

All-at-once algebraic multigrid for Stokes problems

Yvan Notay¹

We consider numerical solution of discrete Stokes problems. We focus on the transform-then-solve approach, which amounts to first apply a specific algebraic transformation to the linear system of equations arising from the discretization, and then solve the transformed system with an algebraic multigrid method. The convergence can be rigorously proved for the two-level variant. On the other hand, extensive numerical experiments on real life finite elements discretizations show that the method is competitive with reference block preconditioners, while being significantly more robust in presence of outflow boundaries, complex geometries, and/or variable viscosity. The method also works indifferently for stationary and non-stationary problems with implicit time discretization. In the latter case, increasingly better performance are observed as the time step is decreased.

References:

- [1] https://dipot.ulb.ac.be/dspace/retrieve/524171/2017_SISC.pdf
- [2] <https://dipot.ulb.ac.be/dspace/retrieve/817679/ganmn2105.pdf>

¹Université Libre de Bruxelles
yvan.notay@ulb.be