Discretization techniques and iterative solvers for non-matching triangulations

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The framework of mortar methods provides a powerful tool to analyze domain decomposition techniques based on the coupling of different discretization schemes or of nonmatching triangulations along interior interfaces. Strong pointwise continuity conditions are replaced by weak integral conditions without loosing the optimality of the a priori bounds for the discretization errors. In contrast to standard mortar techniques, we use dual Lagrange multipliers. As a consequence, the locality of the support of the nodal basis functions in the nonconforming constrained spaces is preserved, and the stiffness matrix associated with the positive definite formulation can be easily assembled by a local postprocessing step. Examples for dual Lagrange multiplier spaces are given for the lowest order case in 2D and 3D and for higher order cases in 2D. Numerical results including overlapping decompositions illustrate the discretization errors and the flexibility of the method. We apply static condensation techniques and work with new nested constrained spaces. The advantage is that multigrid methods can be applied directly.