

Nested grid method for particle simulation

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Co-existence of two plasma components with high density contrast is sometimes found in space plasma. In particular, considering the spacecraft-plasma interaction, the density ratio of plasma emitted from spacecrafts, such as ion beams from electric propulsion systems, photo-electrons, etc., to natural plasma is quite large. We are interested in how natural plasma is affected by artificial plasma, e.g. spacecraft charging, plasma heating, etc., so that plasma kinetic process cannot be ignored to investigate the spacecraft-plasma interaction problems. However, since the time step and the cell size of the kinetic simulation is restricted by the plasma frequency and the Debye length, necessary computational resources are determined by the parameters of the high density region, even when the high density part is confined in a small region of the entire simulation box. To avoid this technical difficulty, we applied the nested grid method to the plasma particle simulation. With the nested grid method, proper time and spatial resolution can be selected depending on the density of each simulation region, and, as a result, the computational resources can be saved. Although the adaptive mesh refinement technique is necessary for general purposes, the nested grid method is useful since global density distribution does not change so much in many situations of interests. In this presentation, we will present a result of some basic tests of the nested grid method for particle simulation.