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CAN A MESH OPTIMISED FOR STEADY FLOW CATER TO UNSTEADY FLOW SIMULATIONS?

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Edge-based second-order finite volume schemes [1], extensively used in industry for external flow simulations, yield to satisfactory solutions for steady problems. Using the same mesh for unsteady cases would result in a failure to resolve transient flow features such as vortices and gust with high fidelity. This is due to excessive dissipation in coarser elements located away from aerodynamic configuration where mesh refinement is prohibitively expensive.

High–order methods developed in recent years (e.g. discontinuous Galerkin) offer advantages such as low dissipation, efficient higher resolution with variable order approximation. The bottleneck for the routine application of higher-order methods in industry is the lack of a robust and efficient high–order meshing strategies that can accurately represent complex aerodynamic configurations.

The proposed method works to retain the advantages of low and high–order schemes by combining finite volumes and the Hybridisable Discontinuous Galerkin (HDG) method [2, 3]. Elements close to the boundary of the aerodynamic body are solved using a vertex–centred finite volume scheme and the HDG method is used for elements further away. The efficiency of the scheme is demonstrated by comparing the results of the combined scheme to that of finite volumes for gust propagation phenomenon.

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