Abstract Submitted
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A Hardware Accelerated Unstructured Overset Method to Simulate Turbulent Flows[1] WYATT HORNE, KRISHNAN MAHESH, University of Minnesota — A numerical method is presented which can effectively use graphic processing units (GPUs) to simulate moving bodies in incompressible turbulent fluid flow. The method is an unstructured overset method where unstructured overset meshes are attached to individual bodies and connected throughout the flow domain to produce a single domain solution through an overset assembly process. Efficient algorithms from real-time ray-tracing and collision detection are used to accelerate the overset assembly process, producing O(100x) speed-up for core assembly operations. A novel method to simulate turbulent fluid flow is presented which uses domain over-decomposition to allow asynchronous calculation of the steps of the method while simultaneously overlapping GPU data transfer and calculations. A pressure regularization based on artificial compressibility is used with mixed precision linear solvers to provide optimal performance while maintaining desired accuracy. Timings and results are shown for canonical cases demonstrating the methods accuracy and effectiveness when using GPUs. A maximum of 80x speed-up is found when compared to a benchmark overset solver for large cases.

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Wyatt Horne
University of Minnesota

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