QUASI-OPTIMAL AND PRESSURE ROBUST DISCRETIZATIONS OF THE STOKES EQUATIONS

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ABSTRACT

Pressure robust finite element discretizations of the Stokes equations have attracted a growing attention in recent years. Pressure robustness means that the approximate velocity field is independent of the pressure or, equivalently, that the invariance of the exact velocity field with respect to irrotational forces is reproduced at the discrete level. We address the problem of combining this structural property with near-best approximation properties with respect to the pair of finite element spaces used to approximate the velocity and the pressure. We formulate this problem by requiring quasi-optimality of the velocity error independent of the pressure as well as quasi-optimality of the sum of velocity and pressure errors. Remarkably, standard Galerkin discretizations fulfill both requirements only if a conforming and divergence-free pair of spaces is used. We overcome this restriction by designing novel nonstandard discretizations.

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