Includi << ..\Default_Functions.mcdx

HORIZONTAL TAIL PARAMETERS INITIALIZATION

Hidden Area --> Import of Excel INPUT H-Tail Data

Hidden Area --> Preliminary Mapping of imported Data

Hidden Area --> Import and preliminary mapping of OTHER Excel Data

INPUT H-TAIL PARAMETERS LIST

Input parameters

$b_H = 21.96\ m$

$\eta_H = 0.9$

$\Lambda_{H\_LE} = 39\ deg$

$\Gamma_H = 8.5\ deg$

$i_H = -3\ deg$

$\xi_{tmax\_H} = 0.35$

$c_{H\_r} = 7.2\ m$

$c_{H\_t} = 2.4\ m$

$\eta_{e\_in} = 0.2$

$t\_over\_c_{H\_r} = 0.1$

$t\_over\_c_{H\_t} = 0.08$

$\eta_{e\_out} = 0.9$

$\alpha_{0l\_H\_r} = -0.05$

$\alpha_{0l\_H\_t} = -0.05$

$c_e = 1.55\ m$

$C_{l\alpha\_H\_r} = 6.303$

$C_{l\alpha\_H\_t} = 6.303$

$C_{m\_ac\_H\_r} = 0$

$C_{m\_ac\_H\_t} = 0$

$\xi_{ac\_H\_r} = 0.25$

$\xi_{ac\_H\_t} = 0.25$

$M_{cr\_H\_2D\_r} = 0.7$

$M_{cr\_H\_2D\_t} = 0.7$

$\varepsilon_{H\_t} = 0$

Imported parameters

$M_1 = 0.65$

$X_{ac\_W} = 9.3\ m$

$MAC_W = 9.505\ m$

$c_{W\_r} = 15.57\ m$

$S_W = 468.83\ m^2$

$K_{MAC4\_WH} = 0.914$

$\Delta X\_HT_{LE}\_W_{LE} = 38.35\ m$

$\Delta X\_HT_{LE}\_Nose = 63.4\ m$

HTAIL PARAMETERS CALCULATIONS

H-Tail basic parameters

$\lambda_H := \frac{c_{H\_t}}{c_{H\_r}} = 0.333$

$\lambda_H = 0.333$

$S_H := \frac{b_H}{2} \cdot c_{H\_r} \cdot (1 + \lambda_H) = 105.408\ m^2$

$S_H = 105.408\ m^2$

$AR_H := \frac{{b_H}^2}{S_H} = 4.575$

$AR_H = 4.575$

$MAC_H := \frac{2}{3} \cdot c_{H\_r} \cdot \left(\frac{1 + {\lambda_H}^2 + \lambda_H}{1 + \lambda_H}\right) = 5.2\ m$

$MAC_H = 5.2\ m$

$X_{MAC\_LE\_H} := \frac{b_H}{6} \cdot \frac{(1 + 2 \cdot \lambda_H)}{(1 + \lambda_H)} \cdot \tan(\Lambda_{H\_LE}) = 3.705\ m$

$X_{MAC\_LE\_H} = 3.705\ m$

$Y_{MAC\_H} := \frac{b_H}{6} \cdot \frac{1 + 2 \cdot \lambda_H}{1 + \lambda_H} = 4.575\ m$

$Y_{MAC\_H} = 4.575\ m$

$Z_{MAC\_H} := Y_{MAC\_H} \cdot \tan(\Gamma_H) = 0.684\ m$

$Z_{MAC\_H} = 0.684\ m$

H-Tail, sweep angles

$_f\Lambda(x, \Lambda_{le}, AR, \lambda) := \text{if}\left(AR = 0, \Lambda_{le}, \text{atan}\left(\tan(\Lambda_{le}) - \frac{4 \cdot x \cdot (1 - \lambda)}{AR \cdot (1 + \lambda)}\right)\right)$

- Sweep angle function

$\Lambda_{H\_LE} := {_f\Lambda}(0, \Lambda_{H\_LE}, AR_H, \lambda_H) = 0.681$

$\Lambda_{H\_LE} = 39\ deg$

$\Lambda_{H\_TE} := {_f\Lambda}(1, \Lambda_{H\_LE}, AR_H, \lambda_H) = 0.357$

$\Lambda_{H\_TE} = 20.437\ deg$

$\Lambda_{H\_c4} := {_f\Lambda}(0.25, \Lambda_{H\_LE}, AR_H, \lambda_H) = 0.611$

$\Lambda_{H\_c4} = 35.011\ deg$

$\Lambda_{H\_c2} := {_f\Lambda}(0.5, \Lambda_{H\_LE}, AR_H, \lambda_H) = 0.534$

$\Lambda_{H\_c2} = 30.592\ deg$

$\Lambda_{H\_tmax} := {_f\Lambda}(\xi_{tmax\_H}, \Lambda_{H\_LE}, AR_H, \lambda_H) = 0.581$

$\Lambda_{H\_tmax} = 33.296\ deg$

Hidden Area --> H-Tail, linear laws coefficients

H-Tail, linear laws defined over the whole semi-span

$_fc_H(y) := A_{c\_H} \cdot y + B_{c\_H}$

$_fC_{l\alpha\_H}(y) := A_{Cl\alpha\_H} \cdot y + B_{Cl\alpha\_H}$

$_f\text{t\_over\_c}_H(y) := A_{tc\_H} \cdot y + B_{tc\_H}$

$_fC_{m\_ac\_2D\_H}(y) := A_{Cm0\_H} \cdot y + B_{Cm0\_H}$

$_f\varepsilon_{g\_H}(y) := A_{\varepsilon\_H} \cdot y + B_{\varepsilon\_H}$

$_f\xi_{ac\_2D\_H}(y) := A_{\xi ac\_H} \cdot y + B_{\xi ac\_H}$

$_f\alpha_{0l\_H\_2D}(y) := A_{\alpha 0\_H} \cdot y + B_{\alpha 0\_H}$

$_fM_{cr\_H\_2D}(y) := A_{Mcr\_H} \cdot y + B_{Mcr\_H}$

Hidden Area --> H-Tail, data vectors for plotting linear laws in LaTeX

H-Tail, 2D mean quantities

$$t\_over\_c_{H\_mean} := \frac{2}{S_H} \cdot \int_0^{\frac{b_H}{2}} \mathrm{f}c_{\mathrm{H}}(y) \cdot \mathrm{f}t\_over\_c_{\mathrm{H}}(y) \,\mathrm{d}y = 0.092$$

