

Numerical Simulations of Positively-Biased Probes and Dielectric-Conductor Disks in a Plasma

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A cylindrical particle-in-cell (PIC) plasma simulation code applicable to plasma densities encountered in low Earth orbit (LEO) has been refined. The basic configuration simulated consists of a conductor, partially covered with dielectric material, placed upon a conducting ground plate. The plasma is Maxwellian for both ions and electrons at large distances. Current vs. voltage curves have been computed by following in time a randomly loaded initial system in which the conductor was held at a specific voltage. The resulting time stationary state is identified as the solution of the boundary value problem. These results have been compared to experimental values-showing quantitatively correct behavior. Techniques allowing the simulation of dielectric charging using PIC time scales are discussed. A method of simulating large ion to electron mass ratios by moving the ions once every n time steps, where n is the square root of the desired mass ratio, has been developed. Enhanced diagnostics have allowed a more detailed study of the plasma behavior near the conductor (hole) and dielectric.