

Project 3 FYS4150

Kjetil Karlsen and Vilde Mari Reinertsen

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Abstract

The program used in this project can be found at [Github](#).

Test: Energy conservation, modulus "position" (lengde vektor) bevart Alle vectorer samme str.

Plan fredag:

Laste ned data NASA

Unit test: catch framework???

Printe + plotte energi stabilitet mellom euler og verlet.

Plotte forskjeller i initialhastigheter på systemet jord, sol, mars?

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1 Introduction

2 Theory

Sentrifugal: $a = \frac{v^2}{r}$.

We know that the earth needs one year to orbit the sun, meaning that $v = \frac{2\pi r}{1 \text{ year}}$. This can be rewritten with $v = \tilde{v}v_0$ and $r = \tilde{r}r_0$. The units of r and v are contained in $v_0 = \frac{1 \text{ Au}}{1 \text{ year}}$ and $r_0 = 1 \text{ Au}$, giving that $\tilde{v}^2 \tilde{r} = 4\pi^2$. In the same way $t = \tilde{t}t_0$, with $t_0 = 1 \text{ year}$.

$$a_E = \frac{F_E}{M_E} = -G \frac{M_{sun}}{r^2} \quad (1)$$

$$= \frac{v^2}{r} \quad (2)$$

$$GM_{sun} = v^2 r = 4\pi^2 \frac{(1 \text{ Au})^3}{(1 \text{ year})^2} \quad (3)$$

$$\frac{d\tilde{v}}{d\tilde{t}} = -\frac{4\pi^2}{\tilde{r}^2} \quad (4)$$

For the rest of the paper we will assume all variables to be dimensionless. In a two dimensional system $r = (x, y) = (r \cos \theta, r \sin \theta)$. This gives the following parametrized relations :

$$\frac{dv_x}{dt} = -\frac{4\pi^2 r \cos \theta}{r^3} = -\frac{4\pi^2 x}{r^3} \quad (5)$$

$$\frac{dv_y}{dt} = -\frac{4\pi^2 r \sin \theta}{r^3} = -\frac{4\pi^2 y}{r^3} \quad (6)$$

$$\frac{dx}{dt} = v_x \quad (7)$$

$$\frac{dy}{dt} = v_y \quad (8)$$

$$(9)$$

3 Method

4 Result

5 Discussion

6 Conclusion

References