FUSELAGE PARAMETERS INITIALIZATION

Import and preliminary mapping of OTHER Excel Data

INPUT FUSELAGE PARAMETERS LIST

INPUT Parameters

$d_{B\_W} = 6.33 \ m$ $\qquad d_B = 6.33 \ m$

$l_B = 73.9 \ m$ $\qquad S_{B\_side} = 460.32 \ m^2$

$Z_1 = 6.33 \ m$ $\qquad Z_2 = 6.33 \ m$ $\qquad Z_{MAX} = 6.33 \ m$

$\omega_{MAX} = 6.33 \ m$ $\qquad r_1 = 3.9 \ m$ $\qquad h_1 = 6.33 \ m$

$N_{B\_0} = 15$ $\qquad N_{B\_1} = 10$ $\qquad N_{B\_2} = 10$ $\qquad N_{B\_W} = 5$

OTHER Parameters

$M_1 = 0.65$

$b_W = 60.92 \ m$ $\qquad i_W = 0.0349$ $\qquad c_{W\_r} = 15.57 \ m$ $\qquad S_W = 468.83 \ m^2$

$MAC_W = 9.505 \ m$ $\qquad \alpha_{0L\_W} = -0.023$ $\qquad C_{L\alpha\_W} = 5.822$ $\qquad \lambda_W = 0.138$

$AR_W = 7.916$

$X_{MAC\_LE\_W} = 6.341 \ m$ $\qquad Y_{MAC\_W} = 9.226 \ m$ $\qquad X_{ac\_W} = 9.3 \ m$ $\qquad \Gamma_{W\_eqv} = 0.122$

$\Lambda_{W\_c4\_eqv} = 0.538$ $\qquad \xi_{ac\_W} = 0.311$

$b_H = 21.96 \ m$ $\qquad \Lambda_{H\_LE} = 39 \ deg$ $\qquad \Gamma_H = 8.5 \ deg$

$c_{H\_r} = 7.2 \ m$ $\qquad c_{H\_t} = 2.4 \ m$

$$\Delta X\_W_{LE}\_Nose = 25.05 \ m \qquad \Delta X\_HT_{LE}\_Nose = 63.4 \ m \qquad \Delta X\_VT_{LE}\_Nose = 61.96 \ m$$

$$\Delta Z\_W_{LE}\_Nose = -0.75 \ m \qquad \Delta Z\_HT_{LE}\_Nose = 1.35 \ m \qquad \Delta X'\_HT_{MAC4}\_W_{MAC4} = 34.56 \ m$$

$$K_{AR\_W} = 0.098 \qquad K_{\lambda\_W} = 1.369 \qquad K_{MAC4\_WH} = 0.914 \qquad \varepsilon_{\alpha\_@M0\_W} = 0.332$$

$$\varepsilon_{\alpha\_W} = 0.252 \qquad \varepsilon_{0\_W} = 0.015$$

FUSELAGE PARAMETERS CALCULATIONS

Fuselage parameters

$$FFR := \frac{l_B}{d_B} \qquad\qquad\qquad FFR = 11.675$$

Miscellaneous Fuselage parameters

$$\Delta X\_W_{TE}\_Nose := \Delta X\_W_{LE}\_Nose + c_{W\_r} \qquad\qquad \Delta X\_W_{TE}\_Nose = 40.62 \ m$$

$$\Delta X\_HT_{LE}\_W_{TE} := \Delta X\_HT_{LE}\_Nose - \Delta X\_W_{TE}\_Nose = 22.78 \ m \qquad\qquad \Delta X\_HT_{LE}\_W_{TE} = 22.78 \ m$$

Some Horizontal Tail Calculations Needed at This Step

$$\lambda_H = 0.333 \qquad S_H = 105.408 \ m^2 \qquad AR_H = 4.575 \qquad X_{MAC\_LE\_H} = 3.705 \ m$$

$$MAC_H = 5.2 \ m \qquad \xi_{ac\_H} = 0.277 \qquad X_{ac\_H} = 5.147 \ m$$

$$\Delta X\_HT_{ac}\_W_{LE} := \Delta X\_HT_{LE}\_W_{TE} + \left(X_{MAC\_LE\_H} + MAC_H \cdot \xi_{ac\_H} \right) = 27.927 \ m$$

POINTS NEEDED TO PLOT THE FUSELAGE

Import from file

$$_mXY_{TOP} := {}_f\text{get\_points}\left(\text{"A"}, \text{"B"}\right)$$
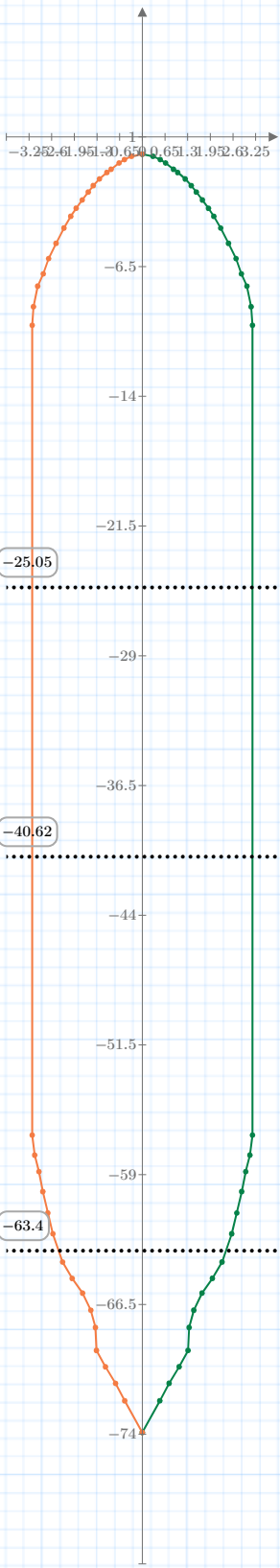
$$_mXY_{BOTTOM} := {}_f\text{get\_points}\left(\text{"D"}, \text{"E"}\right)$$

