

Seminar

Institute for Plasma Research

Title : A new 3D PIC-MCC code for plasma device simulations - PEC3PIC

Speaker: Dr. Meghraj Sengupta
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Date : 22nd March 2018 (Thursday)

Time : 11.00AM

Venue : Committee Room 3, (New Building), IPR

Abstract :

In a recent Thesis [1], a PIC-MCC suite of codes in one and two dimensions were developed to address dynamics of non-neutral plasmas in 2D configurations. For the purpose of investigating neutral and non-neutral plasmas in realistic 3D traps, for eg a Stationary Plasma Thruster (SPT), it becomes necessary to include 3D effects. While in principle, upgrading a 2D code to 3D is just a simple inclusion of a third dimension, actual implementation and development of a working 3D code from a 2D code, has several obstacles which need to be worked around. The main obstacle being the geometric leap in the number of grid points from N^2 to N^3 . This makes a massive difference to the runtime, especially if the field solver is iterative over the grid points. In order to overcome this obstacle several new methods were tried such as upgrading the Poisson solver from Successive-Over-Relaxation (SOR) to a Multigrid Solver, adding an MPI parallelization over the existing OPEN-MP, GPU parallelization in CUDA Fortran, restructuring the PIC solver to implement the method of domain decomposition with MPI (OPEN-MP) parallelization. In the presentation, different technical aspects of each of these methods of the acceleration will be discussed, summarizing the acceleration method that was found to be most suitable for the code. A short glimpse of, the soon to be published results, obtained from the very recently conducted 3D numerical experiments on realistic plasma devices will also be presented along with a plan for the future work.

[1] Studies in non-neutral plasmas using particle-in-cell simulations , Thesis, Meghraj Sengupta, 2017
