AN ADVANCED ILU PRECONDITIONER FOR THE INCOMPRESSIBLE NAVIER STOKES PROBLEM

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Abstract

In this paper, we solve the incompressible Navier Stokes problem with an ILU preconditioned Krylov subspace methods. The finite element discretization and linearization of the Navier Stokes problem gives rise to a linear system having large number of zeros on the main diagonal. ILU factorization of the original system matrix may fail due to zeros on the main diagonal. To avoid breakdown of the ILU decomposition, we present here different ordering techniques of the grid points and the unknowns. The reordering techniques used with ILU preconditioning makes that the iterative methods applied to the system of equations converge rapidly. We call this the AILU preconditioner. With the reordering techniques, a direct solver can also be used to solve the coupled system without pivoting. It is observed that AILU converges rapdily for both Picard's and Newton's linearization for the Navier Stokes problem.

Results are compared with ILUPACK that show that AILU takes a larger number of iterations than ILUPACK. However, AILU is cheaper in construction of the preconditioner and memory, and consumes less CPU time in computations.

References

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