

ODE Solving - Projectile

Suppose that a projectile is launched upwards from the Earth's surface. Assume the only force acting on the object is gravity. The upward velocity can be computed as:

$$\frac{dv}{dt} = -g_0 \left[\frac{R^2}{(R+x)^2} \right] \quad \frac{dx}{dt} = v$$

v = upward velocity (m/s)

t = time (s)

x = altitude (m)

$g_0 = 9.81$ = gravitational acceleration at surface (m/s^2)

$R \approx 6.37 \times 10^6$ = Earth's Radius (m)

Assuming an initial velocity of $1400 m/s$ and an initial height of $0m$, compute the height the projectile reaches after 2 seconds. Use Heun's method with a step size of 1 second.