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Improvement of the Gyocenter-Gauge (G-Gauge) algorithm ZHI YU, Institute of Plasma Physics, Chinese Academy of Sciences, HONG QIN, University of Science and Technology of China and Princeton University — The gyrocenter-gauge (g-gauge) algorithm was improved to simulate rf waves propagating in the three-dimensional sheared magnetic field. The conventional local gyro-center coordinate system $(X, Y, Z, \mu, \theta, u)$ is constructed on the local magnetic field. When particle travel in a sheared magnetic field, the coordinates of particles must be transformed between different local coordinate systems. To avoid these transformation, a new geometric approach is developed to construct a global Cartesian gyro-center coordinate system (X, Y, Z, v_x, v_y, v_z), where (X, Y, Z) is the coordinate of the gyrocenter, and (v_x, v_y, v_z) is the velocity of particle. In the g-gauge theory, the perturbation of distribution function, is obtained from the Lie derivative of gyro-center distribution function F along the perturbing vector field G. The evolution of the first order perturbed distribution contains a term $L_\tau L_G F = L_{[\tau,G]} F$, where τ is the Hamilton vector field of unperturbed world-line of particles. It is proved that vector field $[\tau, G]$ may be directly solved from the electromagnetic fields. In the improved algorithm, $L_G F$ is calculated by integrating along the unperturbed world-line. The improved g-gauge algorithm has been successfully applied to study the propagation and evolution of rf waves in three-dimensional inhomogeneous magnetic field.

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