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High-Order Hybridized Discontinuous Galerkin (HDG) method and a Multigrid solver for Magnetohydrodynamic (MHD) Applications

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In this talk we will present a high-order hybridized discontinuous Galerkin (HDG) method and an efficient solver for MHD systems. The advantages of high-order HDG methods over DG methods is that they have much less globally coupled degrees of freedom when combined with implicit time integration schemes. The coupled unknowns are only the hybrid variables introduced on the skeleton of the mesh, which for high-order is much less compared to the total volume unknowns. Here we will present a multi-grid approach defined entirely on the skeletal system (hence least number of unknowns) and demonstrate its scalability. Multigrid solvers on the skeletal system represent difficulty because of the non-nested nature of the grids i.e. new edges appear on refinement which does not have parents from the previous level. With examples from incompressible and compressible MHD systems we will show the effectiveness and scalability of the multigrid solver.