$$t\_over\_c_{H\_mean} = 0.092$$

$$C_{m\_ac\_H\_mean} := \frac{2}{S_H \cdot MAC_H} \cdot \int_0^{\frac{b_H}{2}} \mathrm{f}c_{\mathrm{H}}(y)^2 \cdot \mathrm{f}C_{\mathrm{m\_ac\_2D\_H}}(y) \,\mathrm{d}y = 0$$

$$C_{m\_ac\_H\_mean} = 0$$

$$C_{l\alpha\_H\_mean} := \frac{2}{S_H} \cdot \int_0^{\frac{b_H}{2}} \mathrm{f}c_{\mathrm{H}}(y) \cdot \mathrm{f}C_{\mathrm{l\alpha\_H}}(y) \,\mathrm{d}y = 6.303$$

$$C_{l\alpha\_H\_mean} = 0.11\ \mathbf{deg}^{-1}$$

$$\alpha_{0l\_H\_mean} := \frac{2}{S_H} \cdot \int_0^{\frac{b_H}{2}} \mathrm{f}c_{\mathrm{H}}(y) \cdot \mathrm{f}\alpha_{\mathrm{0l\_H\_2D}}(y) \,\mathrm{d}y = -0.05\ \mathbf{rad}$$

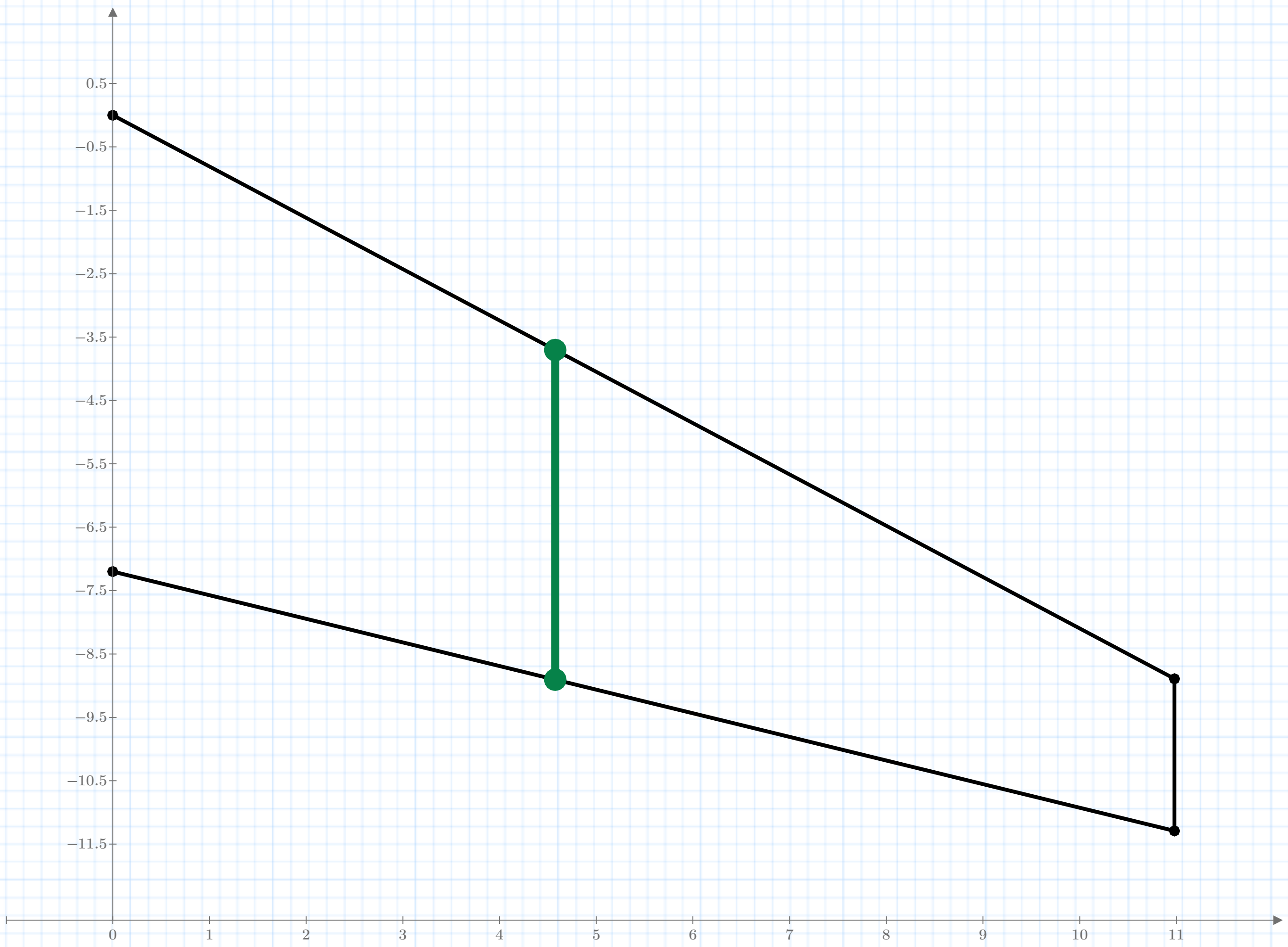
$$\alpha_{0l\_H\_mean} = -2.865\ \mathbf{deg}$$