$$_mXY_{TV} := {}_f\text{get\_points}\left(\text{"G"}, \text{"H"}\right)$$

- **SIDE VIEW (SV)**
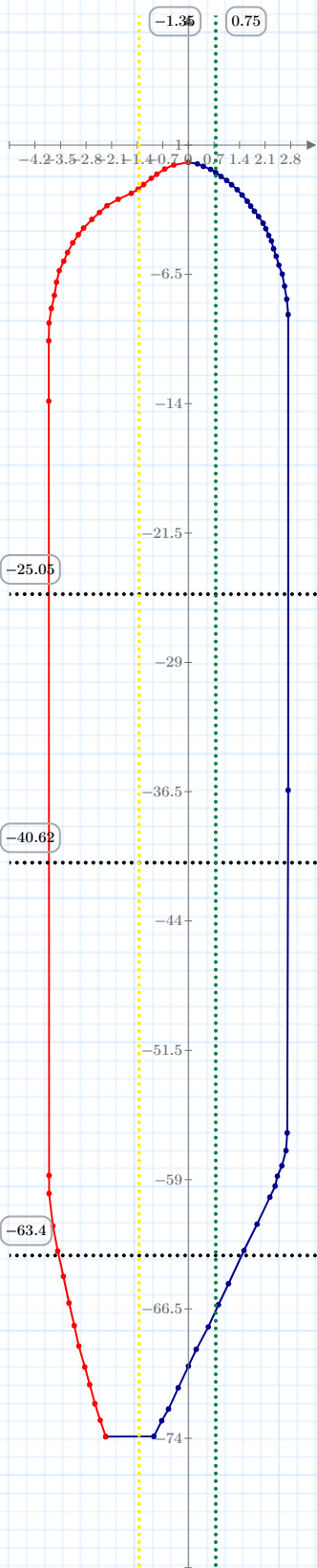
- **TOP VIEW (TV)**

FUSELAGE AERODYNAMICS

$k_{B\_Munch} = 0.943$

$_f y_{TOP}(x)$ $_f y_{BOTTOM}(x)$ $_f y_{TV}(x)$

$_f y_{xi\_cr\_vs\_\varepsilon u}(x)$ $_f y_{xNTWLE\_cr\_vs\_\varepsilon u}(x)$

DOWNWASH

DATCOM Method

$\Delta Z'' := 0$

$K'_{AR\_W} := K_{AR\_W}$ $K'_{\lambda\_W} := K_{\lambda\_W}$ $K'_{MAC4\_WH} := \dfrac{1 - \dfrac{\Delta Z''}{2}}{\left(\dfrac{2 \cdot \Delta X'\_HT_{MAC4\_}W_{MAC4}}{b_W}\right)^{\frac{1}{3}}} = 0.959$

$\varepsilon_{\alpha\_Multhopp} := 4.44 \cdot \left(K'_{AR\_W} \cdot K'_{\lambda\_W} \cdot K'_{MAC4\_WH} \cdot \sqrt{\cos\left(\Lambda_{W\_c4\_eqv}\right)}\right)^{1.19} = 0.351$

$\varepsilon_{\alpha\_@M0\_B} := \varepsilon_{\alpha\_Multhopp} = 0.351$

$_f\varepsilon_{\alpha\_Multhopp}(Mach) := \sqrt{1 - Mach^2} \cdot \varepsilon_{\alpha\_Multhopp}$ $\varepsilon_{\alpha\_B} := {}_f\varepsilon_{\alpha\_Multhopp}(M_1) = 0.267$

C_M_0 FUSELAGE PARAMETERS CALCULATIONS

Fuselage Mesh

$_v extremities\_X\_mesh$ $_v extremities\_Z_{TOP}\_mesh$ $_v extremities\_Z_{BOTTOM}\_mesh$ $_v extremities\_Y_{TV}\_mesh$

$_v midpoints\_X\_mesh$ $_v midpoints\_Z\_mesh$ $_v midpoints\_Y\_mesh$ $_v W_f$

Camber Line Angles

$$C_{M0\_B} := \frac{\pi \cdot k_{B\_Munch}}{2 \cdot S_W \cdot MAC_W} \cdot \sum_{i=0}^{N_{B\_0}-2} \left({}_vW_{f_i}^{\;2} \cdot \left(-i_W + \alpha_{0L\_W} + {}_vi_{cl_i} \right) \right) \cdot dx = -0.052$$

