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Normal Solutions of the Boltzmann Equation for Fourier and Couette Flow J.R. TORCZYNSKI, M.A. GALLIS, D.J. RADER, Sandia National Laboratories — Bird's Direct Simulation Monte Carlo (DSMC) method is used to simulate Fourier flow (uniform heat flux) and Couette flow (uniform shear stress) for highly nonequilibrium conditions. The gas is confined between two parallel, fully-accommodating walls at unequal temperatures with opposite tangential velocities. For small system Knudsen numbers, the solution is normal in the central region of the domain (outside the Knudsen layers). For small heat-flux Knudsen numbers, the normal solution exhibits Chapman-Enskog (CE) behavior. More specifically, excellent agreement is observed between the DSMC and CE thermal conductivity, viscosity, and Sonine-polynomial coefficients of the molecular velocity distribution function. At larger heat-flux Knudsen numbers, the normal solution systematically departs from the CE solution. Under these conditions, the DSMC results for Maxwell molecules are in excellent agreement with the exact solution of Santos and co-workers, and the DSMC results for hard-sphere molecules exhibit similar trends. 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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