H-Tail, 3D alpha-zero-lift

$$\alpha_{0L\_H} := \frac{2}{S_H} \cdot \int_0^{\frac{b_H}{2}} \mathrm{f}c_{\mathrm{H}}(y) \cdot \left(\mathrm{f}\alpha_{\mathrm{0l\_H\_2D}}(y) - \mathrm{f}\varepsilon_{\mathrm{g\_H}}(y)\right) \mathrm{d}y = -0.05\ \mathbf{rad}$$

$$\alpha_{0L\_H} = -2.865\ \mathbf{deg}$$

H-Tail planform with Mean Aerodynamic Chord



MISCELLANEOUS DATA CALCULATIONS

Induced drag factors, only due to geometric effects

$$e_{H\_alt} := \frac{2}{2 - AR_H + \sqrt{4 + AR_H^{\,2}\left(1 + \tan\left(\Lambda_{H\_tmax}\right)^2\right)}} = 0.615$$

$e_{H\_alt} = 0.615$

$$e_{H\_alt\_\Lambda 0} := 1.78 \cdot \left(1 - 0.045 \cdot AR_H^{\,0.68}\right) - 0.64 = 0.915$$

- **Alternative formula: valid for unswept wings**

$$e_{H\_alt\_\Lambda} := 4.61 \cdot \left(1 - 0.045 \cdot AR_H^{\,0.68}\right) \cdot \cos\left(\Lambda_{H\_LE}\right)^{0.15} - 3.1 = 0.777$$

- **Alternative formula: valid for swept wings**

3d critical Mach number at mean aerodynamic chord

$$M_{cr\_H\_3D\_@MAC\_H} := \frac{{}_f\mathrm{M}_{\mathrm{cr\_H\_2D}}\left(Y_{MAC\_H}\right)}{\cos\left(\Lambda_{H\_LE}\right)} = 0.901$$

$M_{cr\_H\_3D\_@MAC\_H} = 0.901$

Elevator inner and outer stations and area

$$y_{e\_in} := \eta_{e\_in} \cdot \frac{b_H}{2} = 2.196\ m$$

$y_{e\_in} = 2.196\ m$

$$y_{e\_out} := \eta_{e\_out} \cdot \frac{b_H}{2} = 9.882\ m$$

$y_{e\_out} = 9.882\ m$

$$c_{H\_mean\_@e} := {}_f\mathrm{c}_{\mathrm{H}}\left(\frac{y_{e\_in} + y_{e\_out}}{2}\right) = 4.56\ m$$

$c_{H\_mean\_@e} = 4.56\ m$

$$S_e := 2 \cdot c_e \cdot \left(y_{e\_out} - y_{e\_in}\right) = 23.827\ m^2$$

$S_e = 23.827\ m^2$

@Aerodynamic Database ---> (control_surface)_tau_e_vs_c_control_surface_over_c_horizontal_tail

$\tau_e = 0.552$

@Aerodynamic Database ---> (control_surface)_C_h_alpha_vs_flap_chord_over_airfoil_chord

$C_{h\_\alpha\_e} = -0.007$

$C_{h\_\alpha\_e} = -1.269 \cdot 10^{-4}\ deg^{-1}$

@Aerodynamic Database ---> (control_surface)_C_h_delta_vs_flap_chord_over_airfoil_chord

$C_{h\_\delta\_e} = -0.013$

$C_{h\_\delta\_e} = -2.277 \cdot 10^{-4}\ deg^{-1}$

H-TAIL LIFT CURVE SLOPE

H-Tail Lift Curve Slope, function definitions

- **Polhamus Formula Coefficient**

$$\mathrm{f}k_{\mathrm{Polhamus}}(M, M_{cr\_3D}, \Lambda_{LE}, \lambda, AR) := \begin{array}{l} \text{if } (M < M_{cr\_3D}) \wedge (\Lambda_{LE} < 32\ deg) \wedge (\lambda > 0.4) \wedge (\lambda < 1) \wedge (AR > 3) \wedge (AR < 8) \\ \quad \begin{array}{l} \text{if } AR < 4 \\ \quad \text{return } 1 + \dfrac{AR \cdot (1.87 - 0.000233 \cdot \Lambda_{LE})}{100} \\ \text{else} \\ \quad \text{return } 1 + \dfrac{((8.2 - 2.3 \cdot \Lambda_{LE}) - AR \cdot (0.22 - 0.153 \cdot \Lambda_{LE}))}{100} \end{array} \\ \text{else} \\ \quad \text{return } 100 \end{array}$$

(---> Polhamus Formula is not valid)

- **General Formula for Lift Curve Slope**

$$\mathrm{f}C_{L\alpha\_H}(M, k_P, AR, \Lambda_{c2}, C_{l\alpha@MAC}, \Lambda_{LE}) := \begin{array}{l} \text{if } k_P \neq 100 \\ \quad \text{return } \dfrac{2 \cdot \pi \cdot AR}{2 + \sqrt{\left(\dfrac{AR^2 \cdot (1 - M^2)}{k_P{}^2}\left(1 + \dfrac{\tan(\Lambda_{c2})}{(1 - M^2)}\right)\right) + 4}} \\ \text{else} \\ \quad a_0 \leftarrow \dfrac{C_{l\alpha@MAC}}{\sqrt{1 - M^2 \cdot \cos(\Lambda_{LE})}} \\ \quad \text{return } \dfrac{a_0 \cdot \cos(\Lambda_{LE})}{\sqrt{1 - (M \cdot \cos(\Lambda_{LE}))^2 + \left(\dfrac{a_0 \cdot \cos(\Lambda_{LE})}{\pi \cdot AR}\right)^2} + \dfrac{a_0 \cdot \cos(\Lambda_{LE})}{\pi \cdot AR}} \end{array}$$

(---> use Polhamus Formula)

