Physics 325 — Scientific Computing — Fall 2016 — Lab 05

September 23, 2016

Exercise 1. Projectile Motion

Use our discussions in class to write a program (RK2 or RK4) that calculates the numerical solution to the basic 2D projectile motion problem. Use your code to create a plot of the trajectory of a projectile fired from (x,y) = (0.,0.) at an initial speed of 100 m/s for an initial velocity angle with respect to the ground of $45°$. **(10 points)**

Exercise 2. Projectile Motion with Air Resistance

Adjust the Exercise 1 program to calculate and plot the results of an initial trajectory angle of $15°$, $30°$, $45°$, and $60°$ on the same plot. You could brute force go through each angle separately, or loop over the angles and use a more complicated array. Make certain to label the plots properly. **(5 points)**

Exercise 3. Projectile Motion with Air Resistance

Repeat Exercise 1 but now assume a drag force $F_{drag} = -B_2 v^2 \hat{v}$ where v is the speed of the projectile, $\hat{v}$ is the unit vector in the direction of motion, and B_2 is not a vitamin, but instead is a drag coefficient. Plot the trajectory for a projectile with $\frac{B_2}{m} = 4 \times 10^{-4} m^{-1}$ and an initial speed of 700 m/s fired at an angle of $45°$ along with the same projectile for now air resistance. Comment on the difference in your code. **(10 points)**