Pressure-correction Algebraic Fractional-step Schemes for the Unsteady Navier-Stokes Incompressible Equations

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One of the most successful approaches to solve the Navier-Stokes equations for incompressible flows is provided by the class of the projection methods at the differential and, more recently, at the algebraic level.

In this talk we present a new family of algebraic projection methods based on inexact LU factorization of the full discretized system. In particular, we will introduce a pressure-correction scheme that resembles a well known projection scheme based on a differential approach (see [3], [2]). We will illustrate the effect of the LU inexact factorization when used as a solver for the fully discretized Navier-Stokes problem. We will refer to a finite element discretization in space and a finite difference discretization in time.

Moreover, we consider the same approach as a preconditioner for the same problem. In this respect, we will build a new preconditioner which in some sense generalize the well known Caouet-Chabard preconditioner [1] and which seems to be well suited not only for the generalized Stokes problem. This is confirmed by several numerical results.

References

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[3]. L. Timmermamns, P. Minev, and F.V. De Vosse, An approximate projection scheme for incompressible flows using spectral methods. *Int. Journ. for Numer. Methods in Fluids*, **22** (1996), 673–688.