

FUSELAGE PARAMETERS INITIALIZATION

Hidden Area --> Import of Excel INPUT Fuselage Data

Hidden Area --> Preliminary Mapping of imported Data

Import and preliminary mapping of OTHER Excel Data

INPUT FUSELAGE PARAMETERS LIST

INPUT Parameters

$d_{B_W} = 3.261 \text{ m}$	$d_B = 2.786 \text{ m}$		
$l_B = 28.164 \text{ m}$	$S_{B_side} = 86.479 \text{ m}^2$		
$Z_1 = 3.688 \text{ m}$	$Z_2 = 3.383 \text{ m}$	$Z_{MAX} = 3.261 \text{ m}$	
$\omega_{MAX} = 3.261 \text{ m}$	$r_1 = 1.524 \text{ m}$	$h_1 = 2.347 \text{ m}$	
$N_{B_0} = 15$	$N_{B_1} = 5$	$N_{B_2} = 6$	$N_{B_W} = 3$

OTHER Parameters

$M_1 = 0.696$			
$b_W = 27.249 \text{ m}$	$i_W = 0.0349$	$c_{W_r} = 5.243 \text{ m}$	$S_W = 87.62 \text{ m}^2$
$MAC_W = 3.642 \text{ m}$	$\alpha_{0L_W} = -0.033$	$C_{L\alpha_W} = 6.227$	$\lambda_W = 0.227$
$AR_W = 8.474$			
$X_{MAC_LE_W} = 2.861 \text{ m}$	$Y_{MAC_W} = 5.381 \text{ m}$	$X_{ac_W} = 3.928 \text{ m}$	$\Gamma_{W_eqv} = 0.038$
$\Lambda_{W_cA_eqv} = 0.429$	$\xi_{ac_W} = 0.293$		
$b_H = 11.217 \text{ m}$	$\Lambda_{H_LE} = 35 \text{ deg}$	$\Gamma_H = 0 \text{ deg}$	
$c_{H_r} = 3.322 \text{ m}$	$c_{H_t} = 1.219 \text{ m}$		

$$\begin{aligned}
\Delta X_{W_{LE}Nose} &= 11.13 \text{ m} & \Delta X_{HT_{LE}Nose} &= 27.86 \text{ m} & \Delta X_{VT_{LE}Nose} &= 22.296 \text{ m} \\
\Delta Z_{W_{LE}Nose} &= -0.94 \text{ m} & \Delta Z_{HT_{LE}Nose} &= 6.1 \text{ m} & \Delta X'_{HT_{MAC4}W_{MAC4}} &= 14.98 \text{ m} \\
K_{AR_W} &= 0.092 & K_{\lambda_W} &= 1.331 & K_{MAC4_{WH}} &= 0.707 & \varepsilon_{\alpha@M0_W} &= 0.229 \\
\varepsilon_{\alpha_W} &= 0.164 & \varepsilon_{0_W} &= 0.011 & & & &
\end{aligned}$$

FUSELAGE PARAMETERS CALCULATIONS

Fuselage parameters

$$FFR := \frac{l_B}{d_B} \quad FFR = 10.109$$

Miscellaneous Fuselage parameters

$$\Delta X_{W_{TE}Nose} := \Delta X_{W_{LE}Nose} + c_{W_r} \quad \Delta X_{W_{TE}Nose} = 16.373 \text{ m}$$

$$\Delta X_{HT_{LE}W_{TE}} := \Delta X_{HT_{LE}Nose} - \Delta X_{W_{TE}Nose} = 11.487 \text{ m} \quad \Delta X_{HT_{LE}W_{TE}} = 11.487 \text{ m}$$

Some Horizontal Tail Calculations Needed at This Step

$$\begin{aligned}
\lambda_H &= 0.367 & S_H &= 25.47 \text{ m}^2 & AR_H &= 4.94 & X_{MAC_{LE_H}} &= 1.66 \text{ m} \\
MAC_H &= 2.433 \text{ m} & \xi_{ac_H} &= 0.264 & X_{ac_H} &= 2.302 \text{ m} & &
\end{aligned}$$

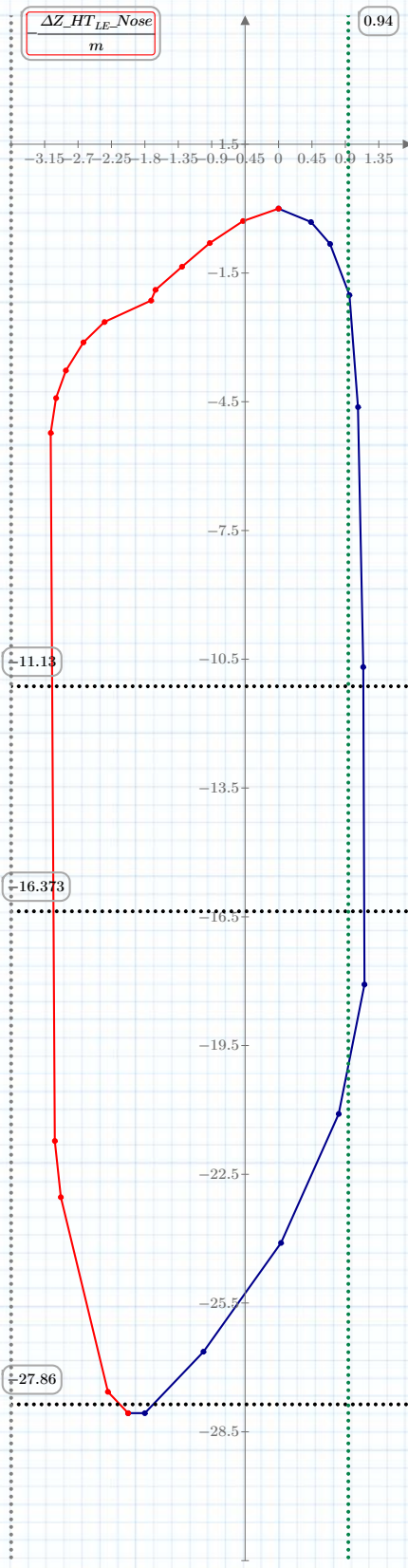
$$\Delta X_{HT_{ac}W_{LE}} := \Delta X_{HT_{LE}W_{TE}} + (X_{MAC_{LE_H}} + MAC_H \cdot \xi_{ac_H}) = 13.789 \text{ m}$$

