CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
S0816

Project Title
Accuracy of Integration Schemes in Planet Trajectory Simulations

Abstract

Objectives/Goals
The objective of this study is to find the most accurate integration scheme using planet trajectory simulations.

Methods/Materials
Computer, Python Programming Language (VPython Library for Visualization and NumPy for Vector Operations), NASA JPL Ephemeris Interface.

Picked a start time, Got position, velocity, mass for the planets from NASA, Chose a timestep, duration, and a integration scheme, Ran the simulation, Found the simulated planet positions, Got actual planet positions from NASA, Compared the simulated and actual planet positions to get the errors.

Results
The Runge-Kutta and Verlet methods were more accurate than the Euler methods. These results tied to my research online and in book sources that the Runge-Kutta and Verlet integration schemes are far more accurate than the Euler integration schemes.

Conclusions/Discussion
Throughout many different timesteps and durations, it's evident that the Runge-Kutta integration methods and the Verlet integration methods were more accurate than the Euler integration methods. It's concluded that the Runge-Kutta and Verlet methods are far more accurate than the Euler methods.

Summary Statement
I created a computer program written in Python to test the accuracy of different integration schemes in planet trajectory simulations.

Help Received
My big brother, a computer scientist helped me with writing and teaching the visualization part of my code.