- **Fuselage Pitch Moment Coefficient @ $\alpha\_B=0$**

C_M_Alpha FUSELAGE PARAMETERS CALCULATIONS

First Fuselage Segment - From Nose to Wing Leading Edge

${}_vextremities\_X\_mesh_1$ ${}_vextremities\_Z_{TOP}\_mesh_1$ ${}_vextremities\_Z_{BOTTOM}\_mesh_1$ ${}_vextremities\_Y_{TV}\_mesh_1$
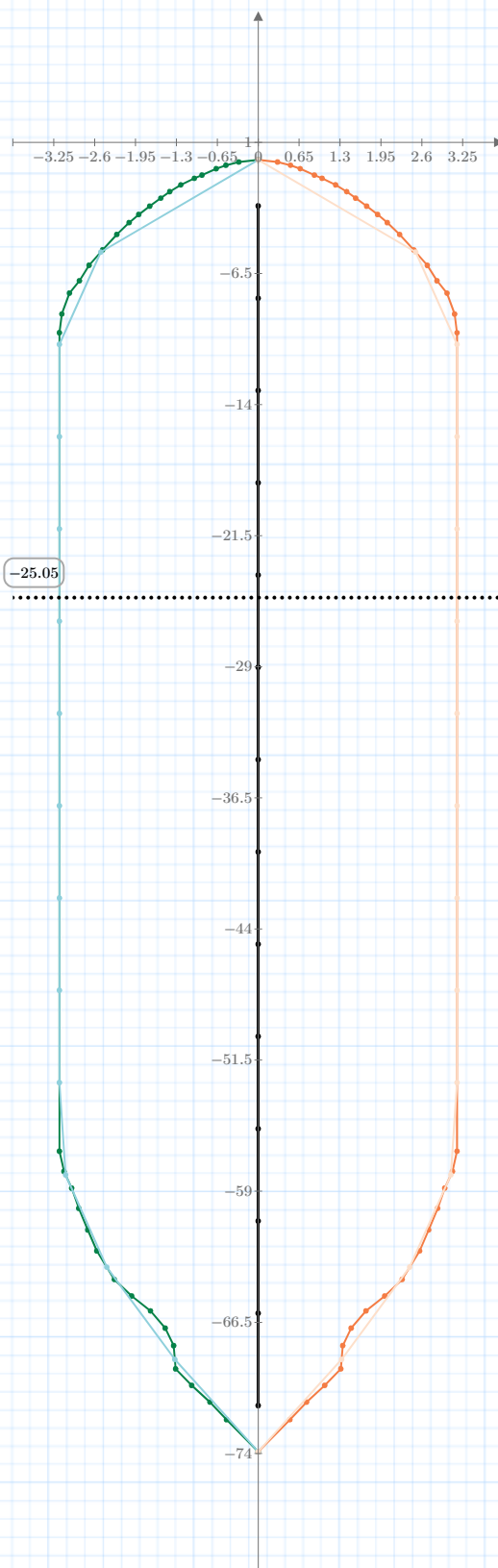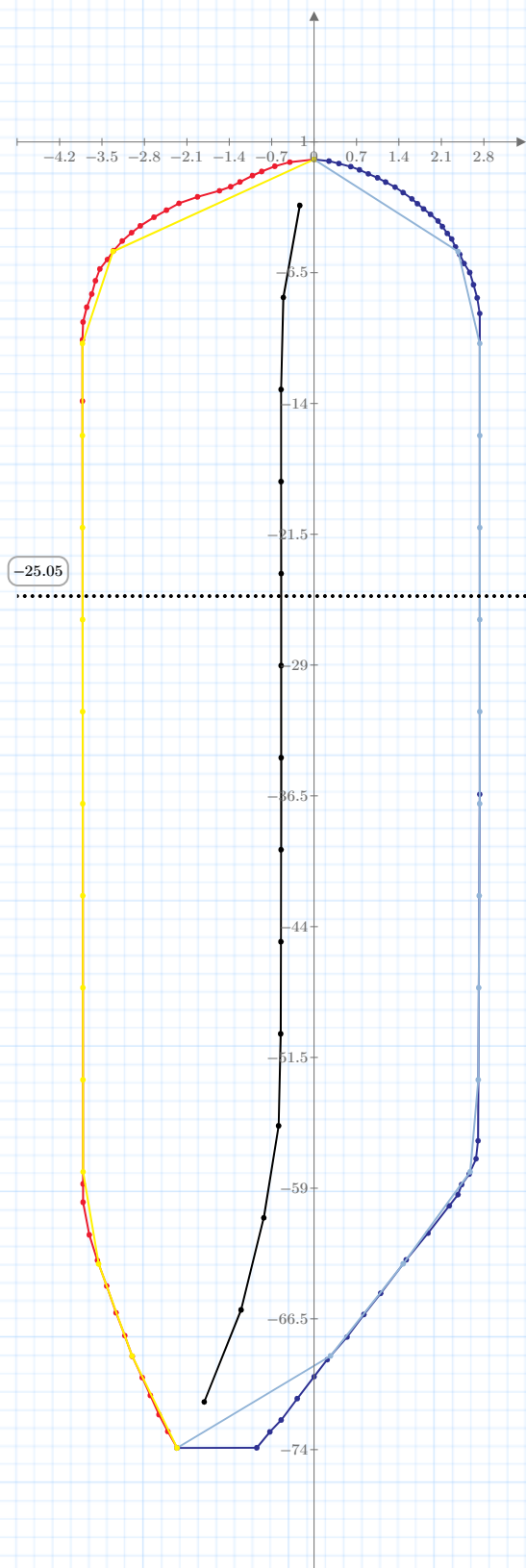
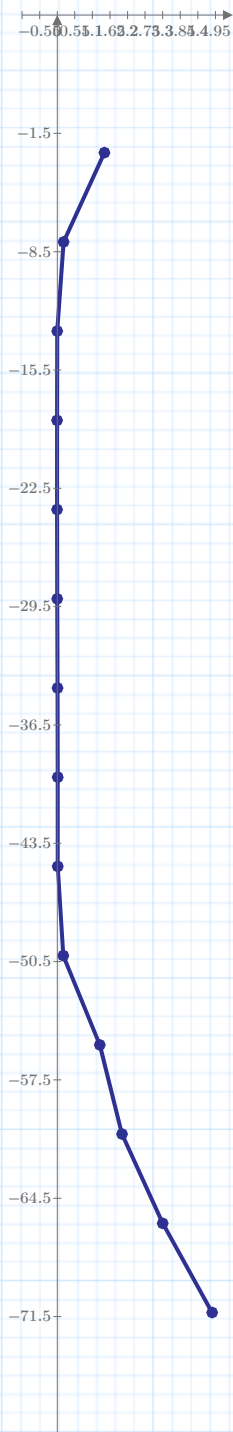${}_vmidpoints\_X\_mesh_1$ ${}_vmidpoints\_Y\_mesh_1$ ${}_vmidpoints\_Z\_mesh_1$ ${}_vW_{f\_1}$

$$\text{FuselageSectionsNose\_to\_W\_LE} := \text{Round}\left(\frac{N_{B\_1}}{5}, 1 \right) = 2$$

