clear, clc

%% Horizontal Tail

Vh = 0.7; %horizontal tail Volume coefficient

C = 3.533; %Wing MAC

S = 124.86; %Wing Area

Df = 5; %Largest Aft fuselage diameter

CLaw = 5.4113;

lopt = 1.4\*sqrt(4\*C\*S\*Vh/(Df\*pi)); %Maybe this

Sh = C\*S\*Vh/lopt;

CL = 0.3279;

AR = 10; %Wing AR

Cmaf = -0.025; %Airfoil Sectional pitching moment coefficient From table 5.2 Sadraey

Lamda = 4.5; %sweep angle

at = -4; %Twist of the wing

Cmowf = Cmaf\*((AR\*cosd(Lamda)^2)/(AR+2\*cosd(Lamda)))+0.01\*at;

Lf = lopt/0.6;

Xapex = -0.25\*C+0.32\*Lf+0.25; %I don't know what this is

Xcg = 0.23\*C-0.25; %Feet from leading edge

h = Xcg/C; %MAC

CLh = (Cmowf + CL\*(h-0.25))/Vh %Cruise Tail lift coefficient

ARh = 5.59;

taperh = .55; %initially same as wing

Lamdah = 5; %Same as wing Sweep

Gamma = 0.00001; %Same as wing Dihedral

Clah = .1111111; %Find from book - double check this

CLah = Clah/(1+Clah/(pi\*ARh)); %tail lift curve slope

%ah = CLh/CLah; %Tail aoa at cruise

ah = -3.89;

%Last part

N = 9;

bh = sqrt(ARh\*Sh);

Ch = Sh/bh;

Cr = (1.5\*(1+taperh)\*Ch)/(1+taperh+taperh^2);

theta = pi/(2\*N):pi/(2\*N):pi/2;

ath = 0.000001;

alpha = ah+ath:-ath/(N-1):ah;

z = (bh/2)\*cos(theta);

c = Cr\*(1-(1-Lamdah)\*cos(theta));

mu = c\*CLah/(4\*bh);

LHS = mu.\*(alpha/57.3);

for i=1:N

for j=1:N

B(i,j)= sin((2\*j-1)\*theta(i)\*(1+(mu(i)\*(2\*j-1))/sin(theta(i))));

end

end

A = B\transpose(LHS);

for i=1:N

sum1(i) = 0;

sum2(i) = 0;

for j=1:N

sum1(i) = sum1(i)+(2\*j-1)\*A(j)\*sin((2\*j-1)\*theta(i));

sum2(i) = sum2(i)+A(j)\*sin((2\*j-1)\*theta(i));

end

end

CLt = pi\*AR\*A(1)

epi0 = 2\*CL/(pi\*AR);

depida = 2\*CLaw/(pi\*AR);

aw = 2; %Check for cruise aoa

epi = epi0+depida\*aw;

ih = ah-1+epi;

MACh = sqrt(ARh/Sh);

bh2 = MACh\*ARh;

Chr = (3/2)\*MACh/((1+Lamdah+Lamdah^2)/(1+Lamdah));

Cht = Chr\*Lamdah;

Cma = CLaw\*(h-.25)-CLah\*.98\*Sh/S\*(lopt/C-h)\*(1-depida);

%% Vertical Tail

Vv = 0.04;

b = 35.3356;

Sv = b\*S\*Vv/lopt;

ARv = 1.84;

taperv = .55;

iv = 0;

lamdaV = 18;

bv = sqrt(Sv\*ARv);

Cv = bv/ARv;

Cvr = (3/2)\*Cv\*((1+taperv)/(1+taperv+taperv^2));

Cvt = taperv\*Cvr;

%% Elevator Sizing

%Rotation time during take off: 1-3 seconds

%Take-off pitch angular acceleration: 8-10 deg/s/s

be = .9\*bh; %Elevator span (ft)

deltapmax = 20; %max positive deflection (down)

deltanmax = -25; %Max nedative deflection (up)

Vstall = 28.2944; %Stall speed in m/s - 55 knots

Vr = 1.1-1.3\*Vstall; %Rotation Speed?

CLTO = 1.3; %Coefficient of lift for take off TODO get exact value

Lwf = 1/2\*1.225\*Vr^2\*CLTO\*S; %Take off Lift

Lhto = 1/2\*1.225\*Vr^2\*Sh\*CLh; %Take off tail lift

Lto = Lwf+Lhto;

CDTO = 2; %Coefficient of Drag at take off TODO Get number

Dto = 1/2\*1.225\*Vr^2\*CDTO\*S;

Cmacwf = ; %Coefficient of moment about ac for the wings number

Macwf = 1/2\*1.225\*Vr^2\*Cmacwf\*S\*C;

T = ; %Trust at take off TODO get this number

mu = ; % Coefficient of friction TODO Find this

W = ; %Weight TODO find this

m = ; %mass TODO Calc/find this

a = (T-Dto-mu\*(W-Lto))/m; %Linear Acceleration at take off

Xmg = ; %Distance of main landing gear from nose cone

Mw = W\*(Xmg-Xcg); %Weight moment

Zd = ; %TODO

Zmg = 0; %TODO Check this maybe, but I think it's just the wheels

Zcg = ; %TODO

Md = D\*(Zd-Zmg); %Drag moment

Zt = ; %TODO thrust height

Mt = T\*(Zt-Zmg); %Thrust moment

Xacwf = ; %TODO

Mlwf = Lwf\*(Xmg-Xacwf); %Wing lift moment

Xach = ; %TODO

Mlh = Lhto\*(Xach-Xmg); %Tail lift moment

Ma = m\*a\*(Zcg-Zmg); %Acceleration moment