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# Error Analysis of non inf-sup Stable Discretizations of the time-dependent Navier-Stokes Equations with Local Projection Stabilization

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**SUMMARY**

In this talk we consider non inf-sup stable finite element approximations to the evolutionary Navier–Stokes equations. Several local projection stabilization (LPS) methods corresponding to different stabilization terms are analyzed, thereby separately studying the effects of the different stabilization terms. Error estimates are derived in which the constants are independent of inverse powers of the viscosity. For one of the methods, using velocity and pressure finite elements of degree $l$, it will be proved that the velocity error in $L^\infty(0,T;L^2(\Omega))$ decays with rate $l+1/2$ in the case that $\nu \leq h$, with $\nu$ being the dimensionless viscosity and $h$ the mesh width. In the analysis of another method, it was observed that the convective term can be bounded in an optimal way with the LPS stabilization of the pressure gradient. Fully discrete schemes with both the implicit Euler and the Crank-Nicolson methods are considered and analyzed Some numerical studies confirm the analytical results.

**Keywords:** Navier-Stokes equations, LPS stabilization

**AMS Classification:** 65M12, 65M60

## References

[1] Javier de Frutos, Bosco García-Archilla, Volker John, Julia Novo. *Error analysis of non inf-sup stable discretizations of the time-dependent Navier-Stojkes equations with local projection stabilization.* IMA Journal of Numerical Analysis, (to appear).

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