1 - BOMB DROP

y0=5;

v0=10;

x0=0;

theta=0;

g=9.81;

b = v0\*sin(pi\*(theta/180));

a = -g/2;

c=y0;

t\_flight=(-b-sqrt(b^2-4\*a\*c))/(2\*a);

t=linspace(0, t\_flight, 30)

xdot0 = v0\*cos(pi\*(theta/180));

ydot0 = v0\*sin(pi\*(theta/180));

x=xdot0\*t + x0;

y=(a\*(t.^2))+(ydot0\*t)+y0;

plot(x,y);

grid

xlabel('Distance between Aircraft and Tank(m)');

ylabel('Height between Aircraft and Tank (m)');

2 - TAKEOFF

mur=0.02;

h=6;

b=53.3;

W=20000;

rho=0.002372;

S=300;

CLmax=1;

CD0=0.02;

E=0.81;

AR=b/h;

T=7300;

G=32.2;

WV=W;

SV=S;

for i=1:101

innerphi=16\*h/b;

phi=(innerphi^2)/(1+innerphi^2);

Vstall=sqrt((2\*WV)/(rho\*S\*CLmax));

VL0=1.2\*(Vstall);

V=0.7\*VL0;

L=0.5\*rho\*(V^2)\*S\*CLmax;

D=0.5\*rho\*(V^2)\*S\*(CD0+phi\*((CLmax^2)/(3.14\*E\*AR)));

deno=G\*rho\*S\*CLmax\*(T-(D+mur\*(WV-L)));

S1(i)=1.44\*(WV^2)/deno;

WV=WV+100;

end

plot(20000:100:30000,S1)

xlabel('WEIGHT')

ylabel('TAKE OFF DISTANCE')

title('Determination of Take-off Distance');

for j=1:101 innerphi=16\*h/b;

phi=(innerphi^2)/(1+innerphi^2);

Vstall=sqrt((2\*W)/(rho\*SV\*CLmax));

V10=1.2\*(Vstall);

V=0.7\*V10;

L=0.5\*rho\*(V^2)\*SV\*CLmax;

D=0.5\*rho\*(V^2)\*SV\*(CD0+phi\*((CLmax^2)/(3.14\*E\*AR)));

deno=G\*rho\*SV\*CLmax\*(T-(D+mur\*(W-L)));

S1(j)=1.44\*(W^2)/deno;

SV=SV+1;

end

plot(300:1:400,S1)

xlabel('Wing Area')

ylabel('TAKE OFF DISTANCE')

title('Determination of Take-off Distance With Change In Wing Area');

3 - LANDING

mur=0.02;

h=6;

b=53.3;

W = 20000;

rho=0.002377;

S = 300;

CLmax=1;

CDo = 0.02;

E = 0.81 ;

AR=b/h;

T = 7300;

G = 32.2;

WV=W;

SV=S;

for i = 1:101

innerphi=16\*h/b;

phi=(innerphi^2)/(1+innerphi^2);

Vstall=sqrt((2\*WV)/(rho\*S\*CLmax));

Vlo=1.3\* (Vstall);

V = 0.7\*Vlo;

L=0.5\*rho\* (V^2) \*S\*CLmax;

D = 0.5 \*rho\* (V^2) \*S\* (CDo+phi\*((CLmax^2)/(3.14\*E\*AR)));

deno=G\*rho\*S\*CLmax\*(T-(D+mur\*(WV-L)));

S1(i)=1.69\*(WV^2)/deno;

WV = WV + 100;

end

plot (20000:100:30000,S1)

xlabel('WEIGHT')

ylabel('LANDING DISTANCE')

grid

title('Determination of Landing distance with change in weight')

figure

for j=1:101

innerphi=16\*h/b;

phi=(innerphi^2)/(1+innerphi^2);

Vstall=sqrt((2\*W)/(rho\*SV\*CLmax));

Vlo=1.3\*(Vstall);

V=0.7\*Vlo;

L=0.5\*rho\* (V^2) \*SV\*CLmax;

D-0.5\*rho \*(V^2) \*SV\* (CDo+phi\*((CLmax^2)/(3.14\*E\*AR)));

deno-G\*rho\*SV\*CLmax\* (T-(D+mur\* (W-L)));

Sl(j)=1.69\* (W^2)/deno;

SV-SV+1;

end

plot(300:1:400,S1)

xlabel('Wing Area')

ylabel('Landing distance')

grid

title('Determination of Landing distance with change in wing')

4 - SIMULINK IDK

5 - POLE ZERO MAP

sys=tf([2 5 1], [1 3 5]);

h=pzplot(sys);

grid on

p=getoptions(h);

p,Color=[1,0,];

setoptions(h, p);

6 - ROOT LOCUS

Num = [ 1 5 ];

Den = [ 1 7 2 5 ];

G = tf(num, den);

Rlocus (G);

7 - BODE PLOT

num=[10];

den=[1 2 10];

G=tf(num, den);

margin(G);

grid on;

title('Bode plot with gain and phase margin')

8 - STATIC MARGIN & STALL

alpha= -5:0.5:25

alpha\_rad=deg2rad(alpha);

CL\_alpha=5.7;

CL\_max=1.5;

alpha\_stall=15;

alpha\_stall\_rad=deg2rad(alpha\_stall);

static\_margins=[0.15, 0.05, -0.05];

colors=['b','g','r'];

labels={'Stable (SM=0.15)', 'Marginal (SM=0.05)', 'Unstable (SM=-0.05)'};

figure;

hold on;

grid on;

for i=1:length(static\_margins)

SM=static\_margins(i);

CL=CL\_alpha\*alpha\_rad\*(1+SM);

CL(CL>CL\_max)=CL\_max;

plot(alpha,CL,colors(i), 'LineWidth', 2, 'DisplayName', labels{i});

end

xlabel('Angle of Attack (degrees)');

ylabel('Lift Coefficient (C\_L');

title('Effect of Static Margin on Stall Characterisitcs');

9 - SERVO MECHANISM

