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Advancing spectral/hp element high fidelity simulation of incompressible and compressible flows

Spencer Sherwin[1]

[1] Department of Aeronautics, Imperial College London, UK

E-mail: s.sherwin@imperial.ac.uk

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1. Introduction

Advanced high order methods using Spectral/hp element discretization [1] including Galerkin, Discontinuous Galerkin (DG) and Flux Reconstruction (FR) formulations are gaining notable interest in both the academic and industrial sectors. The compact nature of the approach is not only attractive from the perspective of implementation on modern computational hardware but also provides a consistent geometric and spatially localized accuracy unlike many high order finite volume methods. These features make the methodology attractive in complex geometry flows involving transitional and turbulent boundary layers demanding a high level of accuracy for high end engineering applications that commonly arise in the automotive and aeronautical sectors.

In this presentation, we will present our current work on developing and advancing spectral/hp element incompressible and compressible flow solvers for industry relevant, high-fidelity applications [2]. The demands of handling "industrial strength" complex geometries at high Reynolds numbers presents a number of challenges both in terms high order mesh generation [2], stabilization of marginally resolved flows [3,4] and maintaining computational efficiency. In this presentation we will highlight our on-going efforts to address all these challenges and demonstrate the suitability of the approach for a number of representative examples.

References

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