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MULTILEVEL SOLUTION STRATEGIES FOR DISCONTINUOUS GALERKIN DISCRETIZATIONS OF INCOMPRESSIBLE FLOW PROBLEMS

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In this work we compare the performance of $\{h, p, hp\}$-multilevel preconditioners conceived for the efficient solution of linearized equation systems arising in discontinuous Galerkin (dG) discretizations of the incompressible Navier-Stokes (INS) equations. Multilevel preconditioners improve convergence rates of iterative solvers by means of *smoothing steps* on coarser problems whose goal is to effectively damp low-frequency components of the error. In h-multigrid, p-multigrid and hp-multigrid, coarse levels are built by recursive agglomeration of the computational mesh (that is increasing h), by progressively reducing the degree of polynomial spaces (decreasing p), and by a combination of increasing h and decreasing p, respectively. Since nested h-coarsened mesh sequences are generated on the fly by means of element agglomeration, all multilevel preconditioners can be employed on arbitrarily unstructured meshes of complex computational domains.

For the sake of efficiency coarse INS dG operators are recursively inherited from the finest ones through carefully designed restriction operators, therein avoiding the cost of numerical integration. In particular, BR2 dG discretizations of viscous terms are inherited by means of element-by-element rescaled L^2-projections in order to enforce the correct amount of stabilization on coarse levels [1]. The benefits of this strategy will be documented for all multigrid strategies. The influence of the Reynolds number will be preliminary investigated by computing the backward facing step flow problem. The numerical solution of challenging hemodynamics flow problems on parallel architectures will be presented.

REFERENCES

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