# Projectile Motion Simulator

Last revised: 2013-06-05

Helper functions

## ========== Projectile properties ==========

**Mass of projectile:** $M := 70 \cdot kg$

**Air drag (in units of force) as a function of speed and air density:** $F_{drag}(v, \rho) := 0.4 \cdot (0.3 \cdot m)^2 \cdot \rho \cdot v^2$

## ========== Properties of the environment ==========

**Acceleration due to gravity as a function of altitude:** $g := 9.8 \cdot \frac{m}{s^2}$

**Density as a function of altitude:** $\rho := \text{InterpDataFile}\left("\text{air-density.txt}", m, \frac{kg}{m^3}, "\text{spline}", \text{TRUE}\right)$

## ========== Initial state of the motion ==========

**Initial speed:** $v_0 := 500 \cdot \frac{m}{s}$

**Initial angle:** $\alpha_0 := \begin{pmatrix} 30 \\ 45 \\ 60 \end{pmatrix} \cdot deg$

**Initial height:** $h_0 := 0 \cdot m$

# ========== Calculation settings ==========

**ODE integration method:** OdeSolver := RK4adapt

**Possible choices:**

1. RK3fixed (3th order Runge-Kutta with fixed step size)
2. RK4fixed (4th order Runge-Kutta with fixed step size)
3. RK4adapt (4th order Runge-Kutta with adaptive step size)
4. Bulstoer (Bulirsch-Stoer method)
5. Adams (Adams methods)
6. BDF (backward differentiation formula method)

