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Title

A local unstructured re-meshing technique for handling multi-body separation in 2D flows.

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Abstract

The aerodynamic analysis of separating/colliding bodies represents one of the most challenging problems for the design of rockets, airplanes and store separation systems, due to the presence of moving bodies within the computational domain. We propose a development of the mesh generation technique in Ref. [1] based on localised re-meshing in order to compute viscous/inviscid 2D flows featuring multi-body separation. In the presented technique, a body-fitted, unstructured grid, herafter called "movable grid", is created for each moving body: this mesh moves over a fixed, background triangulation that covers the entire computational domain. At each time-step, we insert the movable grid within the background mesh by using a newly implemented point-in-polygon algorithm, that temporarily removes the background mesh nodes overlapped by the movable grid. Then, local re-meshing is applied only in the neighbourhood of the outer boundary of the movable grid, constraining this boundary to be a part of the final tessellation: by doing so, the two meshes are merged without overlapping regions, thus ensuring lower interpolation errors between the two grids with respect to most common overset methods. It is of paramount importance especially when viscous flows are considered: indeed, during the early stage of multi-body separations, grids overlapping in boundary layers regions can determine high numerical errors in evaluating aerothermal loads on bodies walls. In the full paper, we will describe the algorithmic details of the proposed technique and we will present different test-cases concerning multi-body separation in 2D inviscid/viscous flows.

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