Fys4150
Project 3

Peter Killingstad and Karl Jacobsen

https://github.com/kaaja/fys4150

October 7, 2017

Note to instructurs about Github repository

If the above Github-link does not work, it is eighter because you have not yet accepted our invite to the repository, or you have not yet provided us with an e-mail adress available at Github so that we can invite you. If the latter applies to you, please send us an e-mail with an e-mailadress available in Github or your Github username so that we can send you an invite. Our e-mailadresses: peter.killingstad@hotmail.com, karljaco@gmail.com.

Abstract

1 Introduction

2 Theory

3 Results

3.1 Sun-Earth Forward Euler

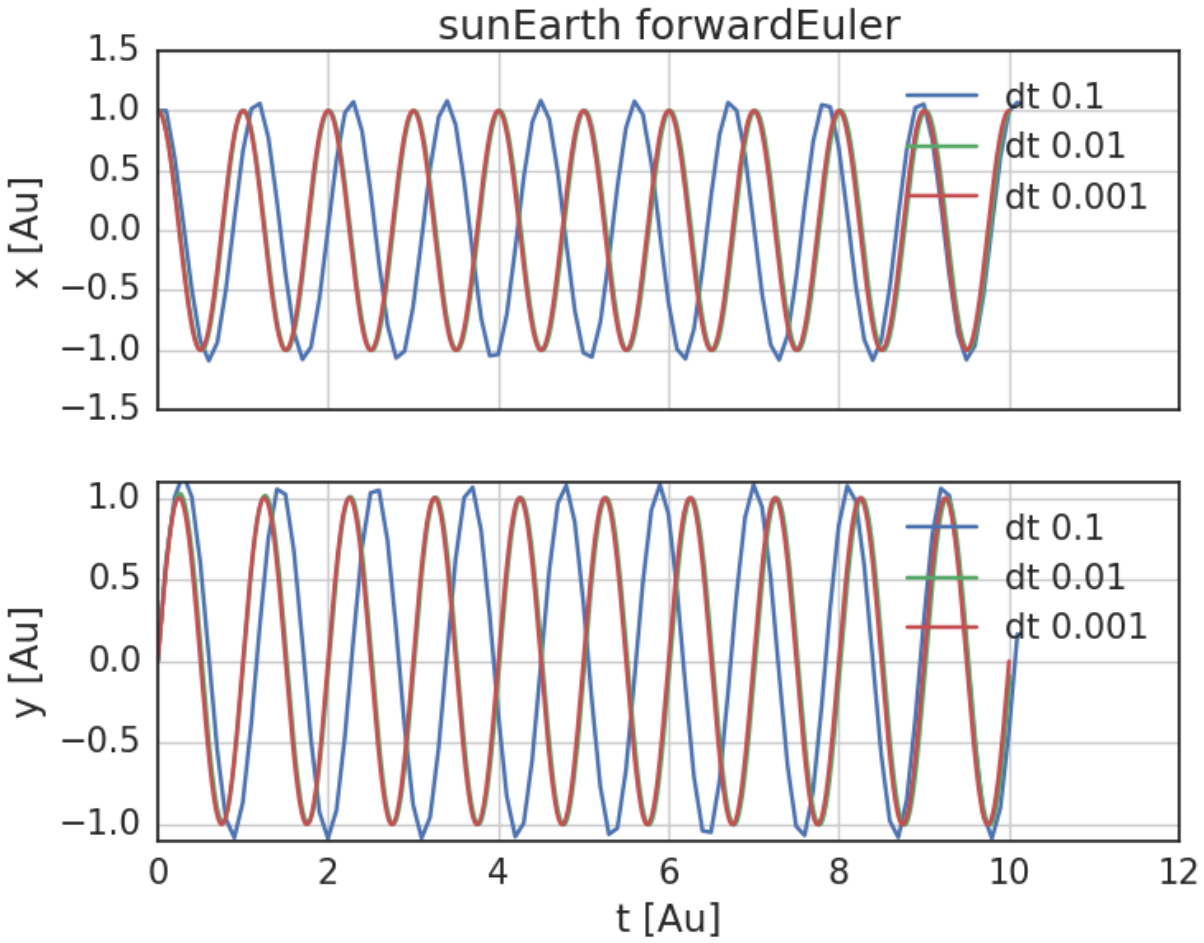

Figure 1: Sun-Earth system. Effect of Δt over a 10 year period.
The Forward Euler method seems to converge for the two smallest Δt

