ANISOTROPIC AND PRESSURE-ROBUST FINITE ELEMENT DISCRETIZATIONS FOR THE STOKES EQUATIONS

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ABSTRACT

The fundamental invariance property of the Stokes equations, which is the fact that the velocity solution is not affected by a change of the right hand side data in form of a gradient field, is not matched in the discrete setting by most classical finite element discretizations. This implies that these methods are not pressure-robust. Only exactly divergence-free methods, e.g., the Scott–Vogelius element, naturally produce solutions with vanishing divergence and show the discrete version of the fundamental invariance property. A remedy for classical methods to gain pressure-robustness is using a reconstruction operator on the right hand side velocity test functions, which however introduces a consistency error that needs to be bounded.

Moreover, the solution of the Stokes equations typically shows boundary layers and singular behavior perpendicular to re-entrant edges, which makes the use of anisotropically graded meshes reasonable.

The talk focuses on the combination of pressure-robust methods using a reconstruction operator and anisotropic meshes.

References

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