Multigrid algorithms for high-order Discontinuous Galerkin discretizations

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We present W-cycle multigrid algorithms for the solution of the linear system of equations arising from a wide class of *hp*-version discontinuous Galerkin discretizations of elliptic problems. Starting from a classical framework in multigrid analysis, we define a smoothing and an approximation property, which are used to prove the uniform convergence of the W-cycle scheme with respect to the granularity of the grid and the number of levels. The dependence of the convergence rate on the polynomial approximation degree p is also tracked, showing that the contraction factor of the scheme deteriorates with increasing p. A discussion on the effects of employing inherited or non-inherited sublevel solvers is also presented. Numerical experiments confirm the theoretical results.