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PRESSURE ENRICHMENT FOR BILINEAR QUADRILATERAL FINITE ELEMENTS IN TWO-FLUID FLOW PROBLEMS

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In fixed mesh finite element formulations for moving interfaces and free surfaces flow, the pressure field exhibits discontinuities along the interface that are poorly described with standard finite element spaces. Different solutions has been proposed in the literature to solve this inconvenient: modification to standard P_1 interpolation [1] or, the most popular, the enrichment of the discrete pressure space (see e.g., [2, 3, 4]).

This work presents enrichment interpolation fuctions in *quadrilateral* elements able to deal with pressure discontinuities. They are combined with a residual-based stabilized formulation to allow for a static condensation of the added unknowns. The formulation is used to analyse classical hydrostatic pressure test and free-sloshing problems.

REFERENCES

[1] R. Ausas, F. Sousa, G. Buscaglia, An improved finite element space for discontinuous pressures. *Comp. Meth. in Appl. Mech. and Eng.*, Vol. **199**(17-20), pp. 1019–1031 , 2010.

[2] T. Fries, T. Belytschko(2010), The extended/generalized finite element method: an overview of the method and its applications. *Int. J. for Num. Meth. in Eng.* **84**(3, pp. 253–304, 2010.

[3] A. Coppola-Owen A, R. Codina, Improving Eulerian two-phase flow finite element approximation with discontinuous gradient pressure shape functions. *Int. J. for Num. Meth. in Fluids*, Vol. **49**(12), pp. 1287–1304, 2005.

[4] R. Ausas, G. Buscaglia, S. Idelsohn, A new enrichment space for the treatment of discontinuous pressures in multi-fluid flows. *Int. J. for Num. Meth. in Fluids*, Vol. **70**(7), pp. 829–850, 2012.