Higher order hybrid temporal discretizations applied to transient Stokes problems

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We analyze finite element discretizations of the transient Stokes equations that are based on inf-sup stable finite element pairs for velocity and pressure. A hybrid temporal discretization is applied: a continuous Galerkin–Petrov method is used for the velocity, while the pressure is approximated in a discontinuous manner. We prove optimal convergence orders in space and time for both velocity and pressure. Moreover, a simple postprocessing allows to improve the temporal accuracy of both velocity and pressure by one order. Furthermore, the postprocessed discrete velocity is continuously differentiable, while the postprocessed discrete pressure is continuous. Numerical results support our theoretical findings.

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