(---> use alternative formula)

H-Tail Lift Curve Slope, classic formula

$$C_{L\alpha\_H\_classic} := \frac{C_{l\alpha\_H\_mean}}{\sqrt{1 - M_1{}^2} + \dfrac{C_{l\alpha\_H\_mean}}{\pi \cdot AR_H \cdot e_{H\_alt}}} = 4.279$$

$$C_{L\alpha\_H\_classic} = 0.075\ deg^{-1}$$

H-Tail Lift Curve Slope, general formula for inner/outer panel and whole wing

$$k_{Polhamus\_H} := \mathrm{f}k_{\mathrm{Polhamus}}(M_1, M_{cr\_H\_3D\_@MAC\_H}, \Lambda_{H\_LE}, \lambda_H, AR_H) = 100 \qquad k_{Polhamus\_H} = 100$$

$$C_{l\alpha\_H\_@MAC\_H} := \mathrm{f}C_{l\alpha\_H}(Y_{MAC\_H}) = 6.303 \qquad C_{l\alpha\_H\_@MAC\_H} = 0.11\ deg^{-1}$$

$$C_{L\alpha\_H\_@M0} := \mathrm{f}C_{L\alpha\_H}(0, k_{Polhamus\_H}, AR_H, \Lambda_{H\_c2}, C_{l\alpha\_H\_@MAC\_H}, \Lambda_{H\_LE})$$

$$C_{L\alpha\_H\_@M0} = 3.505\ rad^{-1} \qquad C_{L\alpha\_H\_@M0} = 0.061\ deg^{-1}$$

$$C_{L\alpha\_H} := \mathrm{f}C_{L\alpha\_H}(M_1, k_{Polhamus\_H}, AR_H, \Lambda_{H\_c2}, C_{l\alpha\_H\_@MAC\_H}, \Lambda_{H\_LE})$$

$$C_{L\alpha\_H} = 4.223\ rad^{-1} \qquad C_{L\alpha\_H} = 0.074\ deg^{-1}$$

H-Tail lift coefficient at initial conditions

$$C_{L0\_H} := C_{L\alpha\_H} \cdot (i_H - \alpha_{0L\_H} - \varepsilon_{0\_W}) = -0.072 \qquad C_{L0\_H} = -0.072$$

Induced drag factor, due to both geometric and aerodynamic effects

$$_{f}e\left(C_{L\alpha},AR,\lambda,\Lambda_{LE}\right):=\left\| \begin{array}{l} \lambda_e \leftarrow \dfrac{AR\cdot\lambda}{\cos\left(\Lambda_{LE}\right)} \\ R \leftarrow 0.0004\cdot\lambda_e^{\ 3}-0.008\cdot\lambda_e^{\ 2}+0.0501\cdot\lambda_e+0.8642 \\ \text{return if}\left(AR=0,0,\dfrac{1.1\cdot C_{L\alpha}}{R\cdot C_{L\alpha}+(1-R)\,\pi\cdot AR}\right) \end{array}\right.$$

- Function for calculating wing induced drag factor, icluding aerodynamic and geometric effects

$$e_H:={_{f}e}\left(C_{L\alpha\_H},AR_H,\lambda_H,\Lambda_{H\_LE}\right)=0.951$$

$$e_H=0.951$$

H-TAIL AERODYNAMIC CENTER - GRAPHICAL METHOD (DATCOM / NAPOLITANO)

@Aerodynamic Database ---> (x_bar_ac_w)_k1_vs_lambda

$$K1_{ac\_H\_Datcom}=1.38$$

@Aerodynamic Database ---> (x_bar_ac_w)_k2_vs_L_LE_(AR)_(lambda)

$$K2_{ac\_H\_Datcom}=0.527$$

@Aerodynamic Database ---> (x_bar_ac_w)_x'_ac_over_root_chord_vs_tan_(L_LE)_over_beta_(AR_times_tan_(L_LE))_(lambda)

$$X_{ac\_over\_c_{r\_H\_Datcom}}=0.728$$

Aerodynamic center positions

$$\xi_{ac\_H}:=K1_{ac\_H\_Datcom}\cdot\left(X_{ac\_over\_c_{r\_H\_Datcom}}-K2_{ac\_H\_Datcom}\right)=0.277$$

$$X_{ac\_H}:=\xi_{ac\_H}\cdot MAC_H+X_{MAC\_LE\_H}=5.147\ m$$

$$X_{ac\_H}=5.147\ m$$

$$x_{ac\_H}:=X_{ac\_H}-X_{MAC\_LE\_H}=1.442\ m$$

$$x_{ac\_H}=1.442\ m$$

H-Tail planform with 2D aerodynamic center distribution and 3D aerodynamic center

H-Tail Volume Ratio based on aerodynamic centers distance

$$\Delta X\_HT_{ac\_}W_{ac} := \Delta X\_HT_{LE\_}W_{LE} - X_{ac\_W} + X_{ac\_H} = 34.197\ m$$

$$VolumeRatio_{H\_ac} := \frac{S_H}{S_W} \cdot \frac{\Delta X\_HT_{ac\_}W_{ac}}{MAC_W} = 0.809$$

SHRENK'S METHOD FOR BASIC AND ADDITIONAL H-TAIL LOADING

Loading function definitions and remarkable values

$${}_f c_{eff}(y) := \frac{{}_f c_H(y) \cdot {}_f C_{l\alpha\_H}(y)}{C_{l\alpha\_H\_mean}}$$

- Effective chord distribution function

$$c_{ell\_0} := \frac{4 \cdot S_H}{\pi \cdot b_H} \qquad {}_f c_{ell}(y) := c_{ell\_0} \cdot \sqrt{1 - \left(\frac{y}{\frac{b_H}{2}}\right)^2}$$

- Elliptic chord distribution function

$${}_f \alpha_b(y) := \alpha_{0L\_H} - \left({}_f \alpha_{0l\_H\_2D}(y) - {}_f \varepsilon_{g\_H}(y)\right)$$

