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%Determining the Steady State Roll Rate

%Determined values
b = 14.5*12;  %Wingspan [in]
Da = 20*(180/pi); %Aileron Deflection [RADIANS]
span = 0.30; %Aileron wingspan percent
chord_ratio = 0.2424; %aileron chord over wing chord
overall_chord = 23.5; % inches
Sw = 4089; %surface area of the wing [in^2]
W = 37.48*12; %in*lbm/s^2
g = 386.22; %in/s^2


Sht = 564; %surface area of the elevator [in^2]
Svt = 345.6; %surface area of the rudder [in^2]
Ixx = (W/g)*((101)^2); %lbm*in^2

Aileron_Chord = chord_ratio*overall_chord;
Aileron_Area = Aileron_Chord*b*span*0.5;

Y = 1; %wing taper ratio [unitless]
Vapp = 616; %approach velocity 1.1-1.3 times the stall speed [in/s]
rho = 0.0765/(12^3); %density of fluid [lbm/in^3]
mu = 3.52*(10^-7)*(1/(12)); %Dynamic viscosity of air (lbm/in*s)
Re = (Vapp*overall_chord)/(1.64*10^-4*12*12)
AR = 7.3; %Aspect Ratio

if Re < 500000;
    Cdr = (1.33/((Re)^(1/2)));
else
   Cdr = (0.455/((log10(Re))^(2.58)))
end

Claw = (pi*AR*Cdr)^(1/2); %Lift coefficient


%Calculated values
yo = 0.95*(b/2); %outboard position of the aircraft
yi = (0.95-span)*(b/2); %inboard position of the aircraft
tau = 0.19+chord_ratio*1.19; %Aileron effectiveness parameter
yd = 0.4*b*0.5; %average distance between rolling drag center and x axis. Typically 40%
of the wingspan

Clda = ((2*Claw*tau*Cdr)/(Sw*b))*((((yo^2)/2)+(2/3)*((Y-1)/2)*(yo^3))-(((yi^2)/2)+(2/3)*
((Y-1)/2)*(yi^3)));
Cl = Clda*Da;   %rolling moment coefficient
La = 0.5*rho*(Vapp^2)*Sw*Cl*b;   %rolling moment
Pss = ((2*La)/(rho*(Sw+Sht+Svt)*Cdr*yd^3))^(1/2) %steady state roll rate
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phi = ((Ixx)/(rho*(yd^3)*(Sw+Sht+Svt)*Cdr))*log(Pss^2)

Rate_of_roll = (Pss^2)/(2*phi);
display(Rate_of_roll);
display(Aileron_Area);
display(Aileron_Chord);
```