Marzio Sala

Algebraic Multilevel Preconditioners Based on Aggregation Procedures: A demonstration for the Navier-Stokes Equations with Associated Heat and Mass Transfer

Sandia National Laboratories
PO BOX 5800 MS 1110
Albuquerque
NM
msala@sandia.gov
John Shadid
Ray Tuminaro
Paul Lin

In this talk a class of algebraic preconditioners, based on the concept of (smoothed) aggregation, is introduced. The resulting procedure, that does not require geometric information, is completely algebraic and well-suited for parallel computations on unstructured grids in two and three dimensions. This technique is described in the context of a simple elliptic model problem with convergence estimates and numerical experiments presented. The procedure is then applied as a preconditioner to our coupled systems of interest in a Newton-Krylov solution procedure.

In the context of Navier-Stokes with coupled heat and mass transfer, we present parallel and algorithmic scaling studies on large-scale distributed memory parallel computers. Comparisons are reported with 1-level domain decomposition preconditioners, and with two-level domain decomposition preconditioners with coarse grids.