Includi << ..\Default_Functions.mcdx

FLIGHT PARAMETERS INITIALIZATION

Hidden Area --> Import of Excel INPUT Wing Data

Hidden Area --> Preliminary Mapping of imported Data

INPUT FLIGHT PARAMETERS LIST

Input parameters

$h_{ASL} = (10 \cdot 10^3)\ m$ $\quad h_{ASL} = 10\ km$ $\quad h_{ASL} = (3.281 \cdot 10^4)\ ft$ $\quad h_{ASL} = 5.4\ nmi$

$M_1 = 0.696$

ISA ATMOSPHERE DEFINITIONS

Air Physical Constants

$R_{air} := 287 \cdot \frac{N \cdot m}{kg \cdot K}$ • Perfect Gas Constant of Air

$\gamma_{air} := 1.4$ • Air Adiabatic Index (Specific Heat Coefficient Ratio)

$\mu_{SL} := 1.7894 \cdot 10^{-5} \frac{kg}{m \cdot s}$ • Dinamic Viscosity @ 0m ASL

$T_{SL} := 288.16 \cdot K$ • Temperature @ 0m ASL

$\rho_{SL} := 1.225 \cdot \frac{kg}{m^3}$ • Density @ 0m ASL

ISA Atmosphere Functions

$${}_{f}LR_{ISA}(h) := \begin{| if\ h \le 11000 \cdot m \\ \quad | return\ -0.0065 \cdot \frac{K}{m} \\ else \\ \quad | return\ 0\ \frac{K}{m}\end{|}$$

• Lapse Rate (LR)

$${}_{f}T_{ISA}(h) := \begin{| if\ h \le 11000 \cdot m \\ \quad | return\ T_{SL} + {}_{f}LR_{ISA}(h) \cdot h \\ else \\ \quad | return\ T_{SL} + {}_{f}LR_{ISA}(11000\ m) \cdot 11000 \cdot m\end{|}$$

• Temperature

$${}_{f}a_{ISA}(h) := \sqrt{\gamma_{air} \cdot R_{air} \cdot {}_{f}T_{ISA}(h)}$$

- **Speed of Sound**

$${}_{f}\rho_{ISA}(h) := \left\| \begin{array}{l} \text{if } h \le 11000 \cdot m \\ \quad \text{return } \rho_{SL} \cdot \left(\frac{{}_{f}T_{ISA}(h)}{T_{SL}} \right)^{-\left(\frac{g}{{}_{f}LR_{ISA}(h) \cdot R_{air}} + 1 \right)} \\ \text{else} \\ \quad \rho_S \leftarrow \rho_{SL} \cdot \left(\frac{{}_{f}T_{ISA}(11000 \cdot m)}{T_{SL}} \right)^{-\left(\frac{g}{{}_{f}LR_{ISA}(11000 \cdot m) \cdot R_{air}} + 1 \right)} \\ \quad T_S \leftarrow T_{SL} + {}_{f}LR_{ISA}(11000\ m) \cdot 11000 \cdot m \\ \quad \text{return } \rho_S \cdot e^{-\left(\frac{g}{T_S \cdot R_{air}} (h - 11000 \cdot m) \right)} \end{array} \right.$$

- **Density**

$${}_{f}\mu_{ISA}(h) := \left(1.458 \cdot 10^{-6} \cdot \frac{kg}{m \cdot s \cdot K^{0.5}} \right) \cdot \frac{\sqrt{{}_{f}T_{ISA}(h)^{3}}}{{}_{f}T_{ISA}(h) + 110.4\ K}$$

- **Viscosity**

$${}_{f}\sigma(h) := \frac{{}_{f}\rho_{ISA}(h)}{\rho_{SL}}$$

- **Density Ratio**

ISA ATMOSPHERE PARAMETERS CALCULATIONS

$$LR_{ISA} := {}_{f}LR_{ISA}\langle h_{ASL} \rangle = -0.0065\ \frac{K}{m}$$

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$$T_{ISA} := {}_{f}T_{ISA}\langle h_{ASL} \rangle = 223.16\ K$$

$$T_{ISA} = -49.99\ °C$$

$$a_{ISA} := {}_{f}a_{ISA}\langle h_{ASL} \rangle = 299.442\ \frac{m}{s}$$

$$a_{ISA} = 1077.992\ \frac{km}{hr}$$

$$\rho_{ISA} := {}_{f}\rho_{ISA}\langle h_{ASL} \rangle = 0.413\ \frac{kg}{m^3}$$

$$\rho_{ISA} = 0.413\ \frac{kg}{m^3}$$

$$\mu_{ISA} := {}_{f}\mu_{ISA}\langle h_{ASL} \rangle = \left(1.457 \cdot 10^{-5}\right) \frac{kg}{m \cdot s}$$

$$\mu_{ISA} = \left(1.457 \cdot 10^{-5}\right) Pa \cdot s$$

$$\sigma_{ISA} := {}_{f}\sigma\langle h_{ASL} \rangle = 0.337$$

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FLIGHT PARAMETERS CALCULATIONS

$V_1 := M_1 \cdot a_{ISA} = 208.412 \ \frac{m}{s}$

$V_1 = 750.283 \ \frac{km}{hr}$

$V_{1\_EAS} := V_1 \cdot \sqrt{\sigma_{ISA}} = 120.957 \ \frac{m}{s}$

$V_{1\_EAS} = 435.445 \ \frac{km}{hr}$

$p_{dyn} := \frac{1}{2} \cdot \rho_{ISA} \cdot V_1^{\ 2} = \left(8.961 \cdot 10^3\right) \ Pa$

$Re_{per.unit.len} := \frac{\rho_{ISA} \cdot V_1}{\mu_{ISA}} = \left(5.902 \cdot 10^6\right) \ \frac{1}{m}$

$Re_{per.unit.len} = \left(1.799 \cdot 10^6\right) \ \frac{1}{ft}$

MAPPING AND OUTPUT CREATION

Includi << ../Default_Map_Flight.mcdx

Excel Writing

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

$Block_{F\_1} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}Flight\_Data\_Map_{input}\right)$

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

$First\_Row_{F\_2} := First\_Row_{F\_1} + \text{rows}\left(Block_{F\_1}\right) + 2 = 9$

$Block_{F\_2} := {}_{f}\text{map\_matrix\_transform}\left({}_{m}Flight\_Data\_Map\right)$

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

TeX Macro writing on .tex

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

${}_{v}tex_{W} := {}_{f}\text{write\_matrix}\left(\text{".\Output\FLIGHT\_TeX\_Macros.tex"}, {}_{v}complete\_macros_{F}, \text{" "}\right)$