POINTS NEEDED TO PLOT THE FUSELAGE

Import from file

$$\begin{aligned}
m_{XY_{TOP}} &:= \text{fget_points}("A", "B") \\
m_{XY_{BOTTOM}} &:= \text{fget_points}("D", "E") \\
m_{XY_{TV}} &:= \text{fget_points}("G", "H")
\end{aligned}$$

• SIDE VIEW (SV)



• TOP VIEW (TV)



FUSELAGE AERODYNAMICS

@Aerodynamic Database ---> (C_m0_b)_k2_minus_k1_vs_FFR

$$k_{B_Munch} = 0.93$$

@Aerodynamic Database ---> (C_m_alpha_b)_upwash_vs_x_i_over_root_chord

@Aerodynamic Database ---> (C_m_alpha_b)_upwash_(NTWLE)_vs_x_i_over_root_chord

$$fY_{TOP}(x)$$

$$fY_{BOTTOM}(x)$$

$$fY_{TV}(x)$$

$$fY_{xi_cr_vs_eu}(x)$$

$$fY_{xNTWLE_cr_vs_eu}(x)$$

DOWNWASH

DATCOM Method

$$\Delta Z'' := 0$$

$$K'_{AR_W} := K_{AR_W}$$

$$K'_{\lambda_W} := K_{\lambda_W}$$

$$K'_{MAC4_WH} := \frac{1 - \frac{\Delta Z''}{2}}{\left(\frac{2 \cdot \Delta X'_{HT_{MAC4}} \cdot W_{MAC4}}{b_W} \right)^{\frac{1}{3}}} = 0.969$$

$$\varepsilon_{\alpha_Multhopp} := 4.44 \cdot \left(K'_{AR_W} \cdot K'_{\lambda_W} \cdot K'_{MAC4_WH} \cdot \sqrt{\cos(\Lambda_{W_c4_eqv})} \right)^{1.19} = 0.333$$

$$\varepsilon_{\alpha_@M0_B} := \varepsilon_{\alpha_Multhopp} = 0.333$$

$$f\varepsilon_{\alpha_Multhopp}(Mach) := \sqrt{1 - Mach^2} \cdot \varepsilon_{\alpha_Multhopp}$$

