A new combined DG-MC solver for large eddy simulation of reacting turbulent flows

Medet INKARBEKOV [1], Aydyn AYTZHAN [1], Aidarkhan KALTAYEV [1]

[1] *Institute of Mathematics and Mechanics*
Al-Faraby Kazakh National University, Kazakhstan
E-mail: inkarbekovm@gmail.com

Abstract: In the presented article, a new computational methodology is developed and implemented to simulate turbulent reacting mixing layers of two opposite parallel flows. The large eddy simulation (LES) approach and the methodology named â€œfiltered density functionâ€İ (FDF) are used for turbulence modelling. In the FDF methodology, the effects of the unresolved scalar fluctuations are taken into account by considering the probability density function of subgrid scale scalar quantities. A big advantage of the methodology is that in the FDF transport equation the effect of chemical reactions appears in a closed form. The base filtered transport equations are solved numerically by a Discontinuous Galerkin (DG) method. The FDF transport equation is solved by a particle based lagrangian Monte-Carlo (MC) method. The power of DG methods is that it can provide high order accuracy with fewer degrees of freedom. It is shown that the developed DG-MC solver is a powerful tool for large eddy simulation of reacting turbulent flows.

Throughout this note we use techniques from the works [1], [2].

Keywords: : turbulence, filtered density function, large-eddy simulation, Monte Carlo method, discontinuous Galerkin methods

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