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Characteristics Based Boundary Conditions for 3D Unstructured DSMC Simulations SERGEY AVERKIN, NIKOLAOS GATSONIS — The theoretical and algorithmic framework of a characteristic-based method for subsonic boundary conditions suitable to the Direct Simulation Monte Carlo (DSMC) is presented. This method is based on the local one dimensional inviscid (LODI) formulation used in compressible (continuous) flow computations. The method is implemented in an unstructured 3D DSMC (U3DSMC) code and is supplemented with a neighboring-cell sampling approach and a time-average smoothing technique to speed convergence and reduce fluctuations. Simulations of a pressure-driven subsonic flow in a circular tube are used for verification and validation of the boundary condition method. The length and the radius of the tube are 0.02m and 0.001m respectively. The inlet surface is specified with a fixed pressure 300Pa and a number density 7.2464e+22 m^{-3} and the outlet surface is specified with a fixed pressure 150Pa. The corresponding Knudsen number at the inlet is 0.1786 and at the exit 0.3572 covering the transitional rarefied flow regime. The sidewall is modeled as a diffuse surface with full accommodation to a temperature of 300K. The average inlet Mach number is 0.156. Local error estimates are compared with theoretical predictions. The numerical results are in good agreement with theoretical and experimental results.

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