in particular for problems with anisotropic and discontinuous material. Equivalently, it may depend heavily on the shape and size of elements, when these change rapidly. A special type of preconditioning methods of algebraic two-level and multilevel type with special preconditioners for the leading top matrix blocks have recently been developed, which behave uniformly efficient in both shape and size of elements. The talk will give a survey of such methods and present the basic ideas behind the new preconditionings.