$$\varepsilon_{\alpha_B} := f\varepsilon_{\alpha_Multhopp}(M_1) = 0.239$$

C_M_0 FUSELAGE PARAMETERS CALCULATIONS

Fuselage Mesh

$$v_{extremities_X_mesh}$$

$$v_{extremities_Z_{TOP}_mesh}$$

$$v_{extremities_Z_{BOTTOM}_mesh}$$

$$v_{extremities_Y_{TV}_mesh}$$

$$v_{midpoints_X_mesh}$$

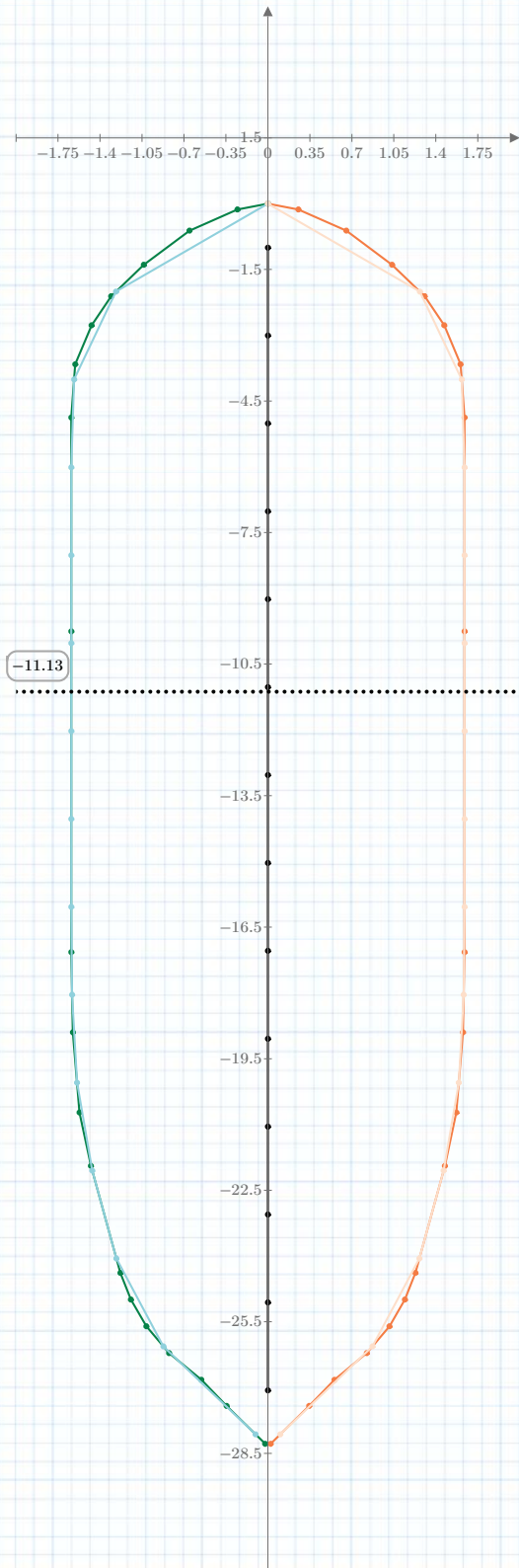
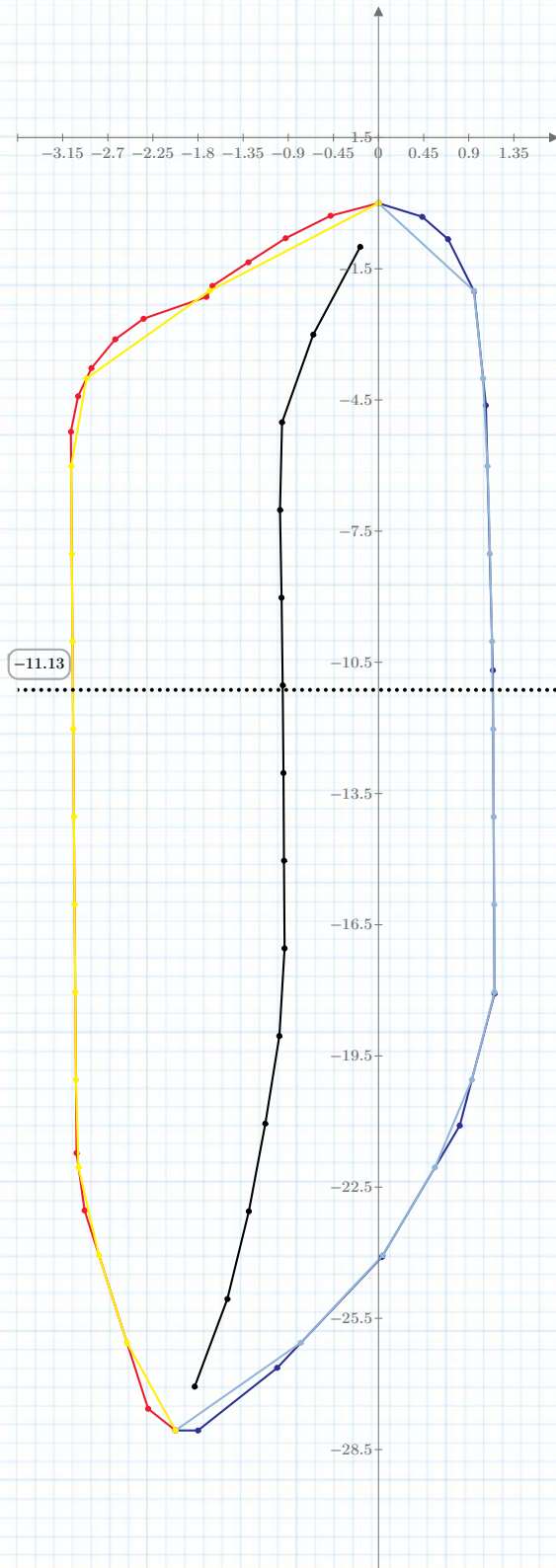
$$v_{midpoints_Z_mesh}$$

$$v_{midpoints_Y_mesh}$$

$$vW_f$$

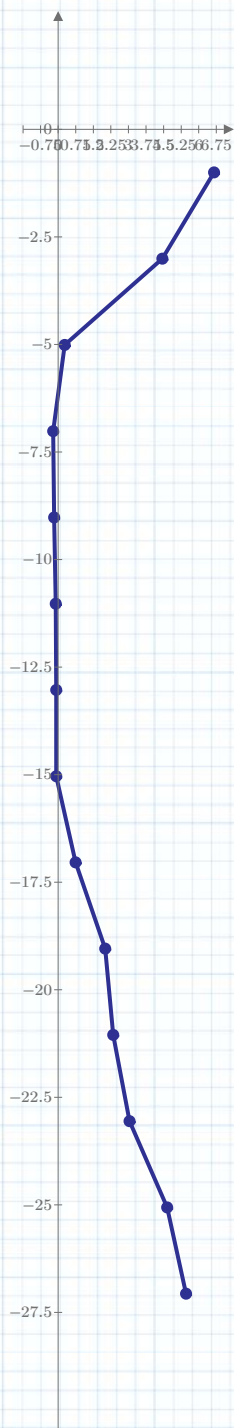
• SIDE VIEW (SV)

• TOP VIEW (TV)



Camber Line Angles

$v\dot{i}_{cl}$



Pitch Coefficient at Wing Zero-Lift

$$C_{M0_B} := \frac{\pi \cdot k_{B_Munch}}{2 \cdot S_W \cdot MAC_W} \cdot \sum_{i=0}^{N_{B,0}-2} \left({}^vW_{f_i}^2 \cdot \left(-i_W + \alpha_{0L_W} + {}^v i_{cl_i} \right) \right) \cdot dx = -0.101$$

