$W := 1200kgf \quad Xcg := 0.3 \cdot Cma \quad CD0 := 0.03 \quad etot := 0.8 \quad \rho := 1.225 \frac{kg}{m^3}$

ALA

$b := 10m \quad Cr := 1.5m \quad \lambda := 0.5 \quad CL\alpha w := 5rad^{-1}$

$\alpha_{0L2dwt} := -2.5deg \quad \alpha_{0L2dwr} := -1.5deg \quad ew := 0.9$

$\eta_i := 0.7 \quad \eta_f := 1 \quad \tau_{alett} := 0.45 \quad \Gamma := 5.5deg \quad \Lambda_{le} := 15deg$

FUSOLIERA

$C_{N\beta f} := -0.003deg^{-1}$

PIANO VERTICALE

$Sv := 4.5m^2 \quad lv := 5.m \quad CL\alpha 3Dv := 4rad^{-1} \quad \eta v := 1$

$\tau_{timon} := 0.45 \quad d\sigma d\beta := 0.11 \quad hv := 1.6m$

Motori installati a $\quad lm := 3m$

$V := 210 \frac{km}{hr} \quad \beta := 10deg$

Determinare la deflessione del timone di coda e degli alettoni per volare con un angolo di derapata pari a 10 gradi con le ali livellate considerando una piantata del motore di sinistra.

SOLUZIONE

$S := \frac{(Cr + \lambda \cdot Cr) \cdot b}{2} \quad S = 11.25\, m^2 \quad CL := \frac{W}{\frac{1}{2} \cdot \rho \cdot V^2 \cdot S} \quad CL = 0.502$

$AR := \frac{b^2}{S} \quad CD := CD0 + \frac{CL^2}{\pi \cdot AR \cdot etot} \quad T := \frac{1}{2} \cdot \rho \cdot V^2 \cdot S \cdot CD \quad T = 98.688 \cdot kgf$

$AR = 8.889 \quad CD = 0.041$

$bc := Cr \quad ac := \frac{\lambda \cdot Cr - bc}{\frac{b}{2}} \quad C(y) := ac \cdot y + bc$

Calcolo del momento di imbardata dovuto alla perdita di un motore

$Mm := -T \cdot lm \quad Mm = -296.063 \cdot kgf \cdot m$

$$CNm := \frac{Mm}{\frac{1}{2}\cdot\rho\cdot V^2\cdot S\cdot b} \qquad CNm = -0.012$$

Equilibrio all'imbardata

$$C_N := C_{N\beta}\cdot\beta + C_N\cdot\delta r + C_{Nm}$$

$$C_{N\beta v} := CL\alpha 3Dv\cdot\frac{lv}{b}\cdot(1 - d\sigma d\beta)\cdot\eta v\cdot\frac{Sv}{S} \qquad C_{N\beta v} = 0.712\cdot rad^{-1} \qquad C_{N\beta v} = 0.012\cdot deg^{-1}$$

$$C_{N\beta} := C_{N\beta v} + C_{N\beta f} \qquad C_{N\beta} = 0.54\cdot rad^{-1} \qquad C_{N\beta} = 0.009\cdot deg^{-1}$$

$$C_{N\delta r} := -CL\alpha 3Dv\cdot\frac{lv}{b}\cdot\eta v\cdot\frac{Sv}{S}\cdot\tau_{timon} \qquad C_{N\delta r} = -0.36\cdot rad^{-1} \qquad C_{N\delta r} = -0.006\cdot deg^{-1}$$

$$\delta r := \frac{-C_{N\beta}\cdot\beta - CNm}{C_{N\delta r}} \qquad \delta r = 13.032\cdot deg \qquad C_{N\beta}\cdot\beta = 0.094$$

Equilibrio al rollio

$$C_{roll} := C_{roll\beta}\cdot\beta + C_{roll\delta a}\cdot\delta a + C_{roll\delta r}\cdot\delta r$$

$$C_{roll\beta v} := -CL\alpha 3Dv\cdot\frac{hv}{b}\cdot(1 - d\sigma d\beta)\cdot\eta v\cdot\frac{Sv}{S} \qquad C_{roll\beta v} = -0.228\cdot rad^{-1} \qquad C_{roll\beta v} = -0.004\cdot deg^{-1}$$

$$C_{roll\beta\Gamma} := -2\cdot\frac{CL\alpha w\cdot\Gamma}{S\cdot b}\cdot\int_0^{\frac{b}{2}} C(y)\cdot y\,dy \qquad C_{roll\beta\Gamma} = -0.107\cdot rad^{-1} \qquad C_{roll\beta\Gamma} = -0.0019\cdot deg^{-1}$$

$$C_{roll\beta\Lambda} := \left(-2\cdot\frac{\sin(2\cdot\Lambda_{le})\cdot CL}{S\cdot b}\right)\cdot\left(\int_0^{\frac{b}{2}} C(y)\cdot y\,dy\right) \qquad C_{roll\beta\Lambda} = -0.056\cdot rad^{-} \qquad C_{roll\beta\Lambda} = -0.001\cdot deg^{-1}$$

$$C_{roll\beta} := C_{roll\beta v} + C_{roll\beta\Gamma} + C_{roll\beta\Lambda} \qquad C_{roll\beta} = -0.39\cdot rad^{-1} \qquad C_{roll\beta} = -0.007\cdot deg^{-1}$$

$$C_{roll\delta a} := -2\cdot\frac{CL\alpha w\cdot\tau_{alett}}{S\cdot b}\cdot\int_{\eta_i\cdot\frac{b}{2}}^{\eta_f\cdot\frac{b}{2}} C(y)\cdot y\,dy \qquad C_{roll\delta a} = -0.218\cdot rad^{-1} \qquad C_{roll\delta a} = -0.004\cdot deg^{-1}$$

$$C_{roll\delta r} := CL\alpha 3Dv\cdot\frac{hv}{b}\cdot\eta v\cdot\frac{Sv}{S}\cdot\tau_{timon} \qquad C_{roll\delta r} = 0.115\cdot rad^{-1} \qquad C_{roll\delta r} = 0.002\cdot deg^{-1}$$

$$\delta a := \frac{-C_{roll\delta r}\cdot\delta r - C_{roll\beta}\cdot\beta}{C_{roll\delta a}} \qquad C_{roll\delta r}\cdot\delta r = 0.026 \qquad C_{roll\beta}\cdot\beta = -0.068 \qquad \delta a = -11.003\cdot deg$$