(p,q,r) = (0,0,0) INITIAL

(u,v,w)
CASE 1: 20, 0, 0
CASE 2: 19.92, 0, 1.743
CASE 3: 19.69, 0, 3.47

# Assignment-3

Due date: 25-04-2023.

1. Consider the following points to derive and simulate the dynamics of the guided projectile.
   a. Assume that it is a point mass.
   b. Assume that it is launched from parental aircraft with 20 $\frac{m}{s}$ initial velocity at a different projectile angle( $0^0, 5^0, 10^0$).
   c. Use aerodynamic characteristics of projectile from the wind tunnel data processing assignment.
2. Simulate the 6-DOF dynamics of HANSA-3 Research Aircraft, flying in steady level condition, using 3 dynamics and 3 kinematics equation as discussed in lecture and control inputs given in following figures.
   a. Simulate the aircraft dynamics by giving 3-2-1-1, doublet and sinusoidal inputs separately to elevator. 3
   b. Simulate the aircraft dynamics by giving 3-2-1-1, doublet and sinusoidal inputs separately to aileron. 3
   c. Simulate the aircraft dynamics by giving 3-2-1-1, doublet and sinusoidal inputs separately to rudder. 3
   d. Simulate the aircraft dynamics by giving 3-2-1-1, doublet and sinusoidal inputs separately to elevator.
   e. Simulate the aircraft dynamics by giving 3-2-1-1 type of input to elevator, aileron, and rudder simultaneously. 1
   f. Simulate the aircraft dynamics by giving doublet type of input to elevator, aileron, and rudder simultaneously. 1
   g. Simulate the aircraft dynamics by giving sinusoidal type of input to elevator, aileron, and rudder simultaneously. 1

**Geometric and Inertial properties:**

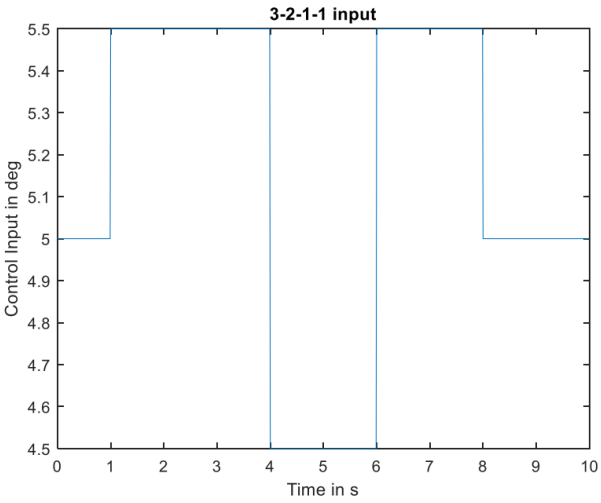
$$m = 750\ kg, IXX = 873\ kgm^2, IYY = 907\ kgm^2, IZZ = 1680\ kgm^2,$$
$$IXZ = 1144\ kgm^2, S = 12.47\ m^2, b = 10.47\ m, \bar{c} = 1.211\ m, AR = 8.8$$