• 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

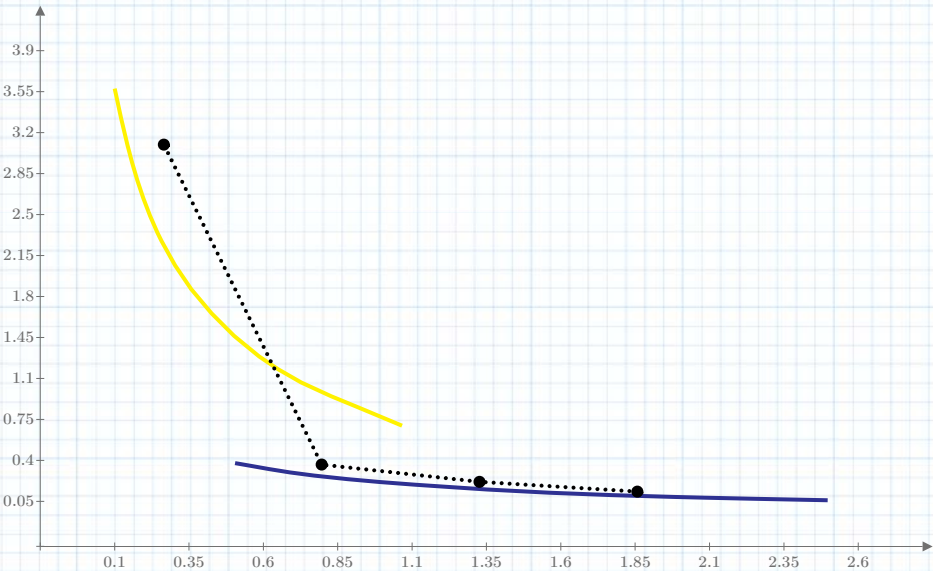
vmidpoints_Y_mesh_1

vmidpoints_Z_mesh_1

${}^vW_{f_1}$

$$FuselageSectionsNose_to_W_LE := Round\left(\frac{N_{B,1}}{5}, 1\right) = 1$$

${}^v\mathcal{E}u_{\alpha 1}$



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

$v_{extremities_X_mesh_W}$

$v_{extremities_Z_{TOP_mesh_W}}$

$v_{extremities_Z_{BOTTOM_mesh_W}}$

$v_{extremities_Y_{TV_mesh_W}}$

$v_{midpoints_X_mesh_W}$

$v_{midpoints_Y_mesh_W}$

$v_{midpoints_Z_mesh_W}$

vW_{f_W}

Third Fuselage Segment - From Wing Trailing Edge To Tail

$v_{extremities_X_mesh_2}$

$v_{extremities_Z_{TOP_mesh_2}}$

$v_{extremities_Z_{BOTTOM_mesh_2}}$

$v_{extremities_Y_{TV_mesh_2}}$

$v_{midpoints_X_mesh_2}$

$v_{midpoints_Y_mesh_2}$

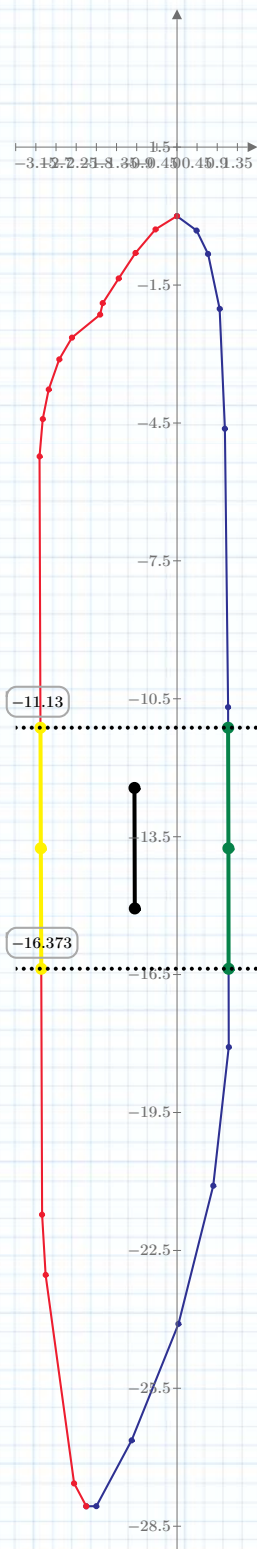
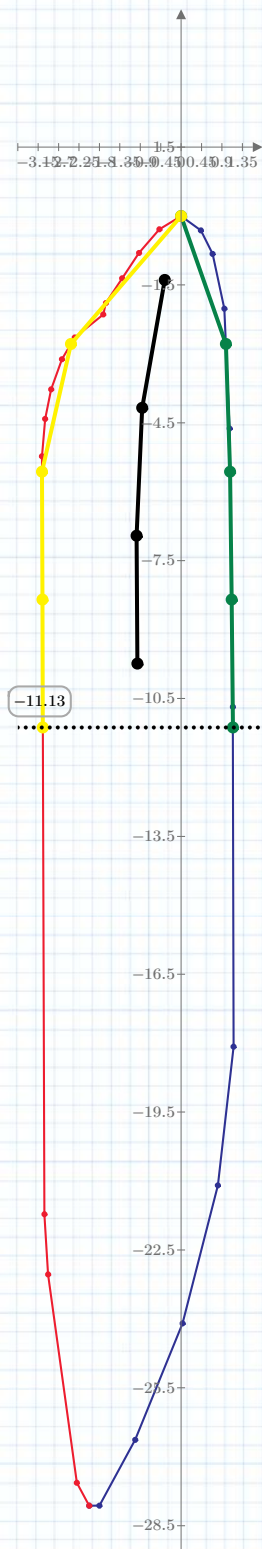
$v_{midpoints_Z_mesh_2}$

vW_{f_2}

• First Segment

• Second Segment

• Third Segment



1_minus_deps/dalpha in afterbody midpoints

$m\epsilon u_{dW}$

$m\epsilon u_{d2}$



Pitch Coefficient Gradient

$$C_{M\alpha_B} := \frac{\pi}{2 S_W \cdot MAC_W} \cdot \left(\sum_{i=0}^{N_{B,1}-2} \left(v W_{f,1_i}^2 \cdot \left(v \varepsilon u_{\alpha 1_i} + 1 \right) \right) \cdot dx_1 + \sum_{i=0}^{N_{B,2}-2} \left(v W_{f,2_i}^2 \cdot \left(\frac{v \text{midpoints_}X1_mesh_{2_i}}{\Delta X_{HT_{ac-W_{LE}}}} \cdot \left(1 - \varepsilon_{\alpha_W} \right) \right) \right) \cdot dx_2 \right) = 1.156 \frac{1}{\text{rad}}$$