- "Basic" angle of attack function

$${}_f cC_{l\_b}(y) := \frac{1}{2} \cdot {}_f c_H(y) \cdot {}_f C_{l\alpha\_H}(y) \cdot {}_f \alpha_b(y)$$

- Basic wing loading

$${}_f cC_{l\_a}(y) := \frac{1}{2} \cdot \left({}_f c_{eff}(y) + {}_f c_{ell}(y)\right)$$

- Additional wing loading function

$${}_f cC_l(y) := {}_f cC_{l\_b}(y) + {}_f cC_{l\_a}(y)$$

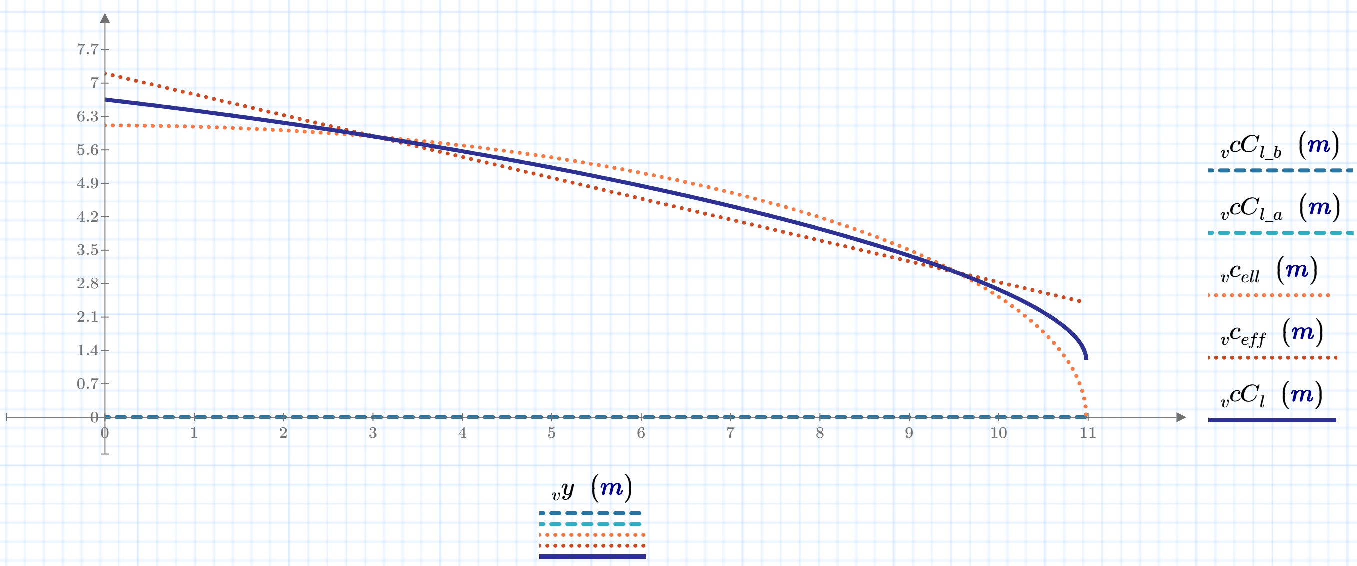
- Wing loading function

$$C_{L\_b} := \frac{2}{S_W} \cdot \int_0^{\frac{b_H}{2}} {}_f cC_{l\_b}(y) \, \mathrm{d}y = 0$$

$$C_{L\_a} := \frac{2}{S_W} \cdot \int_0^{\frac{b_H}{2}} {}_f cC_{l\_a}(y) \, \mathrm{d}y = 0.225$$

- **REMARK:** the effects of wing sweep angle are neglected

Spanwise loading curve plots



3D PITCHING MOMENT COEFFICIENT ABOUT H-TAIL AERODYNAMIC CENTER

Exact formulation

$${}_{f}x_{b\_H}(y) := X_{ac\_H} - \left(y \cdot \tan\left(\Lambda_{H\_LE}\right) + {}_{f}c_{H}(y) \cdot {}_{f}\xi_{ac\_2D\_H}(y)\right)$$

- Moment arm from section's aerodynamic center to wing 3D aerodynamic center

$$C_{M\_ac\_H\_b} := \frac{2}{S_H \cdot MAC_H} \cdot \int_0^{\frac{b_H}{2}} {}_{f}cC_{l\_b}(y) \cdot {}_{f}x_{b\_H}(y)\,\mathrm{d}y = 0$$

$$C_{M\_ac\_H\_b} = 0$$

$$C_{M\_ac\_H\_a} := \frac{2}{S_H \cdot MAC_H} \cdot \int_0^{\frac{b_H}{2}} {}_{f}C_{m\_ac\_2D\_H}(y) \cdot {}_{f}c_{H}(y)^2\,\mathrm{d}y = 0$$

$$C_{M\_ac\_H\_a} = 0$$

$$C_{M\_ac\_H} := C_{M\_ac\_H\_b} + C_{M\_ac\_H\_a} = 0$$

$$C_{M\_ac\_H} = 0$$

Approximated formulation (Roskam)

$$C_{M\_ac\_H\_b\_Roskam} := \frac{2 \cdot \pi}{S_H \cdot MAC_H} \cdot \int_0^{\frac{b_H}{2}} {}_{f}\alpha_{b}(y) \cdot {}_{f}c_{H}(y) \cdot {}_{f}x_{b\_H}(y)\,\mathrm{d}y = 0$$

$$C_{M\_ac\_H\_b\_Roskam} = 0$$

$$C_{M\_ac\_H\_Roskam} := C_{M\_ac\_H\_b\_Roskam} + C_{M\_ac\_H\_a} = 0$$

$$C_{M\_ac\_H\_Roskam} = 0$$

Integrand functions plot

DOWNWASH

Lifting Line Theory

$$_{\mathrm{f}}\varepsilon_{\alpha\_\mathrm{LLT\_H}}\left(C_{L\alpha}, AR, e, M\right) := \mathrm{if}\left(AR = 0, 0, 2 \cdot \frac{C_{L\alpha}}{\pi \cdot AR \cdot e} \cdot \frac{1}{\sqrt{1-M^2}}\right)$$