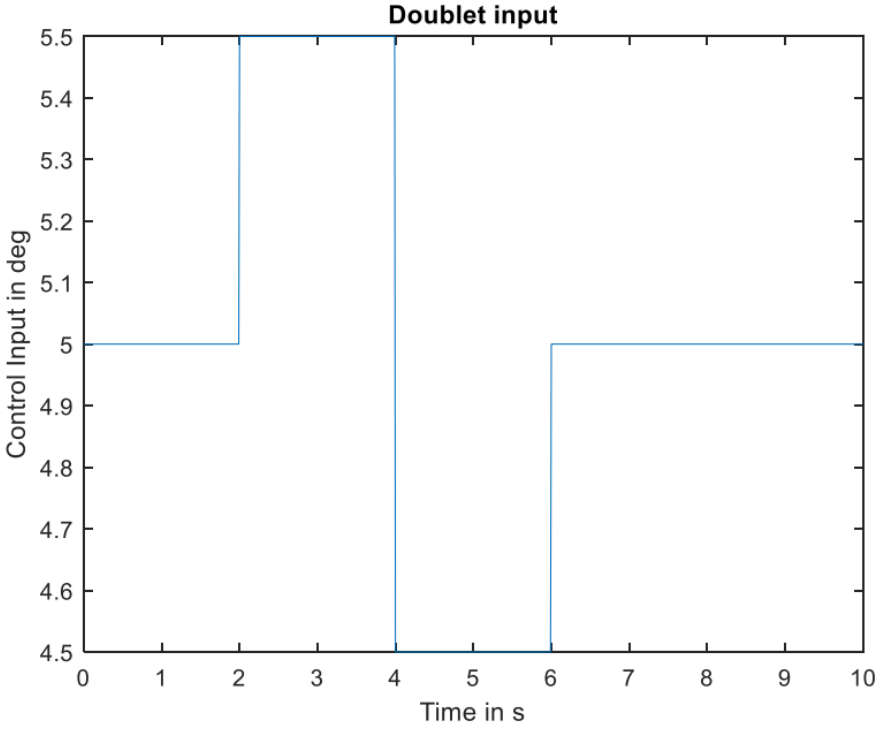
**Aerodynamic Parameters:**

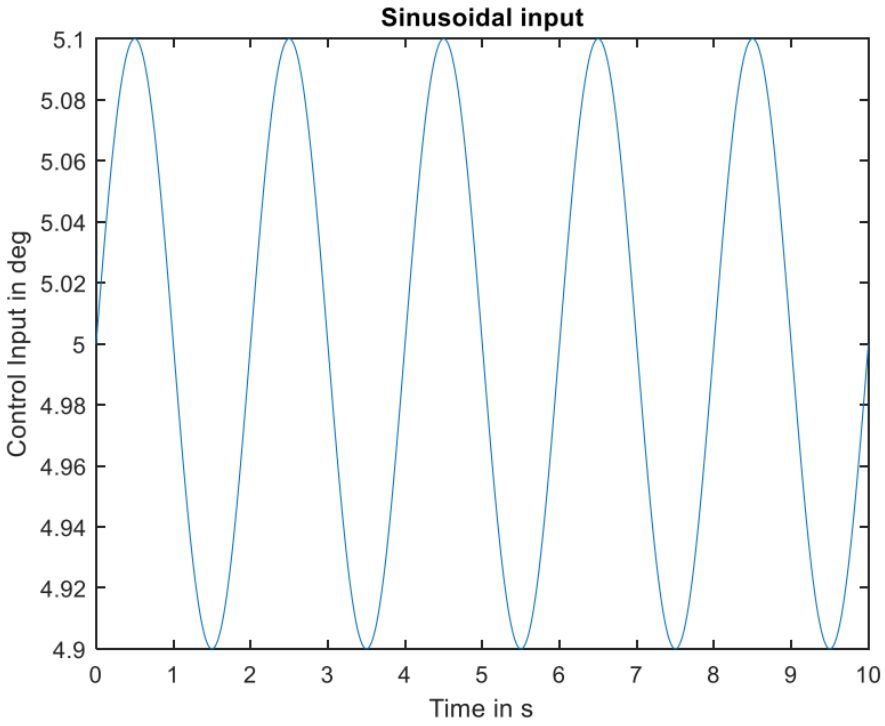
$$CD0 = 0.035, k = 0.045, CL0 = 0.370, CL\alpha = 5.0, CLq = 37.211, CL\delta e = 0.374$$

$$Cm0 = 0.091, Cm\alpha = -2.937, Cmq = -8.719, Cm\delta e = -0.735$$
$$CY0 = 0, CY\beta = -0.531, CYp = -0.0571, CYr = 0.4657, CY\delta r = 0.1502$$
$$Cl0 = 0, Cl\beta = -0.031, Clp = -0.262, Clr = -0.0541, Cl\delta r = 0.005, Cl\delta a = -0.153$$
$$Cn0 = 0, Cn\beta = 0.01, Cnp = -0.007, Cnr = -0.067, Cn\delta r = -0.047$$

**Note:** Please do not consider control surface deflections blindly as given in following figures. You need to consider the similar control input about trim control surface deflection.


3-2-1-1 input
Control Input in deg
Time in s
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
4.7
4.6
4.5
0
1
2
3
4
5
6
7
8
9
10


Doublet input
Control Input in deg
Time in s
5.5
5.4
5.3
5.2
5.1
5
4.9
4.8
4.7
4.6
4.5
0
1
2
3
4
5
6
7
8
9
10


Sinusoidal input
Control Input in deg
Time in s
5.1
5.08
5.06
5.04
5.02
5
4.98
4.96
4.94
4.92
4.9
0
1
2
3
4
5
6
7
8
9
10