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ETNA
Kent State University
etna@mcs.kent.edu

PARALLEL FULLY COUPLED SCHWARZ PRECONDITIONERS FOR SADDLE POINT PROBLEMS*

FENG-NAN HWANG† AND XIAO-CHUAN CAI‡

Abstract. We study some parallel overlapping Schwarz preconditioners for solving Stokes-like problems arising from finite element discretization of incompressible flow problems. Most of the existing methods are based on the splitting of the velocity and pressure variables. With the splitting, fast solution methods are often constructed using various fast Poisson solvers for one of the variables. More recently, several papers have investigated the so-called fully coupled approaches in which the variables are not separated. The fully coupled approach has some advantages over the variable splitting method when solving Stokes-like equations with many variables, where a good splitting may be hard to obtain. In this paper we systematically study the parallel scalability of several versions of the fully coupled Schwarz method for both symmetric and nonsymmetric Stokes-like problems. We show numerically that the performance of a two-level method with a multiplicative iterative coarse solver is superior to the other variants of Schwarz preconditioners.

Key words. saddle point problem, two-level Schwarz preconditioning, fully coupled methods, finite element, parallel processing

AMS subject classifications. 65F10, 65N30, 65N55

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†Department of Mathematics, National Central University, Jhongli City, Taoyuan County 32001, TAIWAN (hwangf@math.ncu.edu.tw).

‡Department of Computer Science, University of Colorado at Boulder, Boulder, CO 80309, USA (cai@cs.colorado.edu).