Jonathan W Boyle
Algebraic multigrid and convection diffusion problems

School of Mathematics
The University of Manchester
Sackville Street
Manchester
M60 1QD
UK
j.boyle@manchester.ac.uk
David J Silvester

The talk discusses the use of algebraic multigrid (AMG) when solving discrete convection diffusion problems. For practical applications, e.g. modelling incompressible fluid flow, the interest is in using AMG as a preconditioning component within a Krylov subspace solver like GMRES. To be effective in this role, the AMG method should be 'black box', i.e. require no user tuning, and be effective in the sense that if applied as a solver for a convection-diffusion subproblem then iteration counts are independent of mesh size and other problem parameters.

When designing AMG for convection diffusion, it is necessary to consider the interplay between wind direction and AMG smoothing scheme. Numerical test data is presented showing performance for AMG applied to streamline diffusion stabilized finite element discretizations of model problems. The results demonstrate the crucial importance of choosing an appropriate smoothing scheme. The performance of a "well-chosen" AMG method in the context of pressure-convection diffusion preconditioning of the Navier-Stokes equations will also be discussed.