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FAST SCALABLE SOLVERS FOR ROBUST DISCRETIZATIONS IN CFD

Frank Hülsemann[1,*], Carola Kruse[2], Paul Mycek[2], Ulrich Rüde[2,3] and Daniel Ruiz[4]

[1] EDF Lab Paris-Saclay, 7 boulevard Gaspard Monge, 91120 Palaiseau, France.
frank.hulsemann@edf.fr
[2] CERFACS, 42 avenue G. Coriolis, 31057 Toulouse Cedex 1, France.
{kruse,mycek}@cerfacs.fr
[3] Lehrstuhl fuer Simulation, Universitaet Erlangen-Nuernberg, Cauerstr. 11, D-91058 Erlangen, Germany. ulrich.ruede@fau.de
[4] University of Toulouse, IRIT-ENSEEIHT, 2 rue Camichel, 31071 Toulouse, France.
daniel.ruiz@irit.fr

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A novel approach to the design and analysis of discretization methods was recently introduced in [1]. The so-called Hybrid High Order (HHO) discretization relies on degrees of freedom that are broken polynomials on a general mesh and its skeleton. This advanced method promises several attractive features including better conservation of physical properties, and has been successfully applied to the discretization of several linear and nonlinear problems.

While research on HHO methods has primarily concentrated on their approximation properties and their application to several differential operators, the question of fast, scalable linear solvers for this family of methods has not been treated yet in the literature. In particular, it has been shown that standard algebraic multigrid (AMG) solvers degenerate for high order settings. The main difficulty stems from the fact that, in contrast to lower order discretizations, the system matrices of high order discretizations are no longer diagonally dominant, making classical Jacobi or Gauss-Seidel methods inefficient as smoothers.

We present ideas and preliminary research on robust multigrid techniques and specific smoothers for the HHO discretization of scalar elliptic operators, as a first step to the study of other operators such as the Stokes operator for which [2] could be a starting point.

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