Convergence Behavior of Bird’s Sophisticated DSMC Algorithm
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— Bird’s standard Direct Simulation Monte Carlo (DSMC) algorithm has remained almost unchanged since the mid-1970s. Recently, Bird developed a new DSMC algorithm, termed “sophisticated DSMC”, which significantly modifies the way molecules both move and collide. The sophisticated DSMC algorithm is implemented in a one-dimensional DSMC code, and its convergence behavior is investigated for one-dimensional Fourier flow, where an argon-like hard-sphere gas is confined between two parallel, motionless, fully accommodating walls with unequal temperatures. As in previous work, the primary convergence metric is the ratio of the DSMC-calculated thermal conductivity to the theoretical value. The convergence behavior of sophisticated DSMC is compared to that of standard DSMC and to the predictions of Green-Kubo theory. The sophisticated algorithm significantly reduces the computational resources needed to maintain a fixed level of accuracy. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.

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