"Coupling of a compressible vortex particle-mesh method with a near-body compressible discontinuous Galerkin solver"

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Abstract

A hybrid approach, coupling a compressible vortex particle-mesh method (CVPM, also with ecient Poisson solver) and a high order compressible discontinuous Galerkin Eulerian solver, is being developed in order to eciently simulate flows past bodies; also in the transonic regime. The Eulerian solver is dedicated to capturing the anisotropic flow structures in the near-wall region whereas the CVPM solver is exploited away from the body and in the wake. An overlapping domain decomposition approach is used. The Eulerian solver, which captures the near-body region, also corrects the CVPM solution in that region at every time step. The CVPM solver, which captures the region away from the body and the wake, also provides the outer boundary conditions to the Eulerian solver. Because of the coupling, a bound- ary element method is also required for consistency. The approach is assessed on typical 2D benchmark cases.

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Coupling of a compressible vortex particle-mesh method with a near-body compressible discontinuous Galerkin solver PHILIPPE PARMENTIER[1], GREGOIRE WINCKELMANS, PHILIPPE CHATELAIN, Universite catholique de Louvain (UCL) - Institute of Mechanics, Materials and Civil Engineering (iMMC), KOEN HILLEWAERT, Cenaero — A hybrid approach, coupling a compressible vortex particle-mesh method (CVPM, also with efficient Poisson solver) and a high order compressible discontinuous Galerkin Eulerian solver, is being developed in order to efficiently simulate flows past bodies; also in the transonic regime. The Eulerian solver is dedicated to capturing the anisotropic flow structures in the near-wall region whereas the CVPM solver is exploited away from the body and in the wake. An overlapping domain decomposition approach is used. The Eulerian solver, which captures the near-body region, also corrects the CVPM solution in that region at every time step. The CVPM solver, which captures the region away from the body and the wake, also provides the outer boundary conditions to the Eulerian solver. Because of the coupling, a boundary element method is also required for consistency. The approach is assessed on typical 2D benchmark cases.

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