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Realizable High-Order Finite-Volume Schemes for Diffusion in Quadrature-Based Moment Methods RODNEY O. FOX, VARUN VIKAS, Z.J. WANG, Iowa State University — Population balance equations (PBEs) can be reformulated in terms of the moments of the distribution function and a quadrature-based moment method (QBMM) can be used to solve them. The success of the QBMM is based on a moment-inversion algorithm that does not work if the moments are non-realizable. For convection terms, the authors have shown that when using a finite-volume approach, a moment-based cellwise reconstruction may lead to non-realizable schemes and hence a reconstruction based on weights and abscissas should be used instead. However, researchers working with diffusive PBEs have not reported realizability problems when using cellwise moment-based reconstruction. This work shows that when moment-based reconstruction with a 2^{nd}-order finite-volume scheme is used, realizability is automatically guaranteed by the satisfaction of Courant-Friedrichs-Lewy (CFL) condition. However, for any high-order finite-volume schemes, a moment-based reconstruction may fail to guarantee realizability. We present high-order realizable schemes based on reconstruction of weights and abscissas. These new schemes give a better performance for a certain class of diffusive PBE problems. Realizability conditions are also presented for a general unstructured mesh.

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