

## **Coupled clustering strategies for hierarchical matrix preconditioners in saddle point problems**

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Fluid flow problems can be modeled by the Navier-Stokes or Oseen equations. Their discretization results in saddle point problems. These systems of equations are typically of large scale and thus need to be solved iteratively. Standard (block-) preconditioning techniques for saddle point problems rely on an approximation of the Schur complement. Such an approximation can be obtained by a hierarchical matrix (H-Matrix) LU decomposition for which the Schur complement is computed explicitly. The computational complexity of this computation depends primarily on the hierarchical block structure of the involved matrices. However, widely used construction techniques for this block structure do not consider the coupling between the discretizations for the velocity field and the pressure, respectively, which is described by the off-diagonal blocks of the saddle point problem. Therefore, a problem-dependent hierarchical block structure, which considers the coupling of the two FEM grids, is presented. Numerical results will show that this block structure allows for a faster computation of the Schur complement, the bottleneck for the set-up of the H-Matrix LU decomposition.