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Superconvergence of a stabilized finite element approximation for the Stokes equations using a local coarse mesh L^2 projection
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MSC Classification: 65N30

Keywords: Stokes equations; Stabilized finite element approximation; Superconvergence; coarse mesh; L^2 projection; Piecewise polynomials of higher degree

Review text:
The authors considered a low equal order finite element method to approximate the stationary Stokes equations in two dimensions. The method does not satisfy the known $inf - sup$ condition. This condition is required for instance to get the stability of the finite element methods approximating Stokes equations. A known stabilized form is then introduced and a well posedness for the new discrete problem is proved. The convergence order of the discrete velocity is h in H^1–norm whereas the convergence order of the discrete pressure is h in L^2–norm. Some postprocessed approximations are derived using the stated discrete velocity and the discrete pressure. These postprocessed approximations are the L^2 projections into piecewise polynomials of higher degree on some coarse meshes. It is proved that the convergence order of the stated postprocessed approximations is higher than that of the stated discrete velocity and the discrete pressure under some suitable choices for the piecewise polynomials of higher degree which are used to define these postprocessed approximations. They are then superconvergence results. Two assumptions are assumed to be satisfied in order to get the above stated results. The first one consists a regularity assumption on the domain on which the problem is posed. The second assumption consists a regularity assumption on the continuous mixed variational form.

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