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AN UNSTEADY SHOCK-FITTING TECHNIQUE FOR UNSTRUCTURED GRIDS

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In recent years [1] the authors have developed a novel unstructured, shock-fitting algorithm capable of simulating 3D supersonic steady flows. The fitted shocks are treated as boundaries of zero thickness that are free to move throughout a triangular / tetrahedral mesh that covers the entire computational domain and locally adapts to follow the shock motion. On the contrary, in the smooth regions of the flow-field the governing PDEs are solved by an unstructured, shock-capturing solver [2].

The aforementioned methodology is being further developed to make it capable of dealing with un-steady flows; this requires upgrading both the shock-capturing solver and the shock-fitting algorithm. Concerning the former, it has been necessary to make the flow solver capable of working in an Arbitrary Lagrangean Eulerian (ALE) setting. This is because the cells that about on a fitted discontinuity are not fixed in space, but move with the shock speed. Concerning the shock-fitting algorithm, two new ingredients are required: i) the order of accuracy of the shock speed calculation has to be raised to second order in time and ii) the shock-fitting algorithm must be capable of dealing with changing flow topologies, such as those that occur when a shock meets another shock or a solid wall. On the one hand, the former issue can be easily addressed by using a simple predictor-corrector computational scheme. On the other hand, the capability of automatically identifying changing topologies is not trivial and mostly un-explored. In recent work [3], the authors have started investigating the use of fuzzy logic and algorithms originally developed in image analysis to accomplish this task.

In the oral presentation and in the full paper the authors will report on the progress in the development of this new technique showing representative simulations of two-dimensional flows featuring moving and/or coalescing shocks.

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