Numerical Simulation of a Disk-Shaped Accelerating Electrostatic Probe

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This paper presents a method utilizing the numerical plasma simulation particle-in-cell technique for studying electron accelerating probe characteristics. A probe configuration other than the commonly used plane, cylindrical, or spherical case will be studied; the probe configuration used is that of a disk. Both static and dynamic characteristics are considered. Cylindrical geometry is used in the simulation model.

The structure of the simulation model as a whole is described and unique features of the model are examined in detail (Chapter 2). Tests of the simulation model are studied in Chapter 3. Static probe characteristics (Chapter 4) and dynamic probe characteristics (Chapter 5) are then presented. One of the advantages of a numerical simulation is the ease with which the details of the system can be examined. Therefore, in addition to the current-voltage characteristics of the static probe and resonance curves for the dynamic probe (which are quantities often determined experimentally), many other kinds of results are also presented. These include plots of the time evolution of the plasma properties, studies of the sheath region surrounding the probe, and for the dynamic probe, studies of field penetration into the plasma.