Interface preconditioners for domain decomposition methods for the stationary Navier-Stokes equations

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ABSTRACT

The convergence of domain decomposition algorithms depends crucially on the choice of interface boundary conditions employed. To date, several techniques have been developed to approximate this problem; in general, extensions of algorithms developed for second-order elliptic problems form the core of available algorithms for flow problems: FETI methods, balancing methods, overlapping methods, all typically enhanced by a two- or multi-level approach.

In this work, we present an algorithm for the approximation of the interface operators arising from the Stokes and Oseen equations with a view to precondition the stationary Navier-Stokes equations linearized via a fixed point iteration. As in the case of second-order elliptic problems, these operators are pseudo-differential operators; for flow problems, they act on both the velocity and pressure variables and have inverses with global support, in general. Motivated by the form of these operators and by recent similar work for elliptic problems ([1], [2]), we design sparse approximations of non-local operators acting on the whole interface. The resulting algorithms are of non-overlapping type and exhibit mesh indepedence while requiring no multi-level enhancement. Numerical results aimed at validating our approach will also be included in the presentation.

REFERENCES

[1] M. Arioli and D. Loghin, Discrete interpolation norms with applications *SIAM J. Num. Anal.* **47**(4), pp. 2924–2951 (2009)

[2] M. Arioli, D. Kourounis, D. Loghin, Discrete fractional Sobolev norms for domain decomposition preconditioning, in review (2010).