

Lecture 20 Review

Solving 2nd order ODEs w/ octave

2D Projectile Motion with Air Resistance

Force on object due to gravity and “quadratic” air resistance:.

$$m\ddot{\vec{r}} = -c_2 v^2 \hat{v} - mg\hat{y}$$

Here, m = mass of object and $c_2 = 0.15D^2 \text{ kg/m}$ (for a spherical object)

The positive y -direction points opposite from the direction to earth's center.

Investigate the effects of air resistance on, say, the trajectory of a baseball.

($m_{bb} = 145 \text{ gm}$; $D_{bb} \approx 7.5 \text{ cm}$.)

Choose different initial velocities and angles; investigate the range of the baseball.

2D Projectile Motion with Air Resistance (2)

Force on object due to gravity and “linear” air resistance:

$$m\ddot{\vec{r}} = -k\hat{v} - mg\hat{y}$$

Here, m = mass of object and $[k] = 1/\text{sec}$.

The positive y -direction points opposite from the direction to earth's center.

Again, investigate the effects of air resistance.

Choose $k = 0.005, 0.01, 0.02, 0.04, .08$ and plot the objects trajectory.

Choose $v_0 = 600 \text{ m/s}$ and $\theta = 60 \text{ degrees}$.

Summary

Ballistic trajectories and air resistance

Don't suffer in silence. Scream for help!!!