• Downwash gradient according to linear theory

$$\varepsilon_{\alpha\_LLT\_@M0\_H} := {}_{\mathrm{f}}\varepsilon_{\alpha\_\mathrm{LLT\_H}}\left(C_{L\alpha\_H}, AR_H, e_H, 0\right) = 0.618$$

$$\varepsilon_{\alpha\_LLT\_@M0\_H} = 0.618$$

$$\varepsilon_{\alpha\_LLT\_H} := {}_{\mathrm{f}}\varepsilon_{\alpha\_\mathrm{LLT\_H}}\left(C_{L\alpha\_H}, AR_H, e_H, M_1\right) = 0.813$$

$$\varepsilon_{\alpha\_LLT\_H} = 0.813$$

$$\varepsilon_{0\_LLT\_H} := \varepsilon_{\alpha\_LLT\_H} \cdot \left(i_H - \alpha_{0L\_H}\right) = -0.002$$

$$\varepsilon_{0\_LLT\_H} = -0.11\ deg$$

DATCOM Method

$${}_f\mathrm{K}_{\mathrm{AR}}(AR) := \frac{1}{AR} - \frac{1}{1+(AR)^{1.7}}$$

$${}_f\mathrm{K}_{\lambda}(\lambda) := \frac{10 - 3 \cdot \lambda}{7}$$

• **Empirical coefficients function definitions**

$$K_M(M, C_{L\alpha\_@M0}, C_{L\alpha}) := \begin{array}{l} \text{if } M \le 0.7 \\ \quad \left\| \text{return } \sqrt{1-M^2} \right. \\ \text{else} \\ \quad \left\| \text{return } \dfrac{C_{L\alpha}}{C_{L\alpha\_@M0}} \right. \end{array}$$

$${}_f\mathrm{K}_{\mathrm{MAC4}}(\Delta Z', \Delta X', b) := \frac{1 - \dfrac{\Delta Z'}{b}}{\sqrt[3]{2 \cdot \dfrac{\Delta X'}{b}}}$$

$K_{AR\_H} := {}_f\mathrm{K}_{\mathrm{AR}}(AR_H) = 0.148$ $\qquad K_{AR\_H} = 0.148$

$K_{\lambda\_H} := {}_f\mathrm{K}_{\lambda}(\lambda_H) = 1.286$ $\qquad K_{\lambda\_H} = 1.286$

$K_{MAC4\_WH} = 0.914$ $\qquad K_{MAC4\_WH} = 0.914$

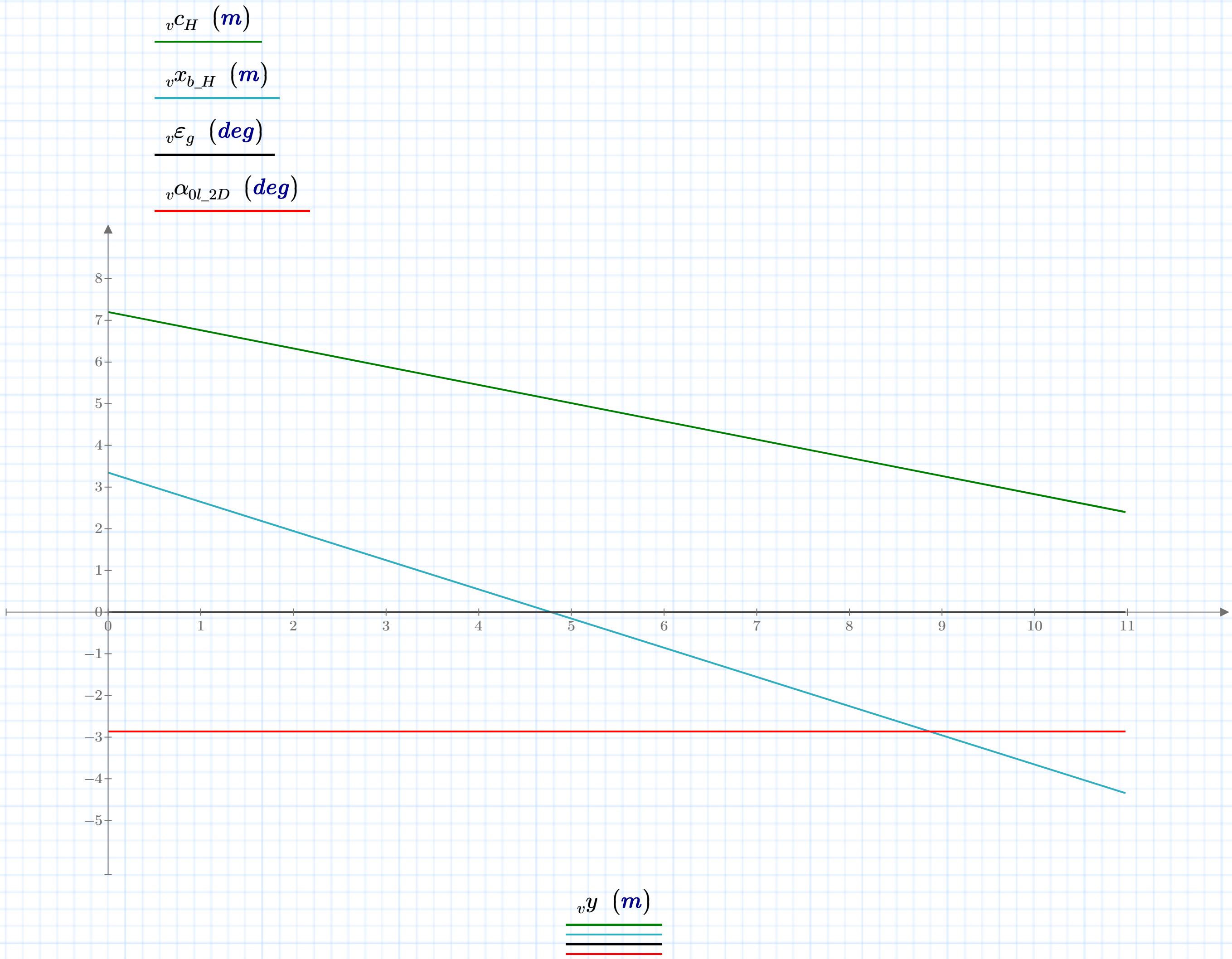
$K_{M\_H} := K_M(M_1, C_{L\alpha\_H\_@M0}, C_{L\alpha\_H}) = 0.76$ $\qquad K_{M\_H} = 0.76$