${}_v\varepsilon u_{\alpha 1}$
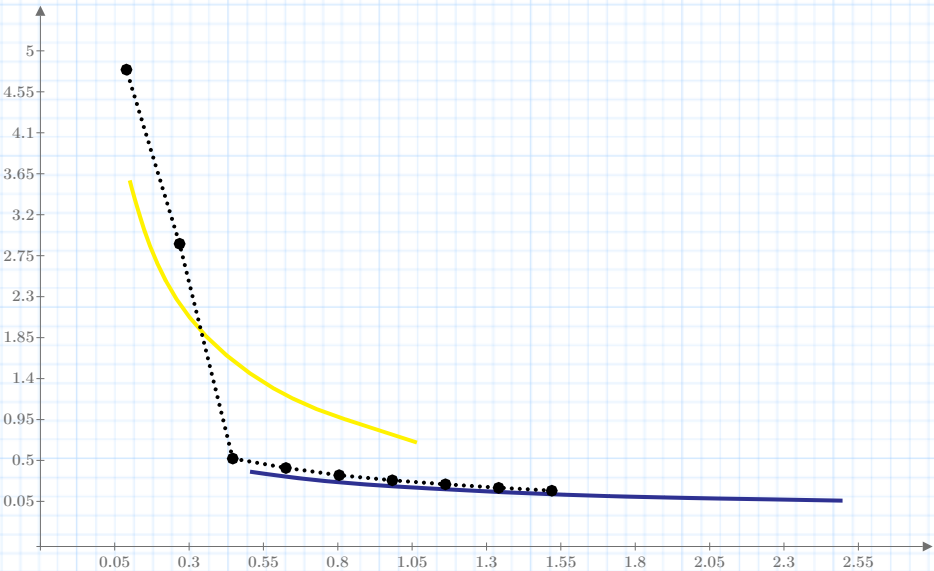
Second Fuselage Segment - From Wing Leading Edge to Wing Trailing Edge

$_v extremities\_X\_mesh_W$

$_v extremities\_Z_{TOP}\_mesh_W$

$_v extremities\_Z_{BOTTOM}\_mesh_W$

$_v extremities\_Y_{TV}\_mesh_W$

$_v midpoints\_X\_mesh_W$

$_v midpoints\_Y\_mesh_W$

$_v midpoints\_Z\_mesh_W$

$_v W_{f\_W}$

Third Fuselage Segment - From Wing Trailing Edge To Tail

$_v extremities\_X\_mesh_2$

$_v extremities\_Z_{TOP}\_mesh_2$

$_v extremities\_Z_{BOTTOM}\_mesh_2$

$_v extremities\_Y_{TV}\_mesh_2$

$_v midpoints\_X\_mesh_2$

$_v midpoints\_Y\_mesh_2$

$_v midpoints\_Z\_mesh_2$

$_v W_{f\_2}$
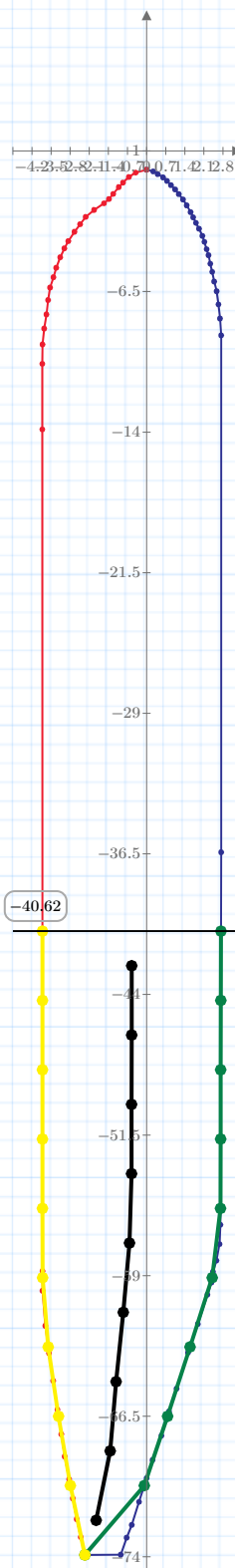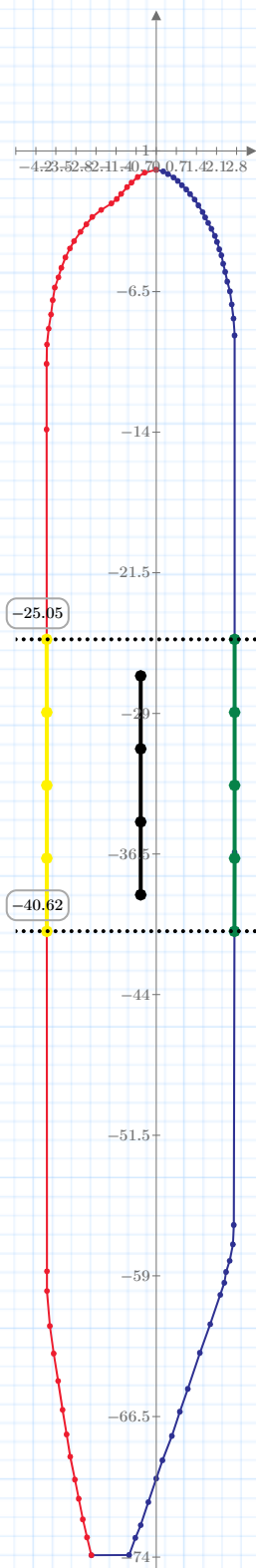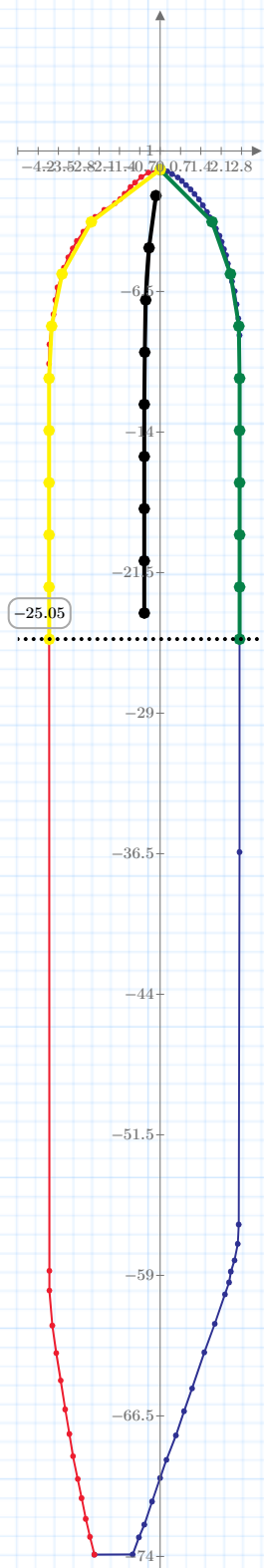
$_m\varepsilon u_{dW}$

