```
%Aidan Carey
%Project 2
%11/14/23

%description- in this phase, we will use all of the givens and knowns of
%the trajectory of a baseball homerun, in order to test how close we can
%get to specific values on the curve with and without air resistance. Then,
%we will compare the analytic versus numeric solutions with a system of
%checks, and plot both trajectories

% initialize
clear

% Constants
g = 32.2;  % acceleration due to gravity in ft/s^2
launch_angle = deg2rad(28);  % launch angle in radians
exit_velocity = 116 * 5280 / 3600;  % exit velocity in ft/s
% (converted from mph)
analytic_time_of_flight = 5.3;  % time of flight in seconds

% Additional constants
mass_of_baseball = 0.145;  % mass of a baseball in kg

% Initial conditions
x0 = 0; y0 = 0;  % initial position
vx0 = exit_velocity * cos(launch_angle);  % initial x-component of velocity
vy0 = exit_velocity * sin(launch_angle);  % initial y-component of velocity

% Time settings
dt = 0.01;  % time step
t_max = analytic_time_of_flight;  % maximum time
t_values = 0:dt:t_max;

% Initialize arrays to store results
x_values = zeros(size(t_values));
y_values = zeros(size(t_values));

% Initial conditions
x_values(1) = x0;
y_values(1) = y0;
vx = vx0;
vy = vy0;

% Checking functions
check_x = abs(x_values(end) - (vx0 * t_values(end)))
check_y = abs(y_values(end) - (y0 + vy0 * t_values(end) - 0.5 * g * t_values(end)^2))

% Numerical computation using Euler's method
for i = 2:length(t_values)
    % Acceleration components
    ax = 0;  % no acceleration in x-direction
    ay = -g;  % acceleration due to gravity in y-direction

    % Update velocities and positions using Euler's method
    vx = vx + ax * dt;
    vy = vy + ay * dt;
    x_values(i) = x_values(i - 1) + vx * dt;
    y_values(i) = y_values(i - 1) + vy * dt;

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60      % Check for the end of the trajectory
61      if y_values(i) < 0
62          break;
63      end
64  end
65
66
67  % Plot trajectories
68  figure;
69  plot(vx0 * t_values, y0 + vy0 * t_values - 0.5 * g * t_values.^2, '--', ...
70      'LineWidth', 1.5, 'DisplayName', 'Analytic');
71  hold on;
72  plot(x_values, y_values, '-', 'LineWidth', 1.5, 'DisplayName', 'Numeric');
73  title(['Aidan Carey | ECE202 Project 2 | 12/07/23 |' ...
74      ' Baseball Trajectory without Air Resistance']);
75  xlabel('Distance (feet)');
76  ylabel('Height (feet)');
77  legend('Location', 'Best');
78  ylim([-20, 100]);  % Adjusted based on your specifications
79  grid on;
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>> Project2phase1

check_x =

  796.1597


check_y =

   28.9234

>>
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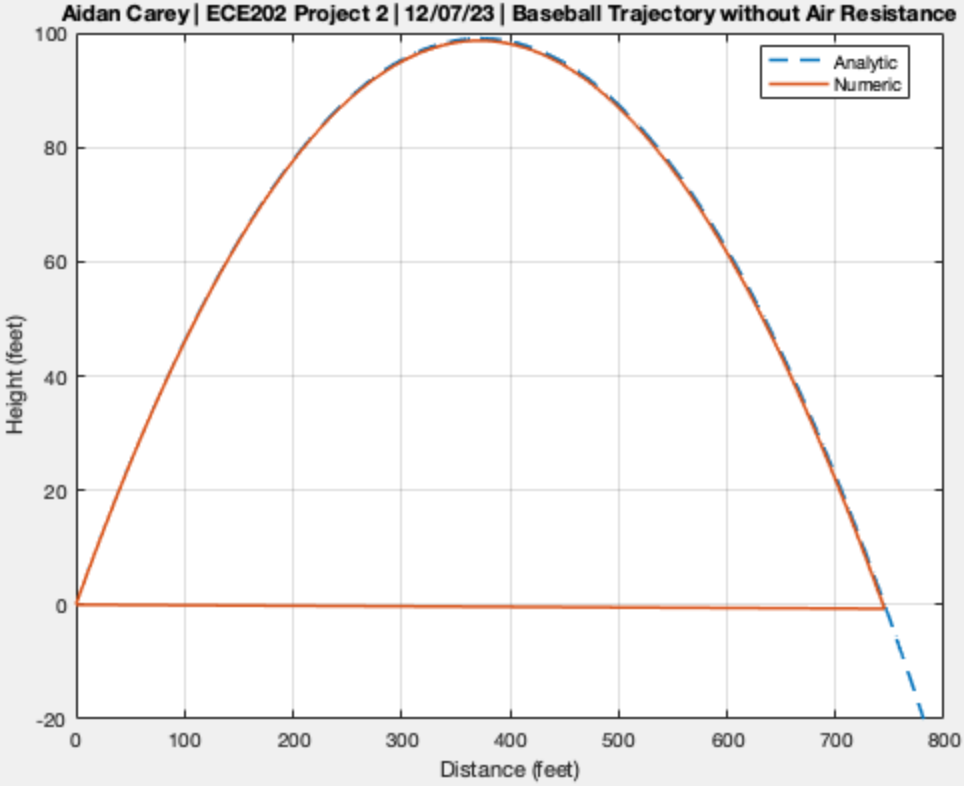
Aidan Carey | ECE202 Project 2 | 12/07/23 | Baseball Trajectory without Air Resistance
Analytic
Numeric
Height (feet)
Distance (feet)
100
80
60
40
20
0
-20
0
100
200
300
400
500
600
700
800