Summary Report

Particle Mesh code for a set of charged particles under mutual electrostatic interaction. Poission equation is solved in 2D structured grid with overlapping rectangular blocks using jacobi method. The code is written in C. For message passing MPI is used. Specific dirichlet boundary conditions are maintained.

Equation solved: $\nabla^2 \Phi = c\rho$

Length of 2D domain= -1.00 to 1.00 in both X and Y direction.

Boundary conditions: left=-1,right=1

                     top bottom=(1-eta)*-1+eta*1

                     eta=(x-xmin)/(xmax-xmin);

Solution approach: Jacobi iteration

Grid used: 120X120

Mass of particle: 1

Charge of particles: 1,-1 assigned randomly.

No of particles in each domain: 10

Particles initialized randomly in each domain with zero velocities.

Total timestep solved: 98

Charge density (ρ) is calculated in each time step.

Array is used to communicate particles from one process to its neighboring process. If a particle goes out of scope that particle is discarded and another particle is initiated randomly in domain from where the particle went out of scope.

Partition Approach:

The following figure shows the partition approach
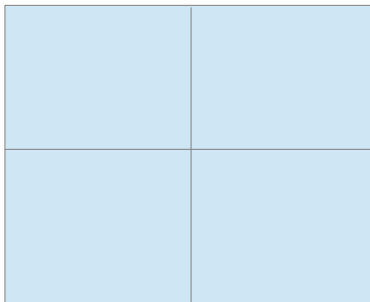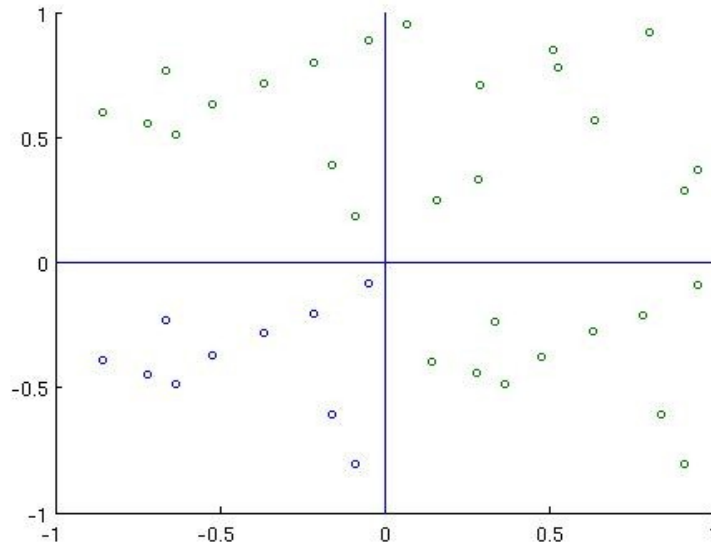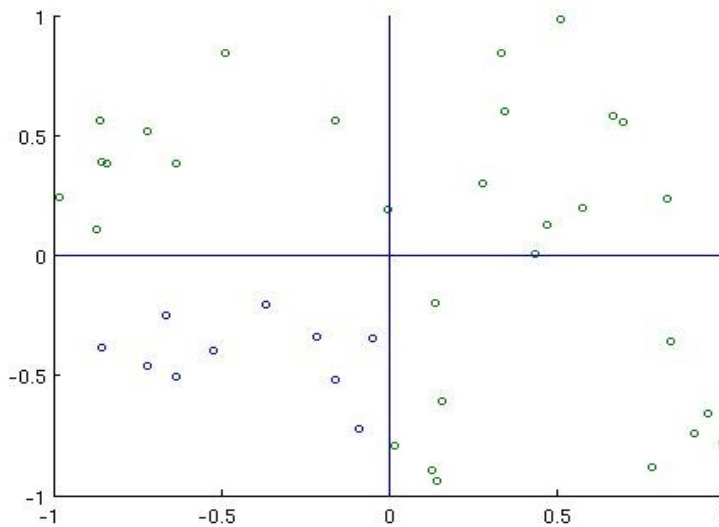

Figure 1: partition of the domain in different processes

Result:

(a) Initial location of particles

(b) particle location after 90 time steps

Figure 2. Results obtained from the solution.

The code was run in the gmice cluster however is was giving an error related to math.h. So it refused to compile over there. Afterwards, the code was ran in my personal laptop under debian ubuntu with gcc,icc compiler. The results presented are obtained from runs performed in my laptop.