Planetary Orbit Practical

Applying time integration schemes

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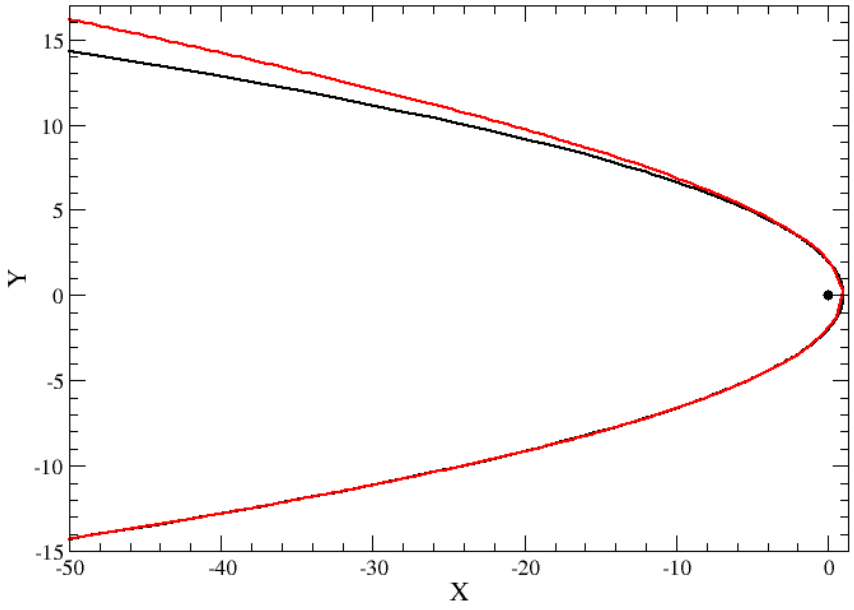
Practical

Orbits

- Simulates the orbit of a single planet around a single star (the sun)
  - the position of the star remains fixed
  - this is a one-body problem, for which exact solutions exist
  - allows us easily to evaluate the accuracy of each scheme
- Code available in FORTRAN or C
- See practical sheet for full details

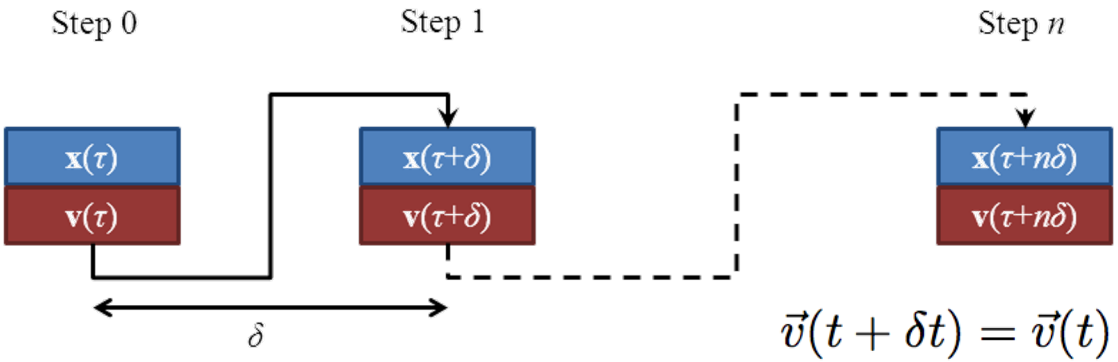
Practical

- Implement and compare two simplest integration schemes
  - Euler and Leapfrog
- Play with different orbits
  - compare with known analytic result
- Explore the dynamics
  - How to measure the error
  - What does effect does the step-size have
  - What effect does the scheme have



Practical: Time integration of orbit

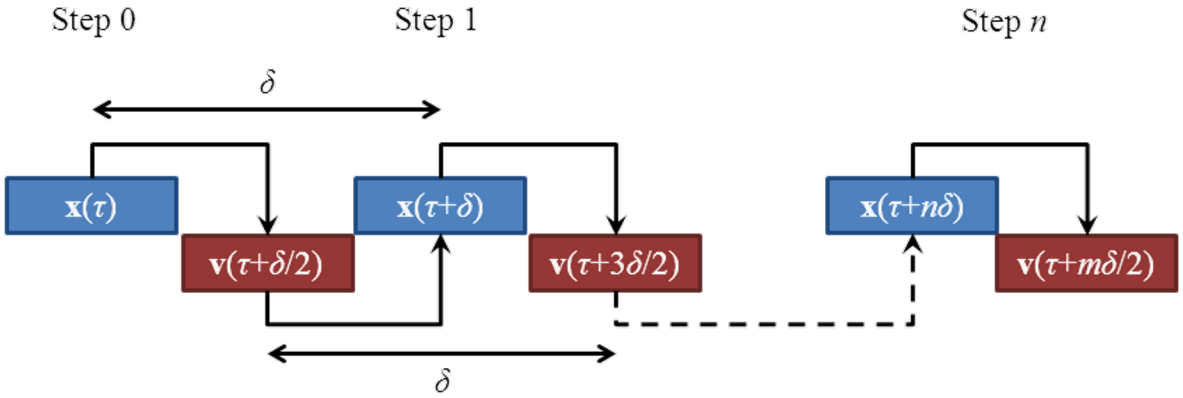
- Euler scheme



$$\vec{v}(t+\delta t) = \vec{v}(t) + \vec{a}(t) \times \delta t$$

$$\vec{x}(t+\delta t) = \vec{x}(t) + \vec{v}(t) \times \delta t$$

- Leapfrog scheme



$$\vec{x}(t+\delta t) = \vec{x}(t) + \vec{v}(t+{}^1\!/\!_2\delta t) \times \delta t$$

$$\vec{v}(t+{}^1\!/\!_2\delta t) = \vec{v}(t-{}^1\!/\!_2\delta t) + \vec{a}(t) \times \delta t$$

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