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Development of an Arbitrary Curvilinear-Coordinate PIC Code
CHRIS FICHTL, UNM/Los Alamos National Laboratory, JOHN FINN, GIAN LUCA DELZANNO, Los Alamos National Laboratory — We are developing an innovative new PIC code that couples a grid generation strategy to the standard PIC algorithm. This approach is very beneficial for studies of small objects immersed in plasmas. Standard PIC codes model curved surfaces with a stair-stepping technique, which highly distorts the shapes of small objects. This can become quite problematic when calculating forces on the surface of the object. Our grid generation strategy conforms to objects of arbitrary shape, eliminating such problems as stair-stepping along curved boundaries, and thus allows us to simulate complicated physical structures very accurately. Furthermore, we have developed a semi-implicit particle mover for based on a generalization of the leapfrog method to arbitrary (including nonorthogonal) grids. We show our mover to be symplectic and thus it preserves phase-space area exactly. Extensive testing has shown that it also conserves energy to high accuracy. Our new code is validated using OML charging theory for spherical and cylindrical dust grains. Further tests include the charging of an electron-emitting dust grain in a uniform plasma. The final goal is to study the forces between two emitting grains of like charge.

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