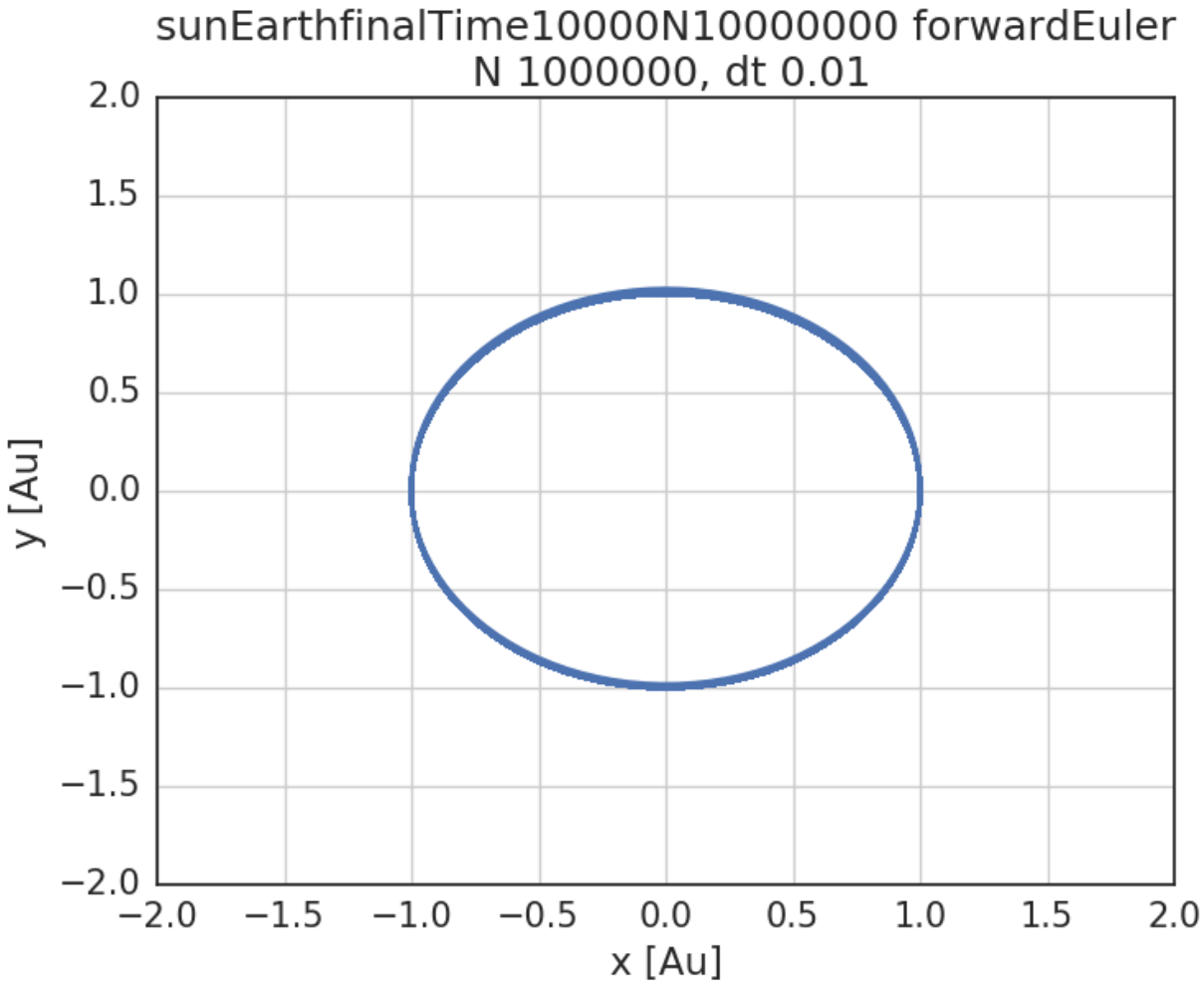

Figure 2: Sun-Earth system. Forward Euler. 10 000 years.
For $\Delta t = 0.01$, the forward Euler seems to give circular orbits, but we can see that the solution changes.

