Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Towards a hypersonic strand/Cartesian adaptive mesh refinement solver CHAY ATKINS, RALF DEITERDING, Univ of Southampton — High resolution in the boundary layer and shock region is required to obtain accurate heating results from Computational Fluid Dynamic simulations of hypersonic vehicles. Manually creating a suitable mesh often becomes a bottle neck, especially if the shape of the vehicle changes, due to ablation, flexible heat shields, or moving components. In this work, a hypersonic strand/Cartesian AMR solver has been developed to enable automated mesh generation around hypersonic vehicles. In a strand/Cartesian AMR solver, the strand mesh technique is used to create a high-quality mesh in the near-body region, which adequately resolves the boundary layer. Cartesian AMR techniques are used in the off-body region, highly resolving off-body shock structures, and the two regions are joined by overset algorithms.
An existing Cartesian AMR solver has been extended to incorporate the two-temperature model, and to enable mapped body-fitted simulations. Strand mesh and overset algorithms have been developed to create the mapped mesh and join the domains, respectively. Verification and validation results from the two individual solvers and the combined solver indicate that the strand/Cartesian AMR method could alleviate the meshing bottlenecks encountered when modelling hypersonic vehicles.

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Date submitted: 03 Aug 2020 Electronic form version 1.4