A hybrid mortar method for Stokes problems on non-matching meshes

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Interface problems typically arise from coupling of non-matching meshes or different physical models. A flexible way to treat interface conditions of different character are Mortar methods, which enforce jump conditions across the interface by Lagrange multipliers. Those methods however involve certain difficulties, as the Lagrange multiplier space in the resulting saddle point problem has to be chosen carefully to obtain inf-sup-stability.

Methods, that satisfy interface conditions only approximately (e.g. Nitsche-type methods) can be formulated without Lagrange multipliers. This makes it possible to circumvent difficulties, as no inf-sup condition has to be satisfied for the interface functions. Unfortunately, most methods introduce a lot of coupling across the interface, which reduces the practicability for parallel computations. We investigate a method, that is related to such methods. It introduces additional (hybrid) variables to reduce the coupling to a minimum. This hybridization yields a Schur complement system for the interface variables only.

We summarize the analysis and numerical results in case of Poisson's problem. We also discuss the extension of the proposed method to the Stokes problem, using a nonconforming $P_1 - P_0$ mixed finite element (lowest order Crouzeix-Raviart element). Numerical results for incompressible flow problems are given and their agreement with the derived a-priori estimates of the error in the energy- and L^2-norm is examined.

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