Cross Section Specific Collision Probability Techniques for DSMC ROBERT TERRY, Enig Associates — In direct simulation Monte Carlo (DSMC) methods the probability of collision, or equivalently the collision frequency, as a function of CM closing speed is a central quantity in choosing collision sample pairs. The calibration of DSMC parameters is also tied to this quantity through the linkage of viscosity's temperature variation and the high velocity dependence of the cross section. A common simplification in the selection of collision pairs is to recalibrate this collision frequency parameter to be bounded above by the largest closing speed seen in the DSMC microstate. Such a practice is neither necessary nor without consequence. Here is developed a new method tied to the full range of closing speeds and the adopted model (or even precisely represented) cross section for the binary channel of interest. By scaling out the ensemble average collision frequency, the local value then sets a relative collision probability on the full speed range. The collision frequency integrals for common cross section models are easily evaluated and a numerical inversion then establishes the appropriate collision probability for any value of closing speed. When a conventional method DSMC calculation is interrogated as to the temperature dependence of viscosity, the power law rule that is the basis of the model molecular diameter is not reproduced. The implications for this problem using the new method are reported.

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