$_m\varepsilon u_{d2}$

Pitch Coefficient Gradient

$$C_{M\alpha\_B} := \frac{\pi}{2\,S_W \cdot MAC_W} \cdot \left(\sum_{i=0}^{N_{B\_1}-2} \left({_v}W_{f\_1_i}^2 \cdot \left({_v}\varepsilon u_{\alpha 1_i} + 1 \right) \right) \cdot dx_1 + \sum_{i=0}^{N_{B\_2}-2} \left({_v}W_{f\_2_i}^2 \cdot \left(\frac{{_v}midpoints\_X1\_mesh_{2_i}}{\Delta X\_HT_{ac\_}W_{LE}} \cdot \left(1 - \varepsilon_{\alpha\_W} \right) \right) \right) \cdot dx_2 \right) = 0.774\, \frac{1}{rad}$$

$$C_{M\alpha\_BMulthopp} := \frac{\pi}{2\,S_W \cdot MAC_W} \cdot \left(\sum_{i=0}^{N_{B\_1}-2} \left({_v}W_{f\_1_i}^2 \cdot \left({_v}\varepsilon u_{\alpha 1_i} + 1 \right) \right) \cdot dx_1 + \sum_{i=0}^{N_{B\_2}-2} \left({_v}W_{f\_2_i}^2 \cdot \left(\frac{{_v}midpoints\_X1\_mesh_{2_i}}{\Delta X\_HT_{ac\_}W_{LE}} \cdot \left(1 - \varepsilon_{\alpha\_Multhopp} \right) \right) \right) \cdot dx_2 \right) = 0.759\, \frac{1}{rad}$$

$$C_{M\alpha\_B} = 0.774\, \frac{1}{rad} \qquad\qquad C_{M\alpha\_B} = 0.014\, \frac{1}{deg}$$

$$C_{M\alpha\_BMulthopp} = 0.759\, \frac{1}{rad} \qquad\qquad C_{M\alpha\_BMulthopp} = 0.013\, \frac{1}{deg}$$

$$\Delta\xi_{ac\_WB} := -\frac{C_{M\alpha\_B}}{C_{L\alpha\_W}} = -0.133 \qquad\qquad\qquad \Delta\xi_{ac\_WB} = -0.133$$

$$\xi_{ac\_WB} := \xi_{ac\_W} + \Delta\xi_{ac\_WB} = 0.178 \qquad\qquad\qquad \xi_{ac\_WB} = 0.178$$

$$\Delta\xi_{ac\_WB\_Multhopp} := -\frac{C_{M\alpha\_BMulthopp}}{C_{L\alpha\_W}} = -0.13 \qquad\qquad \Delta\xi_{ac\_WB\_Multhopp} = -0.13$$

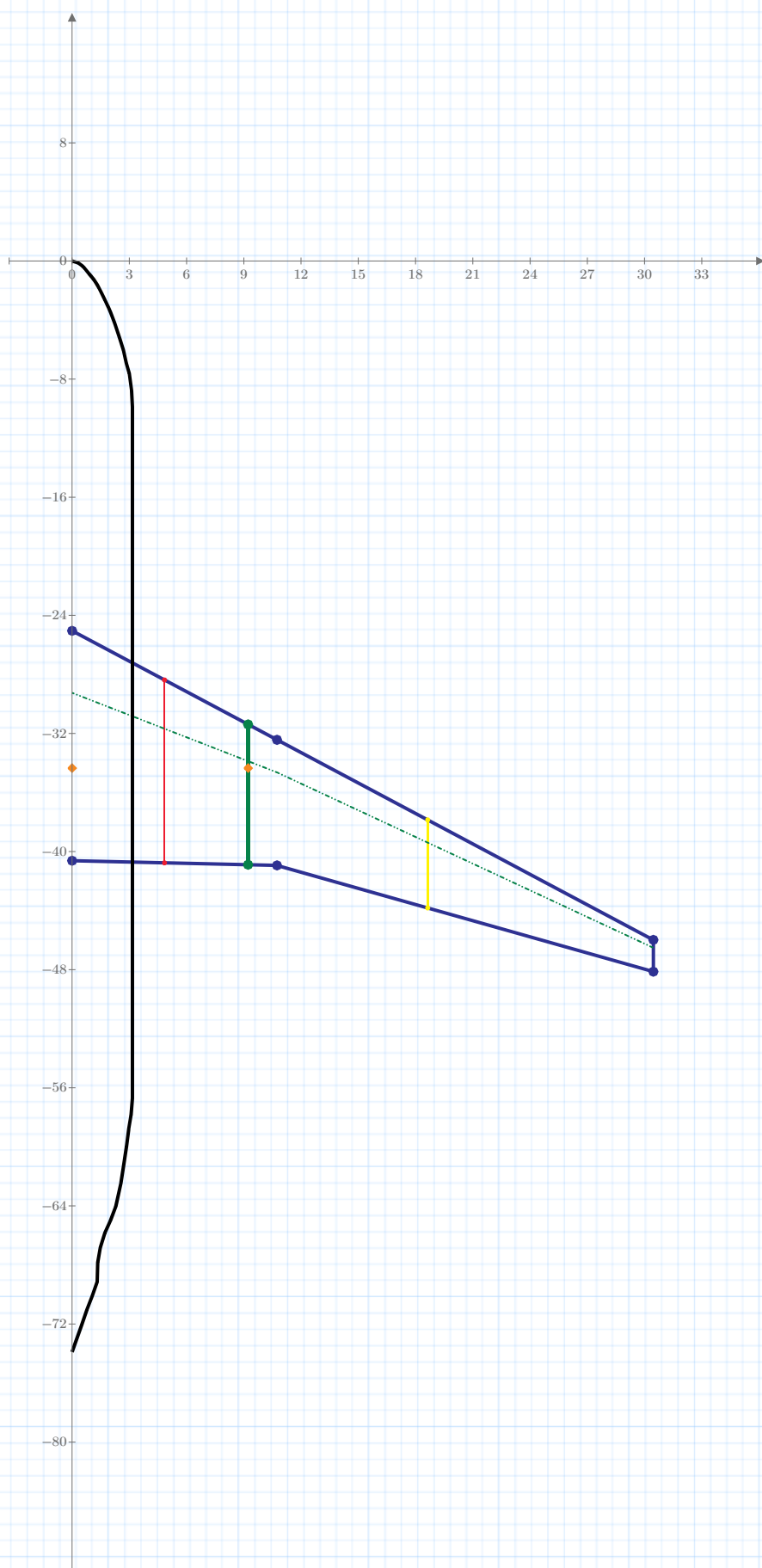$$\xi_{ac\_WB\_Multhopp} := \xi_{ac\_W} + \Delta\xi_{ac\_WB\_Multhopp} = 0.181 \qquad\qquad \xi_{ac\_WB\_Multhopp} = 0.181$$

