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Analysis of a projection/characteristic scheme for incompressible flow

The paper presents the convergence analysis of a characteristic/projection scheme for the incompressible Navier-Stokes equations. This scheme is a modification of the scheme analyzed in [1] which does not eliminate the projected velocity field from the system but rather uses it as the advecting field in the explicit characteristic advection. This field has a zero (generalized) divergence and is therefore more suitable for this purpose. It appears that this scheme has the same convergence rate as the one in [1] but on a given grid seems to produce more accurate results. The computational cost is not significantly higher since it requires only one extra inversion of the mass matrix which can be done relatively efficiently. We present numerical results which illustrate the properties of the scheme.

References

[1] Y. Achdou and J.-L. Guermond, *Convergence analysis of a finite element projection/Lagrange-Galerkin method for the incompressible Navier-Stokes equations.* SIAM J. Numer. Anal. (3) **37**(2000), 799–826.