3-D Simulations of NSTAR Ion Thruster Plasma Interactions

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We describe a ParLicle-in-Cell with Monte Carlo Collision (PI C-MCC) code developed to perform detailed three-dimensional (3-D) ion thruster simulations. To capture the full kinetic behaviour of ion thruster plumes, both the electrons and ions are treated as test particles. The orbits of individual test particles arc followed in the self-consistent electric field. A Monte Carlo collision model is incorporated to calculate the charge-exchange collisions within the thruster plume and electron ionization collisions surrounding the neutralizer. A nonorthogonal grid is utilized for handling complex geometry. The code runs on the 256 processor Cray T3D parallel supercomputer, and is easily portable to other parallel platforms. We discuss simulation results of the NSTA R ion thruster under ground test and in space conditions. We compare numerical results with that from ground tests at JP1 ,. We present assessments of the effects of NSTAR thruster on the host spacecraft.