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Multilevel solver for discontinuous viscosity Stokes problem

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The goal of my work is to develop robust scalable solver for linear system arising from finite element discretization of Stokes problem with strongly variable viscosity. Such linear systems appear in fluid-structure problems.

Symmetric positive definite problems with discontinuous coefficient can be solved effectively by multigrid preconditioned Krylov subspace methods. Here we extend this idea on saddle point problems by using multilevel preconditioned GMRes. The multilevel method developed by Breass and Sarazin and further refined by Zulehner is applied. A multigrid algorithm works on the saddle point problem by applying constrained smoother. The relaxation allows the iterative procedure to remain in divergence free subspace while smoothing out the error in both pressure and velocity. Similarly to other multilevel methods, the algorithm presented here does not require explicitly storing the matrix and thus, deal.II matrix-free framework can be used.

Primary author: WICHROWSKI, Michal (Instytut Podstawowych Problemów Techniki)

Presenter: WICHROWSKI, Michal (Instytut Podstawowych Problemów Techniki)

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