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# Towards the development of an h-p-refinement strategy based upon error estimate sensitivity

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## Abstract

The use of (*a posteriori*) error estimates is a fundamental tool in the application of adaptive numerical methods across a range of fluid flow problems. Such estimates are incomplete however, in that they do not necessarily indicate where to refine in order to achieve the most impact on the error, nor what type of refinement (for example h-refinement or p-refinement) will be best. This paper extends preliminary work of the authors (Comm. Comp. Phys., 7, 631-638, 2010), which uses adjoint-based sensitivity estimates in order to address these questions, to include application with p-refinement to arbitrary order and the use of practical *a posteriori* estimates. Results are presented which demonstrate that the proposed approach can guide both the h-refinement and the p-refinement processes, to yield improvements in the adaptive strategy compared to the use of more orthodox criteria.

*Keywords:* mesh adaptivity, error estimation, discrete adjoint

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