

### Project 3:

## **Determining the trajectory of projectile motion in gravity with drag force**

### 1. Content

Motion equation of projectile motion in gravity with drag force is represented as follows:

$$m\vec{a} = m\vec{g} - h\vec{v}$$

With the initial conditions  $x_0 = y_0 = 0; v_{0x} = v_0 \cos(\alpha); v_{0y} = v_0 \sin(\alpha)$ .

This project requires students to use Matlab to solve the above motion equation, calculate the trajectory, and plot the trajectory depending on the angle.

### 2. Requirements

- 1) Students should have basic programming knowledge of MATLAB.
- 2) Learn about symbolic calculation and graphical interpretation in MATLAB.

### 3. Tasks

Write Matlab program to:

- 1) Enter the values  $m, h, v_0, \alpha, t$  (flight time).
- 2) Set up the differential equations with  $x(t)$  and  $y(t)$ . Use symbolic commands to solve the system of equations.
- 3) Plot the trajectory depending on the angle  $\alpha$  (15, 30, 45, 60, 75°).

Note: Students can use other non-symbolic approaches.

Submitting report has to contain text explaining the content of the program and the entire code verified to run properly in Matlab.

### 4. References:

A. L. Garcia and C. Penland, *MATLAB Projects for Scientists and Engineers*, Prentice Hall, Upper Saddle River, NJ, 1996. <http://www.algarcia.org/fishbane/fishbane.html>. Or <https://www.mathworks.com/matlabcentral/fileexchange/2268-projects-for-scientists-and-engineers>