$\varepsilon_{\alpha\_@M0\_H} := 4.44 \cdot \left(K_{AR\_H} \cdot K_{\lambda\_H} \cdot K_{MAC4\_WH} \cdot \sqrt{\cos(\Lambda_{H\_c4})}\right)^{1.19} = 0.494$ $\qquad \varepsilon_{\alpha\_@M0\_H} = 0.494$

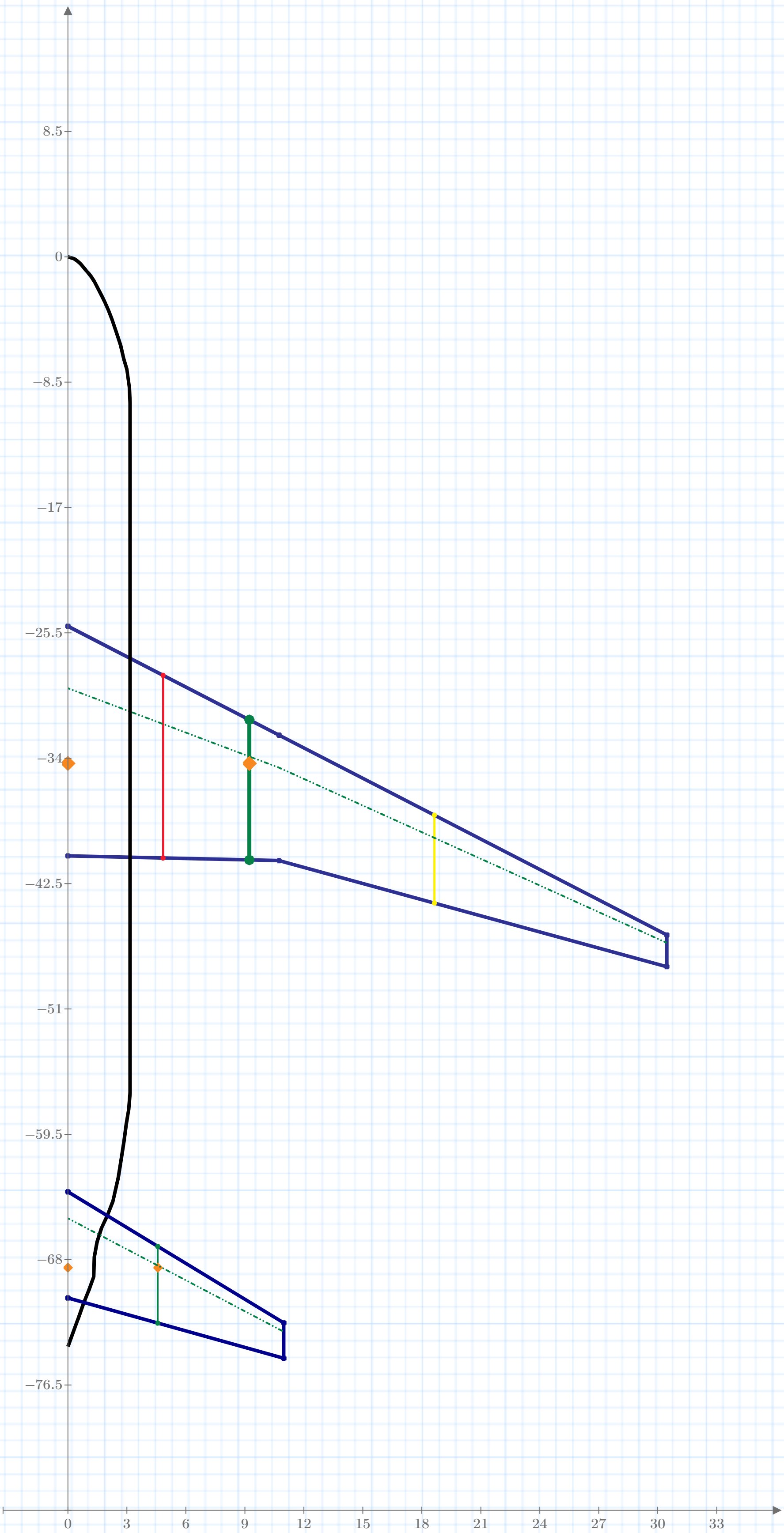
$\varepsilon_{\alpha\_H} := \varepsilon_{\alpha\_@M0\_H} \cdot \sqrt{1 - {M_1}^2}$ $\qquad \varepsilon_{\alpha\_H} = 0.375$

$\varepsilon_{0\_H} := \varepsilon_{\alpha\_H} \cdot (i_H - \alpha_{0L\_H}) = -8.854 \cdot 10^{-4}$ $\qquad \varepsilon_{0\_H} = -0.051\ \textit{deg}$

