Weighting and Numerical Heating in Unstructured 3d PIC Simulations

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A three-dimensional particle in cell/direct simulation Monte Carlo (PIC/DSMC) code was developed on unstructured tetrahedral Delaunay grids. Momentum conserving schemes are used for particle-to-grid weighting and force interpolation. The leapfrog integration scheme is used for the charged-particle equations of motion. Solution of Poisson's equation is obtained with the GMRES technique and the discretization uses the favorable characteristics of the Delaunay-Voronoi grid.

We present issues related to numerical heating in unstructured 3-D PIC. Linear and NGP weighting schemes are considered. A parametric numerical investigation examines the effects of the weighting schemes and time steps on heating time.

As means for validation suddenly of the methodology, expanding plasma flows are simulated. Results are compared with known analytical solutions and previous computational works.