MATLAB Coding for Path Tracing of Coilgun

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Abstract : *Coilguns are made up with electromagnets which uses electrical energy to accelerate the ferromagnetic material. This is more environment friendly as it does not uses any hazardous chemicals for the firing purpose. This paper presents the MATLAB coding which is helpful in tracing the velocity with which the bullet can travel and the range at which it will strike at the ground. The initial velocity or muzzle velocity of the bullet can be obtained by separate simulation model or else it can be preassumed.*

Keywords – MATLAB coding, coilgun, muzzle velocity, path tracing, projectile motion

I. INTRODUCTION

Coilguns are made up of combination of ferromagnetic materials, which acts as a projectile, some coils, which act as an electromagnet, and a conditioned power source, which activates the electromagnets and forces the ferromagnetic materials to get projected out from the coilgun barrel. In the coilgun or any other guns, the velocity with which the bullet leaves from the barrel is very important and it is called as muzzle velocity. If muzzle velocity is known by any mean and angle of projection is known then we can trace the path of the projectile with the help of the MATLAB coding.

II. MATLAB CODE

```
clc
t = 0:0.03:10; % time vector
u = 30; % initial velocity
angle = 60; %angle of projection
theta = unitsratio('rad','deg')*angle; % conversion of angle
g = 9.8; %Gravitatonal constant

ux = u*cos(theta);
uy = u*sin(theta);
x = ux*t;
y = uy*t - 0.5*g*t.^2;
for i=1:size(x,2)
 if(i>1 && y(i)<=0)
    break;
 end
 plot(x(i),y(i),'r*');
 hold on; % if you don't want to see the whole path
 pause(0.02);
 end
```

III. METHODOLOGY

The MATLAB code is designed to demonstrate and to plot a path for the projectile. The code uses predefined values such as time vector, initial velocity, angle of projection, and gravitational constant. Out of above-mentioned constants, initial velocity and angle of projection can be varied as per the requirement of the user. X and Y is calculated with the help of projectile motion formula. 'For' loop is used to plot the continuous graph. 'Hold on' function is used to hold the data in the graph. While 'Pause' function is used to make graph plot discontinuous, which will avoid the straight line of the graph.
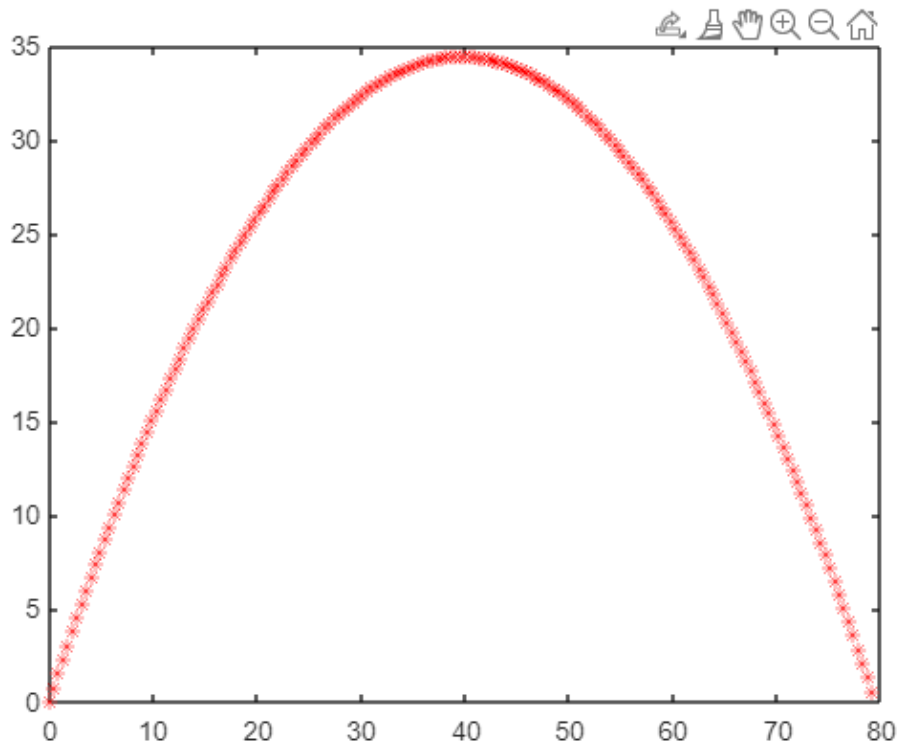
IV. RESULTS

Fig. 1: Path of the projectile after launching from the coilgun

V. CONCLUSION

From the above MATLAB code, the path of a projectile, which is being fired from the coilgun, can be traced easily. User must have two values such as initial / muzzle velocity and angle of projection. In addition, the MATLAB code can be further modified in which it can take inputs from the users directly in command window rather than including the values in the code itself.

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