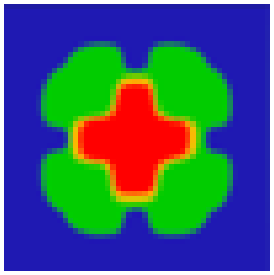

Contribution ID: **9** Type: **Invited talks**

Fast Tensor Product Schwarz Smoothers

Wednesday, July 25, 2018 11:40 AM (20 minutes)

The goal of the ExaDG project is to provide efficient finite element solvers relying on deal.II's MatrixFree framework based on higher order DG methods. However, the matrix-free operators restrict the choice of preconditioners. A powerful tool is offered by a geometric multigrid algorithm having a favorable linear complexity. The quality of multigrid preconditioners is crucially dependent on the choice of the smoother. Overlapping Schwarz smoothers using local spaces supported on vertex patches were introduced by Arnold, Falk, and Winther and provide robust convergence in particular for divergence-constrained problems and almost incompressible elasticity. In classic finite element codes, the local stiffness matrices are extracted from the global system matrix. Therefore, such smoothers are expensive to compute and store, especially for higher order DG discretizations. Exploiting again the tensor product finite elements on the subproblem level offers a remedy to both and fits well into a matrix-free framework. Thus, we approximate the global bilinear form by separable problems in the smoother.

First, we show how to reduce the complexity of inverting and storing subspace problems by means of the fast diagonalization method. Second, a general tensor product setting is presented to illustrate the sum-factorization approaches used in finite element related matrix-vector products resulting from the global forward as well as local inverse problems. Finally, the efficiency of our proposed fast diagonalized Schwarz smoothers is underlined by numerical experiments and we close with a brief overview of future plans.

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Session Classification: Contributed talks

Track Classification: Users' track