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A multivariate quadrature based approach for LES based supersonic combustion modeling[1] PRATIK DONDE, HEESEOK KOO, VENKAT RAMAN, The University of Texas at Austin — The direct quadrature method of moments (DQMOM) was developed to solve high-dimensional probability density function (PDF) equations that arise in the description of turbulent combustion. This method is particularly useful in shock-containing supersonic internal flows such as those encountered in scramjet engines. In the DQMOM approach, the PDF is described in terms of a finite number of weighted delta functions whose weights and locations in composition space are obtained by solving specific transport equations. Since this approach is fully Eulerian in nature, it is advantageous compared to conventional Lagrangian methods used for solving the PDF transport equation. However, implementation of this formulation in the context of the large eddy simulation (LES) methodology leads to large numerical errors. For instance, the high-resolution numerical schemes used in LES lead to non-realizable and diffusive evolution of the DQMOM equations. Here, we propose a novel semi-discrete quadrature method of moments (SeQMOM) that overcomes this problem. A decoupling procedure is used to extend this method to multivariate PDF descriptions. The numerical implementation in LES as well as validation exercises will be presented.

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