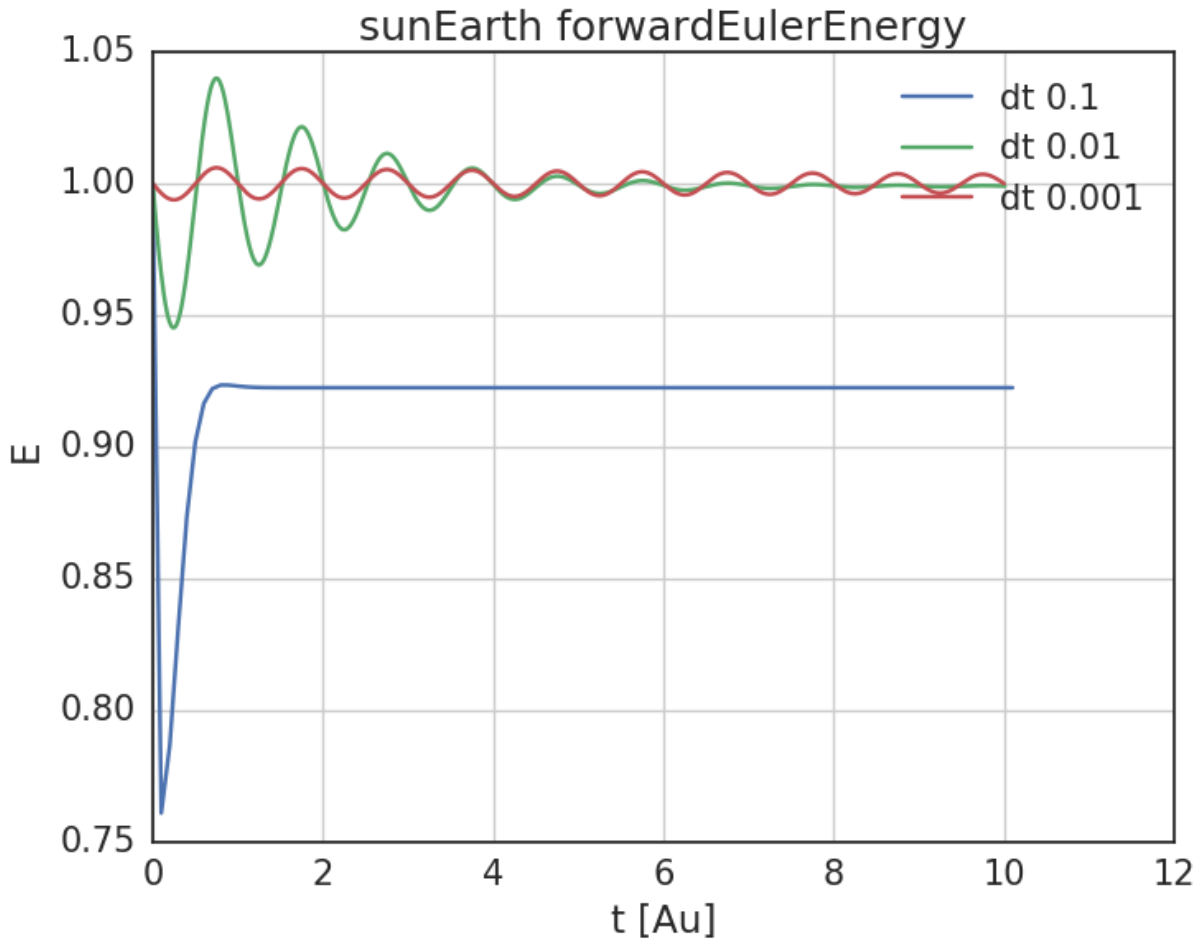

Figure 3: Sun-Earth system. Total Energy. Forward Euler. 10 years.
Energy is not preserver with the Forward Euler method

4 Conclusions

5 Feedback

5.1 Project 1

This project has been extremely educational. We learned about about c++, especially pointers and dynamic memory allocoation. Also which for us was a well forgotten subject, we learned about dangerous of numerical round-off errors.

We feel the size of the project is large, much larger than typical assignments in other courses. However, the quality and quantity of the teaching without a doubt made the workload managable. The detailed lectures, combined with the fast and good respones on Piazza helped a lot!

We think the project could have gone even smoother, if we on the 2nd lab-session had learned basic branching in Github. We used a considerable amount of time finding out of this.

All in all, two thumbs up!

5.2 Project 2

- catch: We ended up using a lot of time making this work properly. Still we have some problems with catch and Qt. We think we might had benefited from a demonstration at the lab.
- We were not able to understand the revised Sturm-Bisection algorithm from Barth et al.'s [1] paper on the revised Sturm-Bisection.
- Apart from the small details above, we are very happy about this project. How would have thought linear algebra could be fun?!

6 Bibliography

[1] Barth, Martin, Wilkinson (1967) Calculation of eigenvalues of a symmetric tridiagonal matrix by the method of bisection. *Numeriche mathematik 9, 386 - 393 (1967)*

[2] Hjorth-Jensen, M.(2015) Computational physics. Lectures fall 2015. `https://github.com/CompPhysics/ComputationalPhysics/tree/master/doc/Lectures`

[3] Hjorth-Jensen, M.(2017) Project 2, fys4150 2017. `https://github.com/CompPhysics/ComputationalPhysics/blob/master/doc/Projects/2017/Project2/pdf/Project2.pdf`

[4] Kiusalaas, J.(2013) Numerical Methods in Engineering with Python 3. 3rd edition.

[5] Taut, M. (1993) Two electrons in an external oscillator potential: Particular analytic solutions of a Coulomb correlation problem *Phys. Rev. A 48, 3561 (1993).*