$$C_{M\alpha_{B\text{Multhopp}}} := \frac{\pi}{2 S_W \cdot MAC_W} \cdot \left(\sum_{i=0}^{N_{B,1}-2} \left(v W_{f,1_i}^2 \cdot \left(v \varepsilon u_{\alpha 1_i} + 1 \right) \right) \cdot dx_1 + \sum_{i=0}^{N_{B,2}-2} \left(v W_{f,2_i}^2 \cdot \left(\frac{v \text{midpoints_}X1_mesh_{2_i}}{\Delta X_{HT_{ac-W_{LE}}}} \cdot \left(1 - \varepsilon_{\alpha_{\text{Multhopp}}} \right) \right) \right) \cdot dx_2 \right) = 1.133 \frac{1}{\text{rad}}$$

$$C_{M\alpha_B} = 1.156 \frac{1}{\text{rad}}$$

$$C_{M\alpha_B} = 0.02 \frac{1}{\text{deg}}$$

$$C_{M\alpha_{B\text{Multhopp}}} = 1.133 \frac{1}{\text{rad}}$$

$$C_{M\alpha_{B\text{Multhopp}}} = 0.02 \frac{1}{\text{deg}}$$

$$\Delta \xi_{ac_{WB}} := -\frac{C_{M\alpha_B}}{C_{L\alpha_W}} = -0.186$$

$$\Delta \xi_{ac_{WB}} = -0.186$$

$$\xi_{ac_{WB}} := \xi_{ac_W} + \Delta \xi_{ac_{WB}} = 0.107$$

$$\xi_{ac_{WB}} = 0.107$$

$$\Delta \xi_{ac_{WB_Multhopp}} := -\frac{C_{M\alpha_{B\text{Multhopp}}}}{C_{L\alpha_W}} = -0.182$$

$$\Delta \xi_{ac_{WB_Multhopp}} = -0.182$$

$$\xi_{ac_{WB_Multhopp}} := \xi_{ac_W} + \Delta \xi_{ac_{WB_Multhopp}} = 0.111$$

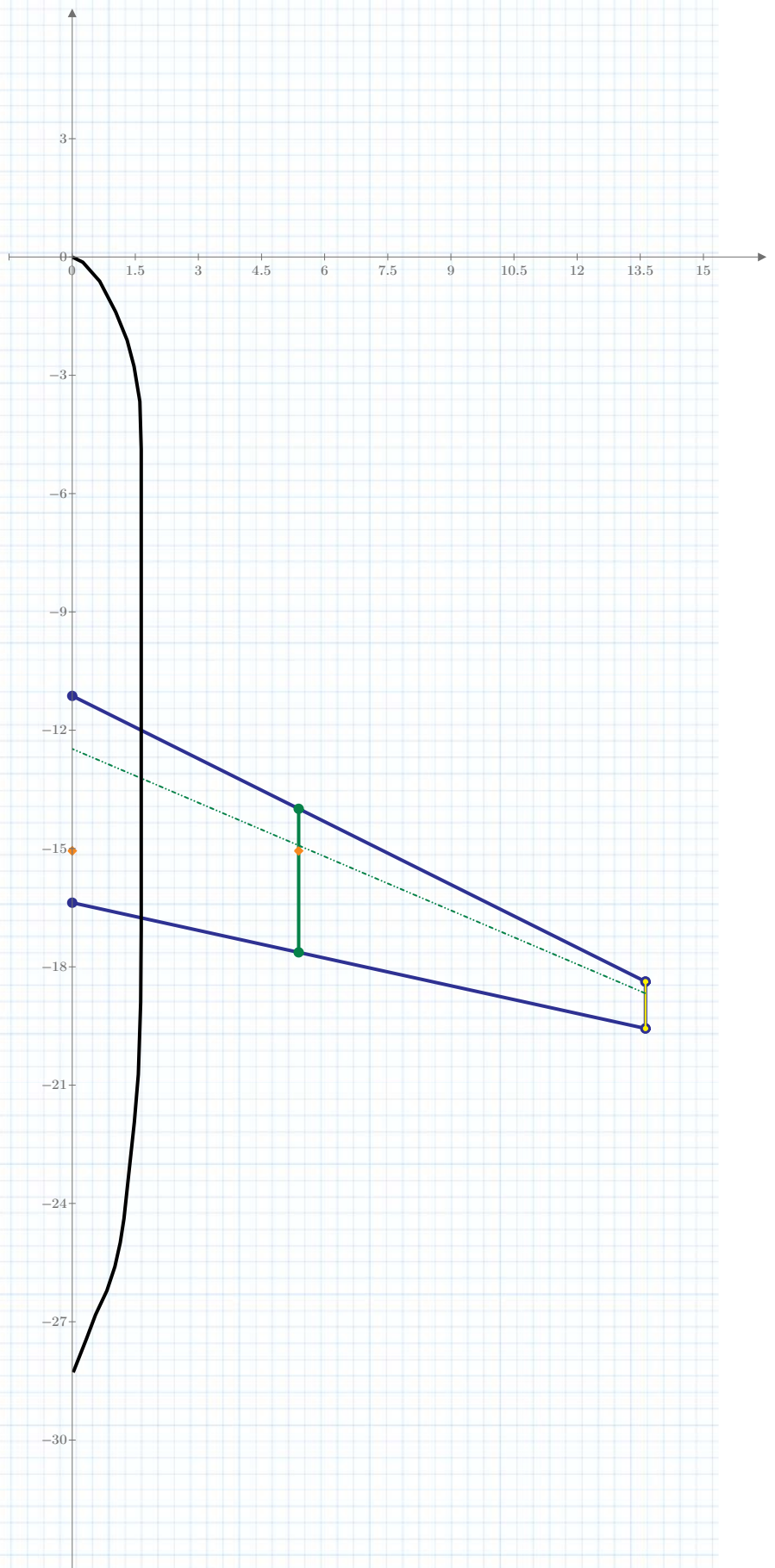
$$\xi_{ac_{WB_Multhopp}} = 0.111$$

Aerodynamic Center Configuration

$$X_{ac_{WB}} := X_{MAC_{LE_W}} + \xi_{ac_{WB_Multhopp}} \cdot MAC_W = 3.265 \text{ m}$$

$${}_v X_{ac_{WB}} := \begin{bmatrix} X_{ac_{WB}} & X_{ac_{WB}} \end{bmatrix}^T \quad {}_v Y_{ac_{WB}} := \begin{bmatrix} 0 & Y_{MAC_W} \end{bmatrix}^T$$

