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On the use of instantaneous versus averaged quantities for error-based *p*-adaptive simulation of turbulent flows

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Static grid adaptation can be efficiently applied to reduce the computational cost of unsteady-flow simulations in configurations for which the spatial resolution requirements do not vary significantly over time. This is the case for statistically steady or periodic turbulent flows. A static adaptive algorithm requires the computation of a time-independent refinement indicator from the time-dependent solution. For this purpose, error indicators derived for adaptive steady-flow simulations are often extended to unsteady problems. Possible approaches include the application of error estimation techniques to one or more snapshots of the unsteady solutions, the use of time-averaged error estimates or the computation of refinement indicators from the mean flow solution (e. g. [1, 2, 3]).

In this work, the effect of three different approaches is investigated for the development of a static p-adaptive algorithm in the discontinuous Galerkin solver *Aghora* [4]. The employed error estimation strategy is based on the energy of the highest-order modes of the solution and acts as a discretization-error estimate [5]. This error estimator is computed either from the mean flow or from instantaneous solutions. In the latter case, two approaches are derived by considering either the maximum or the time-averaged error fields.

The performance of the derived static refinement algorithms is assessed by performing DNS simulations of the turbulent flow over periodic hills at $\mathrm{Re}_b = 2800$ [4].

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