MISCELLANEOUS PARAMETERS PLOT



WING-BODY-HTAIL PLANFORM



MAPPING AND OUTPUT CREATION

Includi << ../Default_Map_HTail.mcdx

Excel Writing

$First\_Row_{H\_1} := 4$

$Block_{H\_1} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}HTail\_Data\_Map_{imported}\right)$

$Excel\_Output_{H\_1} := {}_{f}\text{write\_full\_output}\left({}_{s}Output\_Excel\_File, Block_{H\_1}, n_{sheet}, First\_Row_{H\_1}\right)$

$First\_Row_{H\_2} := First\_Row_{H\_1} + \text{rows}\left(Block_{H\_1}\right) + 2 = 20$

$Block_{H\_2} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}HTail\_Data\_Map_{input}\right)$

$Excel\_Output_{H\_2} := {}_{f}\text{write\_full\_output}\left({}_{s}Output\_Excel\_File, Block_{H\_2}, n_{sheet}, First\_Row_{H\_2}\right)$

$First\_Row_{H\_3} := First\_Row_{H\_2} + \text{rows}\left(Block_{H\_2}\right) + 2 = 58$

$Block_{H\_3} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}HTail\_Data\_Map\right)$

$Excel\_Output_{H\_3} := {}_{f}\text{write\_full\_output}\left({}_{s}Output\_Excel\_File, Block_{H\_3}, n_{sheet}, First\_Row_{H\_3}\right)$

$First\_Row_{H\_4} := First\_Row_{H\_3} + \text{rows}\left(Block_{H\_3}\right) + 2 = 143$

$Block_{H\_4} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}HTail\_Data\_Map_{LLCoeffs}\right)$

$Excel\_Output_{H\_4} := {}_{f}\text{write\_full\_output}\left({}_{s}Output\_Excel\_File, Block_{H\_4}, n_{sheet}, First\_Row_{H\_4}\right)$

$First\_Row_{H\_5} := First\_Row_{H\_4} + \text{rows}\left(Block_{H\_4}\right) + 2 = 178$

$Block_{H\_5} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}HTail\_Data\_Map_{Misc}\right)$

$Excel\_Output_{H\_5} := {}_{f}\text{write\_full\_output}\left({}_{s}Output\_Excel\_File, Block_{H\_5}, n_{sheet}, First\_Row_{H\_5}\right)$

CSV Tabs Writing

$${}_{m}CSV_{H\_1} := \text{augment}\left({}_{v}y, {}_{v}c_{ell}, {}_{v}c_{eff}, {}_{v}cC_{l\_a}, {}_{v}cC_{l\_b}\right) \cdot \frac{1}{m}$$

$CSV\_Output_{H\_1} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_shrenk\_loading(y,c\_ell,c\_eff,cCl\_a,cCl\_b).csv”}, {}_{m}CSV_{H\_1}\right)$

$${}_{m}CSV_{H\_2} := \text{augment}\left({}_{v}y \cdot \frac{1}{m}, {}_{v}x_{b\_H} \cdot \frac{1}{m}, {}_{v}IC_{M\_ac\_H\_b} \cdot \frac{1}{m^2}, {}_{v}IC_{M\_ac\_H\_b\_Roskam} \cdot \frac{1}{m^2}\right)$$

$CSV\_Output_{H\_2} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_shrenk–roskam\_loading(y,x\_b,IC\_M\_b,IC\_M\_b\_Roskam).csv”}, {}_{m}CSV_{H\_2}\right)$

$${}_{m}CSV_{H\_3} := \text{augment}\left({}_{v}y \cdot \frac{1}{m}, {}_{v}c_{H} \cdot \frac{1}{m}, {}_{v}\alpha_{0l\_2D}, {}_{v}\varepsilon_{g}, {}_{v}C_{l\alpha\_H}, {}_{v}C_{m\_ac\_2D\_H}, {}_{v}\xi_{ac\_2D\_H}\right)$$

$CSV\_Output_{H\_3} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_linear\_laws(y,c,alphazl,epsilon,Clalpha,Cmac,Csiac).csv”}, {}_{m}CSV_{H\_3}\right)$

$${}_{m}CSV_{H\_4} := \text{augment}\left({}_{v}X_{H}, {}_{v}Y_{H}\right) \cdot \frac{1}{m}$$

$CSV\_Output_{H\_4} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_planform(X\_H,Y\_H).csv”}, {}_{m}CSV_{H\_4}\right)$

$_{m}CSV_{H\_5} := \text{augment}\left({_v}X_{mac.H}, {_v}Y_{mac.H}, {_v}X_{ac\_H}, {_v}Y_{ac\_H}\right) \cdot \frac{1}{m}$

$CSV\_Output_{H\_5} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_planform\_MAC\_and\_AC(XmacH,YmacH,Xac,Yac).csv”}, {_m}CSV_{H\_5}\right)$

$_{m}CSV_{H\_6} := \text{augment}\left({_v}X_{ac\_2D\_H}, {_v}Y_{ac\_2D\_H}\right) \cdot \frac{1}{m}$

$CSV\_Output_{H\_6} := \text{WRITECSV}\left(\text{“.\textbackslash Output\textbackslash H–TAIL\_planform\_ac2D(Xac2D\_H,Yac2D\_H).csv”}, {_m}CSV_{H\_6}\right)$

TeX Macro writing on .tex

$_{v}complete\_macros_{H} := \text{stack}\left(Block_{H\_1}^{\langle 2\rangle}, Block_{H\_2}^{\langle 2\rangle}, Block_{H\_3}^{\langle 2\rangle}, Block_{H\_4}^{\langle 2\rangle}, Block_{H\_5}^{\langle 2\rangle}\right)$

$_{v}tex_{H} := {_f}\text{write\_matrix}\left(\text{“.\textbackslash Output\textbackslash HTAIL\_TeX\_Macros.tex”}, {_v}complete\_macros_{H}, \text{“ ”}\right)$