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A robust semi-discrete quadrature-based moment method for solution of Boltzmann equation PRAKASH VEDULA, University of Oklahoma — We present an efficient and robust semi-discrete quadrature-based moment method (sDQMOM) for solution of the Boltzmann equation with the full collision operator, for prediction of nonequilibrium flows in the rarefied thru continuum regimes. In the sDQMOM formulation, the distribution function is represented by a set of delta functions with associated weights and locations, whose evolution is determined by semi-discrete equations obtained from evolution of macroscopic moment equations in conservative form, where spatial fluxes of moments are evaluated using appropriate flux limiters. Based on this representation of the distribution function, the generalized moment production terms due to full collision operators can be evaluated analytically using multinomial expansions that ensure preservation collision invariants and correct rates of evolution of selected low order moments. It appears that sDQMOM also addresses some previously encountered limitations of quadrature-based moment methods arising from discontinuities and the ill-posed problem of moment inversion. To ensure realizability and robustness, an automatic and adaptive moment constraint selection algorithm for sDQMOM is also proposed based on orthogonal polynomials with a discrete support. Prediction capabilities of sDQMOM are demonstrated via good agreement between sDQMOM and other approaches for Poiseulle flow and shock tube problem.

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