NAFEMS UK Regional Conference 2018 - Abstract Submission

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Please identify the event for which your submitting?	NAFEMS UK Conference 2018
Will you be the presenting author?	Yes
Presentation Title	TOWARDS INDUSTRIAL LES USING HIGH ORDER DISCONTINOUS GALERKIN METHOD
Relevant Themes / Keywords	HPC, DES, LES, High Order Methods, Discontinuous Galerkin, Flux Reconstruction

Abstract (plain text)	Solving the unsteady compressible Navier-Stokes (NS) equations is a powerful method to investigate acoustic characteristics of fluid flows. A large overlap exists between methods involved in Computational Aeroacoustics (CAA) and those in traditional Computational Fluid Dynamics (CFD). In fact, sound generation and propagation phenomena are, in principle, already embodied in the fluid dynamics conservation equations, and can therefore, be resolved together with the flow evolution itself. The approach by which noise predictions are to be directly computed from accurate, scale-resolved CFD simulations is addressed in literature as Direct Noise Computation (DNC). Several industrial sectors continuously focus on improving the aerodynamic characteristics of various configurations for increased fuel efficiency and drag reduction. At both high and low speeds, the flow generated by various applications (automotive and aerospace), feature complex flow structures downstream of components such high lift configurations, cavities, mirrors and antennas. These structures lead to pressure wave propagation, turbulent fluid flow and multiple nonlinear interactions at different scales. Many of the design studies for external aerodynamics use CFD as a primary tool for investigation in order to reduce the cost when compared with the experimental data. With the latest advances in numerics, high order methods have become popular among scientists and engineers to investigate turbulent flows. The most widely used are the high order DG (Discontinuous Galerkin) based methods introduced for the first time by Reed and Hill (1973). FR, Huynh (2007), can be considered as a generalisation of many high order methods, including DG, and has been applied to solve the compressible Navier-Stokes equations (see Witherden et al. (2004)). In this work we present a potential candidate for addressing some of the issues related to the next generation of CFD solvers in targeting industrial LES at scale for external aerodynamics and aeroacoustic problems. The results are presented based on applications such as transonic cavity flows, vehicle mirrors and aircraft high lift configurations.
Please enter any additional comments or messages here	REFERENCES F. D. Witherden, A. M. Farrington and P. E. Vincent (2004). PyFR: An Open Source Framework for Solving Advection-Diffusion Type Problems on Streaming Architectures using the Flux Reconstruction Approach. Computer Physics Communications, Vol. 185, pp. 3028–3040 H. T. Huynh (2007). A Flux Reconstruction Approach to High-Order Schemes Including Discontinous Galerkin. 18th AIAA Computational Fluid Dynamics Conference, 2007. AIAA 2007-4079. Reed W. H. and Hill T. R. (1973). Triangular mesh methods for the neutron transport equation. Technical Report LA-UR-73-479. Los Alamos National Laboratory
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