Physics 514 – Homework I

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Due 10:00 AM, Thursday September 14, 2017

1 ODE integrators

Write ODE integrator routines for the

1. Forward Euler algorithm
2. Backward Euler algorithm
3. Runge Kutta method
4. Leapfrog method

and integrate the equations of motion of a harmonic oscillator over 10 oscillations. Plot the resulting positions and velocities as a function of time for two step sizes (For example, $\Delta t = 0.10$ and 0.01). Analyze the convergence and stability.

2 Shooting

Given a target distance of 1.5 km and a cannon with an initial velocity of 150 m/s: find the angle of your barrel to hit the target via numerical integration, plot the trajectory and the analytic solution (a parabola). (Assume no friction and use a simple forward Euler to integrate).

Homework Submission

Summarize your results and plots into one PDF file and also submit your codes to Canvas.