GEC14-2014-020056

Abstract for an Invited Paper
for the GEC14 Meeting of
the American Physical Society

Richardson Extrapolation Based Error Estimation for Stochastic Kinetic Plasma Simulations[1]

KEITH CARTWRIGHT, Sandia National Laboratories

To have a high degree of confidence in simulations one needs code verification, validation, solution verification and uncertainty qualification. This talk will focus on numerical error estimation for stochastic kinetic plasma simulations using the Particle-In-Cell (PIC) method and how it impacts the code verification and validation. A technique Is developed to determine the full converged solution with error bounds from the stochastic output of a Particle-In-Cell code with multiple convergence parameters (e.g. Δt, Δx, and macro particle weight). The core of this method is a multi parameter regression based on a second-order error convergence model with arbitrary convergence rates. Stochastic uncertainties in the data set are propagated through the model usin gstandard bootstrapping on a redundant data sets, while a suite of nine regression models introduces uncertainties in the fitting process. These techniques are demonstrated on Flasov-Poisson Child-Langmuir diode, relaxation of an electro distribution to a Maxwellian due to collisions and undriven sheaths and pre-sheaths.

[1]Sandia National Laboratories is a multie-program laboratory managed and operated by Sandia Corporation, a wholly owned subisidiary of Lockheed Martin Corporation, for the U.S. DOE's National Nuclear Security Administration under contract DE-AC04-94AL85000