Aerodynamic Center Configuration

$$X_{ac\_WB} := X_{MAC\_LE\_W} + \xi_{ac\_WB\_Multhopp} \cdot MAC_W = 8.057\ m$$

$${_v}X_{ac\_WB} := \begin{bmatrix} X_{ac\_WB} & X_{ac\_WB} \end{bmatrix}^{\mathrm{T}} \qquad\qquad {_v}Y_{ac\_WB} := \begin{bmatrix} 0 & Y_{MAC\_W} \end{bmatrix}^{\mathrm{T}}$$

WING-BODY PLANFORM

CSV TABS WRITING

k2_minus_k1_vs_FFR

$$_mCSV_{K2\_minus\_K1\_vs\_FFR} := \text{augment} \left(_{v\_tab}FFR_{K2\_minus\_K1} , _{m\_tab}Data_{K2\_minus\_K1} \right)$$

$$CSV\_Output_{B\_1} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_k2\_minus\_k1\_vs\_FFR.csv"} , _mCSV_{K2\_minus\_K1\_vs\_FFR} \right)$$

$$_mCSV_{K2\_minus\_k1\_vs\_FFR\_res} := \text{augment} \left(\begin{bmatrix} FFR & FFR & 0 \end{bmatrix}^T , \begin{bmatrix} 0 & k_{B\_Munch} & k_{B\_Munch} \end{bmatrix}^T \right)$$

$$CSV\_Output_{B\_2} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_k2\_minus\_k1\_vs\_FFR\_res.csv"} , _mCSV_{K2\_minus\_K1\_vs\_FFR} \right)$$

Fuselage Points and Other Values

$$_mCSV_{XZ\_TOP} := \text{augment} \left(_mXY_{TOP} \cdot \frac{1}{m} , _mXY_{TOP} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_3} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_TOP.csv"} , _mCSV_{XZ\_TOP} \right)$$

$$_mCSV_{XZ\_BOTTOM} := \text{augment} \left(_mXY_{BOTTOM} \cdot \frac{1}{m} , _mXY_{BOTTOM} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_4} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_BOTTOM.csv"} , _mCSV_{XZ\_BOTTOM} \right)$$

$$_mCSV_{XY\_TV} := \text{augment} \left(_mXY_{TV} \cdot \frac{1}{m} , _mXY_{TV} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_5} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XY\_TOPVIEW.csv"} , _mCSV_{XY\_TV} \right)$$

$$_mCSV_{mesh} := \text{augment} \left(_vextremities\_X\_mesh \cdot \frac{1}{m} , _vextremities\_Z_{TOP\_mesh} \cdot \frac{1}{m} , _vextremities\_Z_{BOTTOM\_mesh} \cdot \frac{1}{m} , _vextremities\_X\_mesh \cdot \frac{1}{ft} , _vextremities\_Z_{TOP\_mesh} \cdot \frac{1}{ft} , _vextremities\_Z_{BOTTOM\_mesh} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_6} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_MESH.csv"} , _mCSV_{mesh} \right)$$

$$_mCSV_{mesh\_Y} := \text{augment} \left(_vextremities\_X\_mesh \cdot \frac{1}{m} , _vextremities\_Y_{TV\_mesh} \cdot \frac{1}{m} , _vextremities\_X\_mesh \cdot \frac{1}{ft} , _vextremities\_Y_{TV\_mesh} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_7} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XY\_MESH.csv"} , _mCSV_{mesh\_Y} \right)$$

$$_mCSV_{mp\_values\_I} := \text{augment} \left(_vmidpoints\_X\_mesh \cdot \frac{1}{m} , _vmidpoints\_Z\_mesh \cdot \frac{1}{m} , _vW_f \cdot \frac{1}{m} , _vi_{cl} \cdot \frac{1}{deg} \right)$$

$$_mCSV_{mp\_values\_II} := \text{augment} \left(_vmidpoints\_X\_mesh \cdot \frac{1}{ft} , _vmidpoints\_Z\_mesh \cdot \frac{1}{ft} , _vW_f \cdot \frac{1}{ft} , _vi_{cl} \cdot \frac{1}{rad} \right)$$

$$_mCSV_{mp\_values} := \text{augment} \left(_mCSV_{mp\_values\_I} , _mCSV_{mp\_values\_II} \right)$$

$$CSV\_Output_{B\_8} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_MIDPOINT\_VALUES.csv"} , _mCSV_{mp\_values} \right)$$

Fuselage First Segment - From Nose to Wing Leading Edge

$$_mCSV_{mesh1} := \text{augment} \left(_vextremities\_X\_mesh_1 \cdot \frac{1}{m} , _vextremities\_Z_{TOP\_mesh_1} \cdot \frac{1}{m} , _vextremities\_Z_{BOTTOM\_mesh_1} \cdot \frac{1}{m} , _vextremities\_X\_mesh_1 \cdot \frac{1}{ft} , _vextremities\_Z_{TOP\_mesh_1} \cdot \frac{1}{ft} , _vextremities\_Z_{BOTTOM\_mesh_1} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_9} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_MESH\_Nose\_Wing\_LE.csv"} , _mCSV_{mesh1} \right)$$

$$_mCSV_{mesh\_Y\_1} := \text{augment} \left(_vextremities\_X\_mesh_1 \cdot \frac{1}{m} , _vextremities\_Y_{TV\_mesh_1} \cdot \frac{1}{m} , _vextremities\_X\_mesh_1 \cdot \frac{1}{ft} , _vextremities\_Y_{TV\_mesh_1} \cdot \frac{1}{ft} \right)$$

