PHY480 REPORT

1. Abstract

2. Introduction

In a system of N particles, the acceleration can be defined as,

Where, mass of the test particle

the unit vector along the direction of the distance vector

the modulus square of the distance between the bodies considered

The system of N particles is self-gravitating. These gravitational interactions affect the dynamical properties (position, velocity and acceleration) of the particles in the system. For N2 particles, an analytical solution can be obtained showing the evolution of these properties. Since we are considering stellar clusters as our system, where N2, numerical solutions are considered.

We can expand newton’s laws of motion to higher orders for the position, ***r*** and velocity, ***v****.*

Where,

3. Body

3.1 Literature review

3.2 Progress (WRITE ABOUT PROGRESS)

The initial work on the project was carried by constructing a simple second order code.

3.3 Project plan

At the start of week 1, the core part of the work in semester 2 begins with task1, i.e., building a basic fourth order predictor-corrector code. A time of 2-3 weeks is given for this task based on its difficulty. After forming the base, we require an adaptive timestep for the code (task 2). Depending on the errors obtained from the energy checks, the code either doubles or halves the timestep, *dt*. A similar amount of time of 3 weeks is assigned to this task. The two main components of the code are ready. This leads to task 3 of testing the code. The results obtained from these tests determine whether the code is working. For example, we should observe milankovic cycles when we produce the plot of the orbits of the planets in our Solar System.

Task 4 provides the motivation of writing this piece of code. We apply this code to any astrophysics problem (like late oligarchic phase of planet formation). Moreover, certain tweaks are added at this point to increase the speed of the code. With a time of 2 weeks, it overlaps with the easter break. Then we lead to the most important task 5, the write-up of the report. All the figures and results produced in tasks 3 and 4 are included in the report. Tasks 4 and 5 overlap at the beginning of easter break. A time of 3-4 weeks is assigned so that a draft of the final report can be submitted to the supervisor approximately two weeks before the deadline (17/05/2019). The final task involves in refining the report. Within a week the report is checked for any mistakes before the final submission.

4. Conclusion