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Optimal first-order error estimates of a fully segregated scheme for the Navier-Stokes equations*

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Abstract

A first-order linear fully discrete scheme is studied for the incompressible time-dependent Navier-Stokes equations in three-dimensional domains. This scheme is based on an incremental pressure projection method and decouples each component of the velocity and the pressure, solving in each time step, a linear convection-diffusion problem for each component of the velocity and a Poisson-Neumann problem for the pressure.

Using an *inf-sup* stable and continuous finite-elements approach of order $O(h)$ in space, unconditional optimal error estimates of order $O(k+h)$ are deduced for velocity and pressure (without imposing constraints on the mesh size h and the time step k).

Finally, some numerical results are performed to validate the theoretical analysis, and also to compare the studied scheme with other current first-order segregated schemes.

Subject Classification. 35Q30, 65N15, 76D05.

Keywords: Navier-Stokes Equations, incremental pressure projection schemes, segregated scheme, error estimates, finite-elements.

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