$$CSV\_Output_{B\_10} := \text{WRITECSV} \left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XY\_MESH\_Nose\_Wing\_LE.csv"} , _mCSV_{mesh\_Y\_1} \right)$$

$$_mCSV_{mp\_values\_I\_1} := \text{augment} \left(_vmidpoints\_X\_mesh_1 \cdot \frac{1}{m} , _vmidpoints\_Z\_mesh_1 \cdot \frac{1}{m} , _vW_{f\_1} \cdot \frac{1}{m} \right)$$

$$_{m}CSV_{mp\_values\_II\_1} := \text{augment}\left(_{v}midpoints\_X\_mesh_{1} \cdot \frac{1}{ft}, _{v}midpoints\_Z\_mesh_{1} \cdot \frac{1}{ft}, _{v}W_{f\_1} \cdot \frac{1}{ft}\right)$$

$$_{m}CSV_{mp\_values\_1} := \text{augment}\left(_{m}CSV_{mp\_values\_I\_1}, _{m}CSV_{mp\_values\_II\_1}\right)$$

$$CSV\_Output_{B\_11} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_MIDPOINT\_VALUES\_Nose\_Wing\_LE.csv"}, _{m}CSV_{mp\_values\_1}\right)$$

Fuselage Second Segment - From Wing Leading Edge to Wing Trailing Edge

$$_{m}CSV_{meshW} := \text{augment}\left(_{v}extremities\_X\_mesh_{W} \cdot \frac{1}{m}, _{v}extremities\_Z\_TOP\_mesh_{W} \cdot \frac{1}{m}, _{v}extremities\_Z\_BOTTOM\_mesh_{W} \cdot \frac{1}{m}, _{v}extremities\_X\_mesh_{W} \cdot \frac{1}{ft}, _{v}extremities\_Z\_TOP\_mesh_{W} \cdot \frac{1}{ft}, _{v}extremities\_Z\_BOTTOM\_mesh_{W} \cdot \frac{1}{ft}\right)$$

$$CSV\_Output_{B\_12} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_MESH\_Wing\_LE\_TE.csv"}, _{m}CSV_{meshW}\right)$$

$$_{m}CSV_{mesh\_Y\_W} := \text{augment}\left(_{v}extremities\_X\_mesh_{W} \cdot \frac{1}{m}, _{v}extremities\_Y_{TV}\_mesh_{W} \cdot \frac{1}{m}, _{v}extremities\_X\_mesh_{W} \cdot \frac{1}{ft}, _{v}extremities\_Y_{TV}\_mesh_{W} \cdot \frac{1}{ft}\right)$$

$$CSV\_Output_{B\_13} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XY\_MESH\_Wing\_LE\_TE.csv"}, _{m}CSV_{mesh\_Y\_W}\right)$$

$$_{m}CSV_{mp\_values\_I\_W} := \text{augment}\left(_{v}midpoints\_X\_mesh_{W} \cdot \frac{1}{m}, _{v}midpoints\_Z\_mesh_{W} \cdot \frac{1}{m}, _{v}W_{f\_W} \cdot \frac{1}{m}\right)$$

$$_{m}CSV_{mp\_values\_II\_W} := \text{augment}\left(_{v}midpoints\_X\_mesh_{W} \cdot \frac{1}{ft}, _{v}midpoints\_Z\_mesh_{W} \cdot \frac{1}{ft}, _{v}W_{f\_W} \cdot \frac{1}{ft}\right)$$

$$_{m}CSV_{mp\_values\_W} := \text{augment}\left(_{m}CSV_{mp\_values\_I\_W}, _{m}CSV_{mp\_values\_II\_W}\right)$$

$$CSV\_Output_{B\_14} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_MIDPOINT\_VALUES\_Wing\_LE\_TE.csv"}, _{m}CSV_{mp\_values\_W}\right)$$

Fuselage Third Segment - From Wing Trailing Edge To Tail

$$_{m}CSV_{mesh2} := \text{augment}\left(_{v}extremities\_X\_mesh_{2} \cdot \frac{1}{m}, _{v}extremities\_Z\_TOP\_mesh_{2} \cdot \frac{1}{m}, _{v}extremities\_Z\_BOTTOM\_mesh_{2} \cdot \frac{1}{m}, _{v}extremities\_X\_mesh_{2} \cdot \frac{1}{ft}, _{v}extremities\_Z\_TOP\_mesh_{2} \cdot \frac{1}{ft}, _{v}extremities\_Z\_BOTTOM\_mesh_{2} \cdot \frac{1}{ft}\right)$$

$$CSV\_Output_{B\_15} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XZ\_MESH\_Wing\_TE\_Tail.csv"}, _{m}CSV_{mesh2}\right)$$

$$_{m}CSV_{mesh\_Y\_2} := \text{augment}\left(_{v}extremities\_X\_mesh_{2} \cdot \frac{1}{m}, _{v}extremities\_Y_{TV}\_mesh_{2} \cdot \frac{1}{m}, _{v}extremities\_X\_mesh_{2} \cdot \frac{1}{ft}, _{v}extremities\_Y_{TV}\_mesh_{2} \cdot \frac{1}{ft}\right)$$

$$CSV\_Output_{B\_16} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_XY\_MESH\_Wing\_TE\_Tail.csv"}, _{m}CSV_{mesh\_Y\_2}\right)$$

$$_{m}CSV_{mp\_values\_I\_2} := \text{augment}\left(_{v}midpoints\_X\_mesh_{2} \cdot \frac{1}{m}, _{v}midpoints\_Z\_mesh_{2} \cdot \frac{1}{m}, _{v}W_{f\_2} \cdot \frac{1}{m}\right)$$

$$_{m}CSV_{mp\_values\_II\_2} := \text{augment}\left(_{v}midpoints\_X\_mesh_{2} \cdot \frac{1}{ft}, _{v}midpoints\_Z\_mesh_{2} \cdot \frac{1}{ft}, _{v}W_{f\_2} \cdot \frac{1}{ft}\right)$$

$$_{m}CSV_{mp\_values\_2} := \text{augment}\left(_{m}CSV_{mp\_values\_I\_2}, _{m}CSV_{mp\_values\_II\_2}\right)$$

