

Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Preconditioners for incompressible flows CORNELIS VUIK, MEHFOOZ UR REHMAN, GUUS SEGAL, Delft University of Technology — We consider solution methods for large systems of linear equations that arise from the finite element discretization of the incompressible Navier-Stokes equations. These systems are of the so-called saddle point type, which means that there is a large block of zeros on the main diagonal. To solve these type of systems efficiently, several block preconditioners have been published. We propose a new block preconditioner MSIMPLER which is a modified version of the SIMPLER solver proposed by Patankar. We compare the performance of the block preconditioners: pressure convection diffusion (PCD), least squares commutator (LSC), and augmented Lagrangian based (AL) preconditioners with the MSIMPLER preconditioner. These preconditioners are first compared for academic problems generated by the IFISS package. Thereafter, we compare the best preconditioners for industrial problems using the SEPRAN FEM package. It appears that the MSIMPLER preconditioner is in general the best method. Finally we also consider the solution of the Stokes problem with variable viscosity. We consider smoothly varying viscosity and jumps in the viscosity. It appears that a special preconditioner is independent of the grid-size and independent of the viscosity variation. Applications from geophysics are used to illustrate the performance.

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Date submitted: 15 Jul 2009

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