WING-BODY PLANFORM



CSV TABS WRITING

k2_minus_k1_vs_FFR

$mCSV_{K2_minus_K1_vs_FFR} := \text{augment} \left(v_{tab}^{FFR}_{K2_minus_K1}, m_{tab}^{Data}_{K2_minus_K1} \right)$

$CSV_Output_{B_1} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_k2_minus_k1_vs_FFR.csv}", mCSV_{K2_minus_K1_vs_FFR} \right)$

$mCSV_{K2_minus_k1_vs_FFR_res} := \text{augment} \left(\begin{bmatrix} FFR & FFR & 0 \end{bmatrix}^T, \begin{bmatrix} 0 & k_{B_Munch} & k_{B_Munch} \end{bmatrix}^T \right)$

$CSV_Output_{B_2} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_k2_minus_k1_vs_FFR_res.csv}", mCSV_{K2_minus_K1_vs_FFR} \right)$

Fuselage Points and Other Values

$mCSV_{XZ_TOP} := \text{augment} \left(m^{XY_TOP} \cdot \frac{1}{m}, m^{XY_TOP} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_3} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XZ_TOP.csv}", mCSV_{XZ_TOP} \right)$

$mCSV_{XZ_BOTTOM} := \text{augment} \left(m^{XY_BOTTOM} \cdot \frac{1}{m}, m^{XY_BOTTOM} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_4} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XZ_BOTTOM.csv}", mCSV_{XZ_BOTTOM} \right)$

$mCSV_{XY_TV} := \text{augment} \left(m^{XY_TV} \cdot \frac{1}{m}, m^{XY_TV} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_5} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XY_TOPVIEW.csv}", mCSV_{XY_TV} \right)$

$mCSV_{mesh} := \text{augment} \left(v^{extremities_X_mesh} \cdot \frac{1}{m}, v^{extremities_Z_TOP_mesh} \cdot \frac{1}{m}, v^{extremities_Z_BOTTOM_mesh} \cdot \frac{1}{m}, v^{extremities_X_mesh} \cdot \frac{1}{ft}, v^{extremities_Z_TOP_mesh} \cdot \frac{1}{ft}, v^{extremities_Z_BOTTOM_mesh} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_6} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XZ_MESH.csv}", mCSV_{mesh} \right)$

$mCSV_{mesh_Y} := \text{augment} \left(v^{extremities_X_mesh} \cdot \frac{1}{m}, v^{extremities_Y_TV_mesh} \cdot \frac{1}{m}, v^{extremities_X_mesh} \cdot \frac{1}{ft}, v^{extremities_Y_TV_mesh} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_7} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XY_MESH.csv}", mCSV_{mesh_Y} \right)$

$mCSV_{mp_values_I} := \text{augment} \left(v^{midpoints_X_mesh} \cdot \frac{1}{m}, v^{midpoints_Z_mesh} \cdot \frac{1}{m}, v^{W_f} \cdot \frac{1}{m}, v^{i_{cl}} \cdot \frac{1}{deg} \right)$

$mCSV_{mp_values_II} := \text{augment} \left(v^{midpoints_X_mesh} \cdot \frac{1}{ft}, v^{midpoints_Z_mesh} \cdot \frac{1}{ft}, v^{W_f} \cdot \frac{1}{ft}, v^{i_{cl}} \cdot \frac{1}{rad} \right)$

$mCSV_{mp_values} := \text{augment} \left(mCSV_{mp_values_I}, mCSV_{mp_values_II} \right)$

$CSV_Output_{B_8} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_MIDPOINT_VALUES.csv}", mCSV_{mp_values} \right)$

Fuselage First Segment - From Nose to Wing Leading Edge

$mCSV_{mesh1} := \text{augment} \left(v^{extremities_X_mesh1} \cdot \frac{1}{m}, v^{extremities_Z_TOP_mesh1} \cdot \frac{1}{m}, v^{extremities_Z_BOTTOM_mesh1} \cdot \frac{1}{m}, v^{extremities_X_mesh1} \cdot \frac{1}{ft}, v^{extremities_Z_TOP_mesh1} \cdot \frac{1}{ft}, v^{extremities_Z_BOTTOM_mesh1} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_9} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XZ_MESH_Nose_Wing_LE.csv}", mCSV_{mesh1} \right)$

$mCSV_{mesh_Y_1} := \text{augment} \left(v^{extremities_X_mesh1} \cdot \frac{1}{m}, v^{extremities_Y_TV_mesh1} \cdot \frac{1}{m}, v^{extremities_X_mesh1} \cdot \frac{1}{ft}, v^{extremities_Y_TV_mesh1} \cdot \frac{1}{ft} \right)$

$CSV_Output_{B_10} := \text{WRITECSV} \left(".\backslash\text{Output}\backslash\text{FUSELAGE_data_XY_MESH_Nose_Wing_LE.csv}", mCSV_{mesh_Y_1} \right)$