TimeStep := 0

**If set to zero, defaults will be used.**

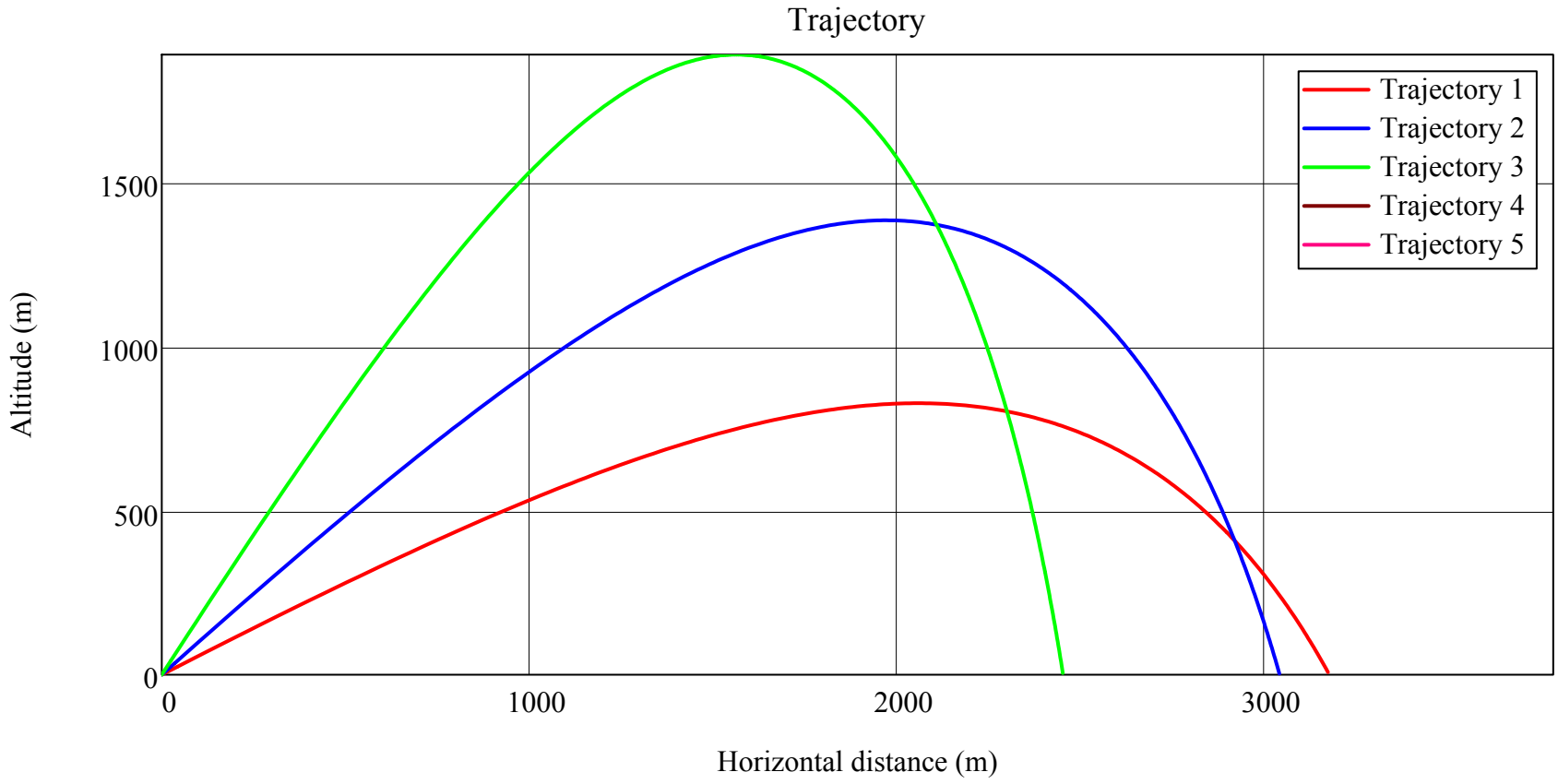
TimeSpan := 0

Processing

# Results

Span := 4·km

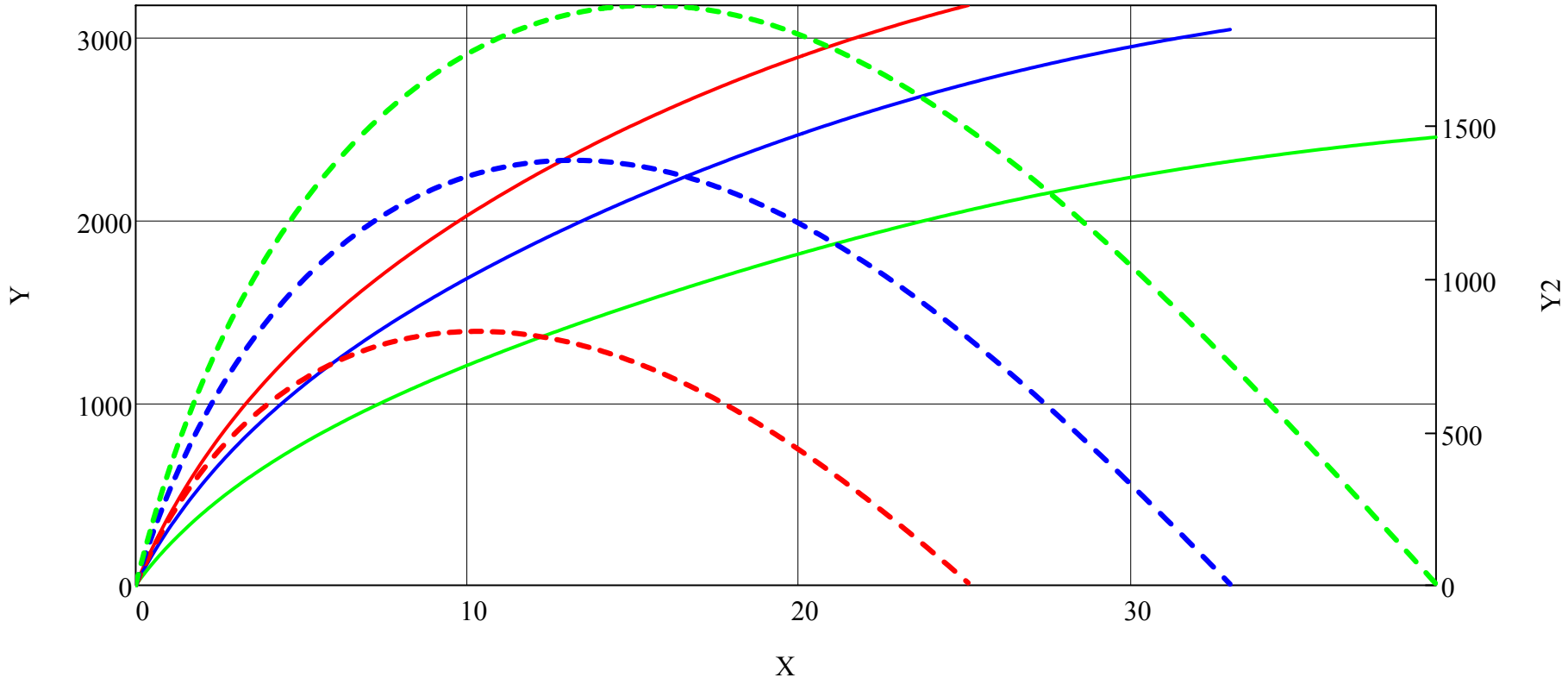
AspectRatio := 1



X := TIME

Y := POSITION

Y2 := ALTITUDE




========== End of Program ==========