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UNFITTED SOLUTION OF THE STOKES PROBLEM USING AGGREGATION-BASED FINITE ELEMENTS

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We present a novel approach for the numerical solution of the 3D Stokes problem using high-order inf-sub stable unfitted finite elements. The main novelty is how cut cells are handled so that the discrete system is not affected by the small cut cell problem. To this purpose, we consider "the aggregated unfitted finite element method" recently introduced in [1], which consists in merging cut cells with full neighbors forming macro-elements that are used to construct well-behaved finite element spaces. In contrast to previous works, this technique is easy to implement (no extra ghost penalty terms are added to the weak form like in CutFEM [2]), it does not modify the underlying physics (oppositely to fictitious domain methods that change the properties of the extended domain), and it can be used in standard continuous Galerkin methods with conforming Lagrangian finite element spaces (oppositely to other cell-agglomeration techniques, which are designed for discontinuous Galerkin methods, see e.g. [3]).

Our goal is to analyze the numerical method for the solution of Stokes problems with high-order inf-sub stable finite elements. Like previously shown in [1] for elliptic problems, numerical results (both in 2D and 3D) show that the method leads to well-posed discrete linear systems, whose condition number is not affected by small cut cells. Moreover, the optimal finite element convergence order is recovered. Mathematical results in [1] for coercive problems will be extended to the Stokes problem.

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