$mCSV_{mp_values_I_1} := \text{augment} \left(v^{midpoints_X_mesh1} \cdot \frac{1}{m}, v^{midpoints_Z_mesh1} \cdot \frac{1}{m}, v^{W_{f1}} \cdot \frac{1}{m} \right)$

$$mCSV_{mp_values_I_1} := \text{augment} \left(v_{midpoints_X_mesh_1} \cdot \frac{1}{m}, v_{midpoints_Z_mesh_1} \cdot \frac{1}{m}, v_{W_{f_1}} \cdot \frac{1}{m} \right)$$

$$mCSV_{mp_values_II_1} := \text{augment} \left(v_{midpoints_X_mesh_1} \cdot \frac{1}{ft}, v_{midpoints_Z_mesh_1} \cdot \frac{1}{ft}, v_{W_{f_1}} \cdot \frac{1}{ft} \right)$$

$$mCSV_{mp_values_1} := \text{augment} (mCSV_{mp_values_I_1}, mCSV_{mp_values_II_1})$$

$$CSV_Output_{B_11} := \text{WRITECSV} (".\Output\FUSELAGE_data_MIDPOINT_VALUES_Nose_Wing_LE.csv", mCSV_{mp_values_1})$$

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

$$mCSV_{meshW} := \text{augment} \left(v_{extremities_X_meshW} \cdot \frac{1}{m}, v_{extremities_Z_{TOP_meshW}} \cdot \frac{1}{m}, v_{extremities_Z_{BOTTOM_meshW}} \cdot \frac{1}{m}, v_{extremities_X_meshW} \cdot \frac{1}{ft}, v_{extremities_Z_{TOP_meshW}} \cdot \frac{1}{ft}, v_{extremities_Z_{BOTTOM_meshW}} \cdot \frac{1}{ft} \right)$$

$$CSV_Output_{B_12} := \text{WRITECSV} (".\Output\FUSELAGE_data_XZ_MESH_Wing_LE_TE.csv", mCSV_{meshW})$$

$$mCSV_{mesh_Y_W} := \text{augment} \left(v_{extremities_X_meshW} \cdot \frac{1}{m}, v_{extremities_Y_{TV_meshW}} \cdot \frac{1}{m}, v_{extremities_X_meshW} \cdot \frac{1}{ft}, v_{extremities_Y_{TV_meshW}} \cdot \frac{1}{ft} \right)$$

$$CSV_Output_{B_13} := \text{WRITECSV} (".\Output\FUSELAGE_data_XY_MESH_Wing_LE_TE.csv", mCSV_{mesh_Y_W})$$

$$mCSV_{mp_values_I_W} := \text{augment} \left(v_{midpoints_X_meshW} \cdot \frac{1}{m}, v_{midpoints_Z_meshW} \cdot \frac{1}{m}, v_{W_{f_W}} \cdot \frac{1}{m} \right)$$

$$mCSV_{mp_values_II_W} := \text{augment} \left(v_{midpoints_X_meshW} \cdot \frac{1}{ft}, v_{midpoints_Z_meshW} \cdot \frac{1}{ft}, v_{W_{f_W}} \cdot \frac{1}{ft} \right)$$

$$mCSV_{mp_values_W} := \text{augment} (mCSV_{mp_values_I_W}, mCSV_{mp_values_II_W})$$

$$CSV_Output_{B_14} := \text{WRITECSV} (".\Output\FUSELAGE_data_MIDPOINT_VALUES_Wing_LE_TE.csv", mCSV_{mp_values_W})$$

Fuselage Third Segment - From Wing Trailing Edge To Tail

$$mCSV_{mesh2} := \text{augment} \left(v_{extremities_X_mesh2} \cdot \frac{1}{m}, v_{extremities_Z_{TOP_mesh2}} \cdot \frac{1}{m}, v_{extremities_Z_{BOTTOM_mesh2}} \cdot \frac{1}{m}, v_{extremities_X_mesh2} \cdot \frac{1}{ft}, v_{extremities_Z_{TOP_mesh2}} \cdot \frac{1}{ft}, v_{extremities_Z_{BOTTOM_mesh2}} \cdot \frac{1}{ft} \right)$$

$$CSV_Output_{B_15} := \text{WRITECSV} (".\Output\FUSELAGE_data_XZ_MESH_Wing_TE_Tail.csv", mCSV_{mesh2})$$

$$mCSV_{mesh_Y_2} := \text{augment} \left(v_{extremities_X_mesh2} \cdot \frac{1}{m}, v_{extremities_Y_{TV_mesh2}} \cdot \frac{1}{m}, v_{extremities_X_mesh2} \cdot \frac{1}{ft}, v_{extremities_Y_{TV_mesh2}} \cdot \frac{1}{ft} \right)$$

$$CSV_Output_{B_16} := \text{WRITECSV} (".\Output\FUSELAGE_data_XY_MESH_Wing_TE_Tail.csv", mCSV_{mesh_Y_2})$$

$$mCSV_{mp_values_I_2} := \text{augment} \left(v_{midpoints_X_mesh2} \cdot \frac{1}{m}, v_{midpoints_Z_mesh2} \cdot \frac{1}{m}, v_{W_{f_2}} \cdot \frac{1}{m} \right)$$

$$mCSV_{mp_values_II_2} := \text{augment} \left(v_{midpoints_X_mesh2} \cdot \frac{1}{ft}, v_{midpoints_Z_mesh2} \cdot \frac{1}{ft}, v_{W_{f_2}} \cdot \frac{1}{ft} \right)$$

$$mCSV_{mp_values_2} := \text{augment} (mCSV_{mp_values_I_2}, mCSV_{mp_values_II_2})$$

$$CSV_Output_{B_17} := \text{WRITECSV} (".\Output\FUSELAGE_data_MIDPOINT_VALUES_Wing_TE_Tail.csv", mCSV_{mp_values_2})$$

