

Augmented Lagrangian Preconditioners For Incompressible Flow Problems

Z. Wang, M. Benzi

Department of Mathematics and Computer Science, Emory University, Atlanta, GA 30322, USA
zhen.wang@emory.edu, benzi@mathcs.emory.edu

M. A. Olshanskii

Department of Mechanics and Mathematics, Moscow State M. V. Lomonosov University, Moscow
119899, Russia
Maxim.Olshanskii@mtu-net.ru

We describe a few variants of the augmented Lagrangian (AL) preconditioner proposed in [1] for saddle point systems arising from finite element discretizations of the Oseen problem. The original preconditioner was designed for steady problems discretized by means of LBB-stable elements. In this talk we will discuss both steady and unsteady problems and the extension of AL-based preconditioning to the case where the incompressible NavierStokes equations are discretized using stabilized finite elements. We will assess the robustness and effectiveness of different versions of the preconditioner as functions of the discretization parameter h , time step Δt , and viscosity ν .

Finally, we will report on the performance of the proposed preconditioners on 3D unstructured finite element discretizations of blood flow problems from cardiovascular modelling.

References

- [1] M. Benzi and M. A. Olshanskii. An augmented Lagrangian-based approach to the Oseen problem. *SIAM Journal on Scientific Computing*, 28:2095–2113, 2006.
- [2] H. C. Elman, D. J. Silvester and A. J. Wathen. Finite Elements and Fast Iterative Solvers, Numerical Mathematics and Scientific Computation, Oxford University Press, Oxford.