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Pressure Projection Methods Arising From An Enriched Finite Element Approach*

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Abstract

To make some of the simplest and desirable pair of spaces inf-sup stable for the Stokes and the Darcy models, namely the P_1/P_0, P_1/P_1 and P_1/P_1^{dis} elements, this work proposes a Petrov-Galerkin strategy relied on velocity and pressure enhanced spaces (see [1, 2, 3, 4] for related results). The enriching functions turn out to be the solutions of local mixed problems at element level driven by residuals and spurious modes with degree of freedom fixed by the original pair of elements. Having incorporates the element wise contribution the now stable methods recover some of the pressure projection methods recently proposed in [5, 6]. In addition, we take advantage of the enriched framework to make methods local mass conservative and super convergent for some particular meshes. Numerical tests infer achieved theoretical results and validate optimal error estimates.

References

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