All Fuselage Segments

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 $mCSV_{mp\_ALL} := \begin{aligned} & k \leftarrow -1 \\ & \text{for } i \in 0 \dots N_{B\_1} - 2 \\ & \quad k \leftarrow k + 1 \\ & \quad mtemporary_{k,0} \leftarrow k + 1 \\ & \quad mtemporary_{k,1} \leftarrow v_{midpoints\_X\_mesh_1} \cdot \frac{1}{m} \\ & \quad mtemporary_{k,2} \leftarrow dx_1 \cdot \frac{1}{m} \\ & \quad mtemporary_{k,3} \leftarrow v_{W_{f\_1i}} \cdot \frac{1}{m} \\ & \quad mtemporary_{k,4} \leftarrow v_{W_{f\_1i}}^2 \cdot \frac{1}{m^2} \\ & \quad mtemporary_{k,5} \leftarrow v_{\varepsilon u_{\alpha 1i}} \\ & \quad mtemporary_{k,6} \leftarrow 1 + v_{\varepsilon u_{\alpha 1i}} \\ & \quad mtemporary_{k,7} \leftarrow v_{W_{f\_1i}}^2 \cdot \frac{1}{m^2} \cdot (1 + v_{\varepsilon u_{\alpha 1i}}) \cdot dx_1 \cdot \frac{1}{m} \\ & \text{for } i \in 0 \dots N_{B\_2} - 2 \\ & \quad k \leftarrow k + 1 \\ & \quad mtemporary_{k,0} \leftarrow k + 1 + N_{B\_W} - 1 \\ & \quad mtemporary_{k,1} \leftarrow v_{midpoints\_X\_mesh_2} \cdot \frac{1}{m} \\ & \quad mtemporary_{k,2} \leftarrow dx_2 \cdot \frac{1}{m} \\ & \quad mtemporary_{k,3} \leftarrow v_{W_{f\_2i}} \cdot \frac{1}{m} \\ & \quad mtemporary_{k,4} \leftarrow v_{W_{f\_2i}}^2 \cdot \frac{1}{m^2} \\ & \quad mtemporary_{k,5} \leftarrow m_{\varepsilon u_{d2i,1}} - 1 \\ & \quad mtemporary_{k,6} \leftarrow m_{\varepsilon u_{d2i,1}} \\ & \quad mtemporary_{k,7} \leftarrow v_{W_{f\_2i}}^2 \cdot \frac{1}{m^2} \cdot m_{\varepsilon u_{d2i,1}} \cdot dx_2 \cdot \frac{1}{m} \\ & mtemporary \end{aligned}$ 
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$CSV_Output_{B_18} := \text{WRITECSV}(\text{".\Output\FUSELAGE_data_MIDPOINT_VALUES_All_Fuselage.csv"}, mCSV_{mp_ALL})$

1_minus_deps/dalphi in afterbody midpoints

$mCSV_{edW} := \text{augment} \left(m_{\varepsilon u_{dW}}^{(0)} \cdot \frac{1}{m}, m_{\varepsilon u_{dW}}^{(0)} \cdot \frac{1}{c_{W_r}}, (m_{\varepsilon u_{dW}}^{(0)} - c_{W_r}) \cdot \frac{1}{\Delta X_{HT_{ac-W_{LE}}}}, m_{\varepsilon u_{dW}}^{(1)} \right)$

$CSV_Output_{B_19} := \text{WRITECSV}(\text{".\Output\FUSELAGE_xw_cr_vs_edw.csv"}, mCSV_{edW})$

$mCSV_{ed2} := \text{augment} \left(m_{\varepsilon u_{d2}}^{(0)} \cdot \frac{1}{m}, m_{\varepsilon u_{d2}}^{(0)} \cdot \frac{1}{\Delta X_{HT_{ac-W_{LE}}}}, m_{\varepsilon u_{d2}}^{(1)} \right)$

$CSV_Output_{B_20} := \text{WRITECSV}(\text{".\Output\FUSELAGE_x2_cr_vs_ed2.csv"}, mCSV_{ed2})$

MAPPING AND OUTPUT CREATION

Includi << ../Default_Map_Fuselage.mcdx

$First_Row_{B_1} := 4$

$Block_{B_1} := \text{fmap_matrix_transform} \left(\langle_m Fuselage_Data_Map_{imported} \rangle \right)$

$Excel_Output_{B_1} := \text{fwrite_full_output} \left(\langle_s Output_Excel_File, Block_{B_1}, n_{sheet}, First_Row_{B_1} \rangle \right)$

$First_Row_{B_2} := First_Row_{B_1} + \text{rows} \left(Block_{B_1} \right) + 2 = 63$

$Block_{B_2} := \text{fmap_matrix_transform} \left(\langle_m Fuselage_Data_Map_{input} \rangle \right)$

$Excel_Output_{B_2} := \text{fwrite_full_output} \left(\langle_s Output_Excel_File, Block_{B_2}, n_{sheet}, First_Row_{B_2} \rangle \right)$

$First_Row_{B_3} := First_Row_{B_2} + \text{rows} \left(Block_{B_2} \right) + 2 = 89$

$Block_{B_3} := \text{fmap_matrix_transform} \left(\langle_m Fuselage_Data_Map \rangle \right)$

$Excel_Output_{B_3} := \text{fwrite_full_output} \left(\langle_s Output_Excel_File, Block_{B_3}, n_{sheet}, First_Row_{B_3} \rangle \right)$

$First_Row_{B_4} := First_Row_{B_3} + \text{rows} \left(Block_{B_3} \right) + 2 = 118$

$Block_{B_4} := \text{fmap_matrix_transform} \left(\langle_m Fuselage_Data_Map_{Misc} \rangle \right)$

$Excel_Output_{B_4} := \text{fwrite_full_output} \left(\langle_s Output_Excel_File, Block_{B_4}, n_{sheet}, First_Row_{B_4} \rangle \right)$

TeX Macro writing on .tex

${}_v complete_macros_B := \text{stack} \left(Block_{B_1}^{(2)}, Block_{B_2}^{(2)}, Block_{B_3}^{(2)}, Block_{B_4}^{(2)} \right)$

${}_v tex_W := \text{fwrite_matrix} \left(\langle \text{".\Output\FUSELAGE_TeX_Macros.tex"}, {}_v complete_macros_B, \text{" "} \rangle \right)$