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A GPU Accelerated Filtered Density Function Discontinuous Galerkin Large Eddy Simulator

## Abstract:

A new GPU accelerated solver is presented and utilized for large eddy simulation (LES) of turbulent reacting flows. In this solver the effects of chemical reactions are modelled via the filtered density function (FDF) model. The base filtered transport equations are approximated via discontinuous Galerkin (DG) scheme and the FDF transport equation is solved numerically by Lagrangian Monte Carlo (MC) scheme. Computational performance tests show that the GPU algorithm can outperform the sequential CPU algorithm by factors of 156 and 212 times for DG and MC procedures, respectively. The consistency and the overall performance of the solver, and the realizability of the simulated results are demonstrated by LES of a temporally developing mixing layer under both non-reacting and reacting conditions. This brings LES of turbulent flows to a new level, facilitating efficient simulation of more complex turbulent flows.