

```
1 %Aidan Chin
2 %Project 2
3 %11/14/23
4
5
6 % initialize
7
8 clear
9 clc
10
11 % Constants
12
13 g = 32.2; % acceleration of gravity in ft/s^2
14 theta = deg2rad(28); % launch angle in radians
15 vE = 116 * 5280 / 3600; % exit velocity in ft/s (converted from mph)
16 aToF = 5.3; % time of flight in seconds
17 baseballmass = 0.145; % mass of a baseball in kg
18
19 % Initial conditions
20 x0 = 0; y0 = 0; % initial position
21 vx0 = vE * cos(theta); % initial x-component of velocity
22 vy0 = vE * sin(theta); % initial y-component of velocity
23
24 % Time settings
25 dt = 0.01; % time step
26 tmax = aToF; % maximum time
27 tval = 0:dt:tmax; % array of time values
28
29 % Initialize arrays to store results
30 x = zeros(size(tval));
31 y = zeros(size(tval));
32
33 % Initial conditions
34 x(1) = x0;
35 y(1) = y0;
36 vx = vx0;
37 vy = vy0;
38
39 % Checking functions
40 check_x = abs(x(end) - (vx0 * tval(end)));
41 check_y = abs(y(end) - (y0 + vy0 * tval(end) - 0.5 * g * tval(end)^2))
42
43 % Numerical computation using Euler's method
44 for i = 2:length(tval)
45     % Acceleration components
46     ax = 0; % no acceleration in x-direction
47     ay = -g; % acceleration due to gravity in y-direction
48
49     % Update velocities and positions using Euler's method
50     vx = vx + ax * dt;
51     vy = vy + ay * dt;
```

```
52     x(i) = x(i - 1) + vx * dt;
53     y(i) = y(i - 1) + vy * dt;
54
55     % Check for the end of the trajectory
56     if y(i) < 0
57         break;
58     end
59 end
60
61 % Plot trajectories
62 figure;
63 plot(vx0 * tval, y0 + vy0 * tval - 0.5 * g * tval.^2, '--', ...
64      'LineWidth', 1.5, 'DisplayName', 'Analytic');
65 hold on;
66 plot(x, y, '-', 'LineWidth', 1.5, 'DisplayName', 'Numeric');
67 title(['Aidan Chin | ECE202 Project 2 | 12/07/23 | ' ...
68      ' Baseball Trajectory without Air Resistance']);
69 xlabel('Distance (feet)');
70 ylabel('Height (feet)');
71 legend('Location', 'Best');
72 ylim([-20, 100]); % Adjusted based on your specifications
73 grid on;
74
```