Category: Algorithms and high-performance architectures with approach of astrophysics Escuela de física U.I.S
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N-BODIES PROBLEM

ABSTRACT

In physics, the question of the n-bodies problem tries to determine the individual movements of a group of material particles which constantly interact with the entire set of particles, therefore, the description of the movement of each body alters the description of the movement of the rest of the bodies and therefore the body itself again and so on. Originally, the problem was posed for a set of astronomical objects that mutually interact according to Newton's laws of universal gravitation. So in this poster we show you how to solve that problem numerically, using high-performance algorithms

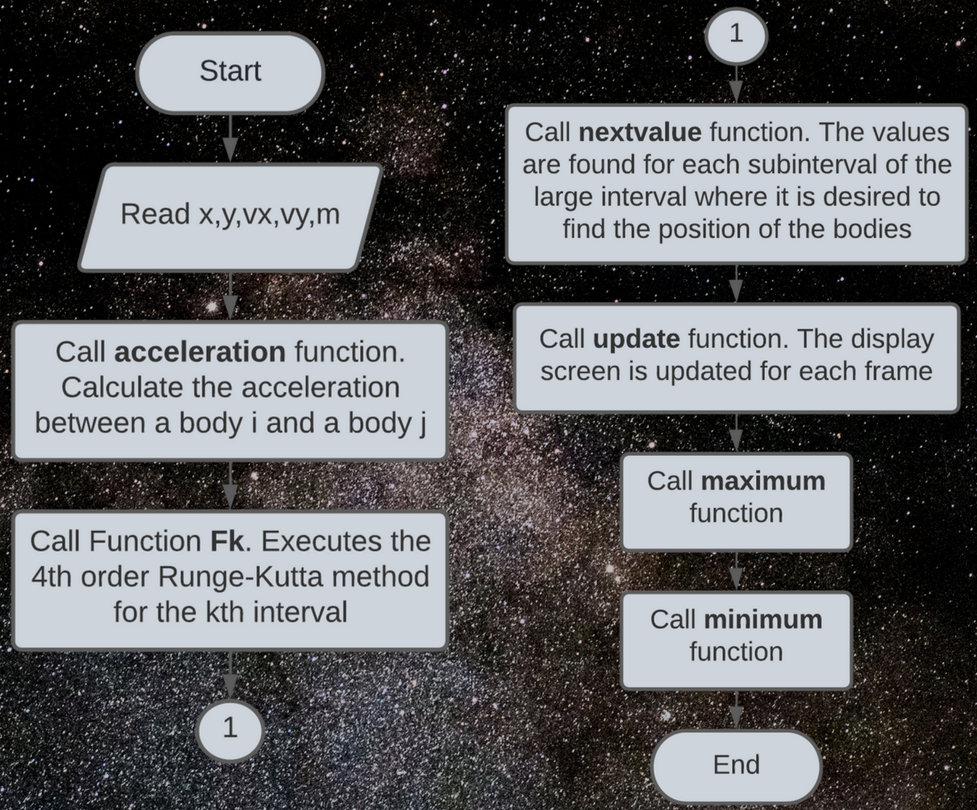
INTRODUCTION AND UTILITY

The motivation of the problem is that when it's solved, the motions of the Sun, the Moon, the planets and the visible stars, or in general any kind of n-bodies system that affects their motion among themselves, could be predicted.

Mathematical description of the selected method and its introduction into the N-bodies problem

The mathematical method selected was the Runge-Kutta method, which is a set of implicit and explicit iterative methods for the approximation of solutions of ordinary differential equations, specifically, the initial value problem. In that case consistent solutions were obtained for the case of a two-dimensional model of planetary orbits.

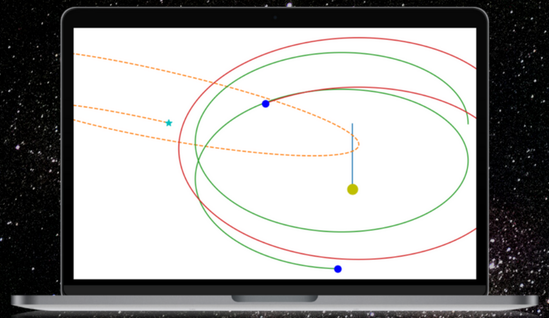
CODE'S FLOW CHART



PERFORMANCE ANALYSIS

The code without parallelization was analyzed based on the computation time given in this case of approximately 1 second, then it was compared by parallelizing and it was obtained that the time was approximately 0.3 seconds, this with approximately 6 bodies, however when it was done with 3 bodies, the fact of parallelizing did not show improvement in the computation time.

RESULTS



CONCLUSIONS

Results were obtained consistent with what was expected in the description of the motion of more than 2 celestial bodies. Allowing us to simulate the motion of the earth, the sun and an arbitrary commet. Also It was possible to analyze the problem with relative and non-relative motions to the system in general. The performance analysis allowed rendering the computation time by 70%.