

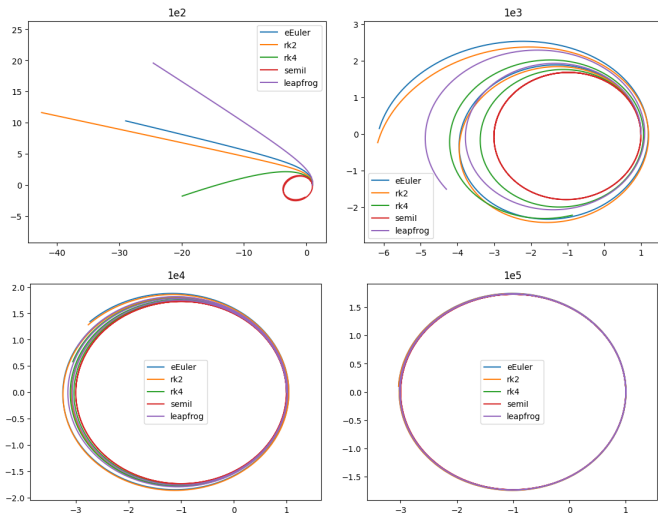
Exercise 1

Kepler Orbits

October 25, 2022

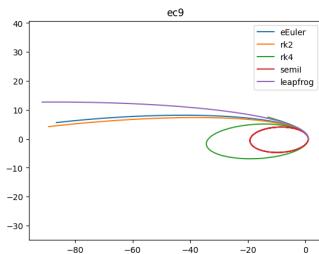
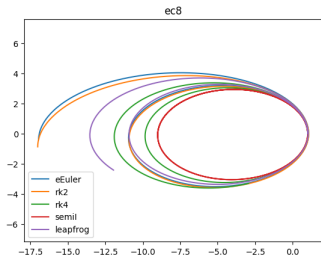
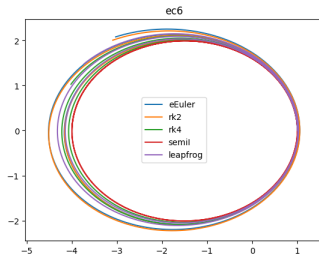
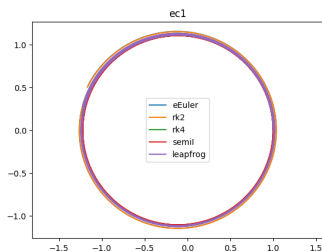
Nsteps

Comparison between different nsteps 10^2 to 10^5 ($dt = \frac{T}{nsteps}$)



Eccentricity

Comparison between different eccentricity values 0.1 to 0.9



Summary

For low values of $nsteps$ 10^2 and 10^3 the integration methods produce considerably different results.

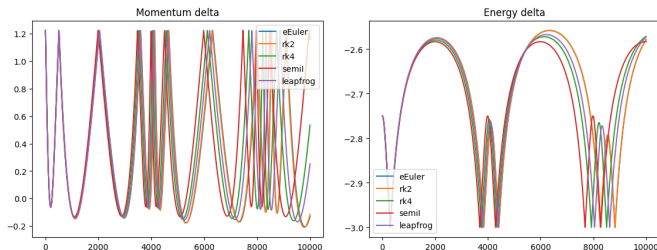
With increasing $nsteps$ these differences tend to disappear.

For the eccentricity, it is true the opposite, with lower eccentricity we have similar results.

The Semi Implicit Euler scheme seems to perform well with all the range of values tried, both for varying eccentricity as for varying $nsteps$.

Validation

Energy and Momentum delta along 10^4 steps ($1T$)



The plots are very similar between different numerical methods. This might suggest there is a problem, not all of these methods are supposed to behave in the same way.

Benchmark

Performance in $GFlops/s$ ($P = \frac{Op}{\Delta t} \cdot 10^{-9}$)

