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p-adaption for compressible flow problems using a goal-based error estimator DIRK EKELSCHOT, DAVID MOXEY, JOAQUIM PEIRO, SPENCER SHERWIN, Imperial Coll — We present an approach of applying p-adaption to compressible flow problems using a dual-weighted error estimator. This technique has been implemented in the high-order h/p spectral element library Nektar++. The compressible solver uses a high-order discontinuous Galerkin (DG) discretization. This approach is generally considered to be expensive and that is why the introduced p-adaption technique aims for lowering the computational cost while preserving the high-order accuracy and the exponential convergence properties. The numerical fluxes between the elements are discontinuous which allows one to use a different polynomial order in each element. After identifying and localizing the sources of error, the order of approximation of the solution within the element is improved. The solution to the adjoint equations for the compressible Euler equations is used to weigh the local residual of the primal solution. This provides both the error in the target quantity, which is typically the lift or drag coefficient, and an indication on how sensitive the local solution is to the target quantity. The dual-weighted error within each element serves then as a local refinement indicator that drives the p-adaptive algorithm. The performance of this p-adaptive method is demonstrated using a test case of subsonic flow past a 3D wing geometry.

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