$$CSV\_Output_{B\_17} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_MIDPOINT\_VALUES\_Wing\_TE\_Tail.csv"}, _{m}CSV_{mp\_values\_2}\right)$$

$$_mCSV_{mp\_ALL} := \begin{Vmatrix} k \leftarrow -1 \\ \text{for } i \in 0\,..\,N_{B\_1}-2 \\ \quad \begin{Vmatrix} k \leftarrow k+1 \\ _mtemporary_{k,0} \leftarrow k+1 \\ _mtemporary_{k,1} \leftarrow {_vmidpoints\_X\_mesh_{1_i}} \cdot \dfrac{1}{m} \\ _mtemporary_{k,2} \leftarrow dx_1 \cdot \dfrac{1}{m} \\ _mtemporary_{k,3} \leftarrow {_vW_{f\_1_i}} \cdot \dfrac{1}{m} \\ _mtemporary_{k,4} \leftarrow {_vW_{f\_1_i}}^2 \cdot \dfrac{1}{m^2} \\ _mtemporary_{k,5} \leftarrow {_v\varepsilon u_{\alpha 1_i}} \\ _mtemporary_{k,6} \leftarrow 1 + {_v\varepsilon u_{\alpha 1_i}} \\ _mtemporary_{k,7} \leftarrow {_vW_{f\_1_i}}^2 \cdot \dfrac{1}{m^2} \cdot \left(1 + {_v\varepsilon u_{\alpha 1_i}}\right) \cdot dx_1 \cdot \dfrac{1}{m} \end{Vmatrix} \\ \text{for } i \in 0\,..\,N_{B\_2}-2 \\ \quad \begin{Vmatrix} k \leftarrow k+1 \\ _mtemporary_{k,0} \leftarrow k+1+N_{B\_W}-1 \\ _mtemporary_{k,1} \leftarrow {_vmidpoints\_X\_mesh_{2_i}} \cdot \dfrac{1}{m} \\ _mtemporary_{k,2} \leftarrow dx_2 \cdot \dfrac{1}{m} \\ _mtemporary_{k,3} \leftarrow {_vW_{f\_2_i}} \cdot \dfrac{1}{m} \\ _mtemporary_{k,4} \leftarrow {_vW_{f\_2_i}}^2 \cdot \dfrac{1}{m^2} \\ _mtemporary_{k,5} \leftarrow {_m\varepsilon u_{d2_{i,1}}} - 1 \\ _mtemporary_{k,6} \leftarrow {_m\varepsilon u_{d2_{i,1}}} \\ _mtemporary_{k,7} \leftarrow {_vW_{f\_2_i}}^2 \cdot \dfrac{1}{m^2} \cdot {_m\varepsilon u_{d2_{i,1}}} \cdot dx_2 \cdot \dfrac{1}{m} \end{Vmatrix} \\ _mtemporary \end{Vmatrix}$$

$$CSV\_Output_{B\_18} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_data\_MIDPOINT\_VALUES\_All\_Fuselage.csv"}, {_mCSV_{mp\_ALL}}\right)$$

$$_mCSV_{edW} := \text{augment}\left({_m\varepsilon u_{dW}}^{\langle 0 \rangle} \cdot \dfrac{1}{m}, {_m\varepsilon u_{dW}}^{\langle 0 \rangle} \cdot \dfrac{1}{c_{W\_r}}, \left({_m\varepsilon u_{dW}}^{\langle 0 \rangle} - c_{W\_r}\right) \cdot \dfrac{1}{\Delta X\_HT_{ac\_}W_{LE}}, {_m\varepsilon u_{dW}}^{\langle 1 \rangle}\right)$$

$$CSV\_Output_{B\_19} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_xw\_cr\_vs\_edw.csv"}, {_mCSV_{edW}}\right)$$

$$_mCSV_{ed2} := \text{augment}\left({_m\varepsilon u_{d2}}^{\langle 0 \rangle} \cdot \dfrac{1}{m}, {_m\varepsilon u_{d2}}^{\langle 0 \rangle} \cdot \dfrac{1}{\Delta X\_HT_{ac\_}W_{LE}}, {_m\varepsilon u_{d2}}^{\langle 1 \rangle}\right)$$

$$CSV\_Output_{B\_20} := \text{WRITECSV}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_x2\_cr\_vs\_ed2.csv"}, {_mCSV_{ed2}}\right)$$

MAPPING AND OUTPUT CREATION

Includi << ../Default_Map_Fuselage.mcdx

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

$Block_{B\_1} := {}_{\mathrm{f}}\mathrm{map\_matrix\_transform}\left({}_m Fuselage\_Data\_Map_{imported}\right)$

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

$First\_Row_{B\_2} := First\_Row_{B\_1} + \mathrm{rows}\left(Block_{B\_1}\right) + 2 = 63$

$Block_{B\_2} := {}_{\mathrm{f}}\mathrm{map\_matrix\_transform}\left({}_m Fuselage\_Data\_Map_{input}\right)$

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

$First\_Row_{B\_3} := First\_Row_{B\_2} + \mathrm{rows}\left(Block_{B\_2}\right) + 2 = 89$

$Block_{B\_3} := {}_{\mathrm{f}}\mathrm{map\_matrix\_transform}\left({}_m Fuselage\_Data\_Map\right)$

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

$First\_Row_{B\_4} := First\_Row_{B\_3} + \mathrm{rows}\left(Block_{B\_3}\right) + 2 = 118$

$Block_{B\_4} := {}_{\mathrm{f}}\mathrm{map\_matrix\_transform}\left({}_m Fuselage\_Data\_Map_{Misc}\right)$

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

TeX Macro writing on .tex

$_v complete\_macros_B := \mathrm{stack}\left(Block_{B\_1}{}^{\langle 2\rangle}\,,Block_{B\_2}{}^{\langle 2\rangle}\,,Block_{B\_3}{}^{\langle 2\rangle}\,,Block_{B\_4}{}^{\langle 2\rangle}\right)$

$_v tex_W := {}_{\mathrm{f}}\mathrm{write\_matrix}\left(\text{".\textbackslash Output\textbackslash FUSELAGE\_TeX\_Macros.tex"}\,,{}_v complete\_macros_B\,,\text{" "}\right)$