Design, Analysis and Research Corporation (DARcorporation)

ERRATA: Airplane Flight Dynamics and Automatic Flight Controls Part I

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page iii, line 3 — Topic 3.2.17 Review of Important Sign Conventions should be removed

page x, line 4 — The second word 'control' in the description of the c_{l_δ} should be deleted

pages xxii – xxviii — Add the following symbols and descriptions

	Symbol	Description	Unit
page xxii	X, Y, Z	Body-fixed (rotating) axis system	--
page xxii	X', Y', Z'	Earth-fixed (non-rotating) axis system	--
page xxvi	1, 2, 3	Eular rotation sequence (the use of the symbol "1" to denote the first Euler rotation is used only in Chapter 1)	
page xxvii	P	Origin of the XYZ system	

page xxv, 6th line — μ_g should be dimensionless.

page 7, before *Eqn (1.14)* — Should read: 'The transformation formula .....of both equations (1.11) and (1.12). **First**, for the l.h.s. of Eqn (1.11):'

page 17, Fig 1.7 — The aircraft of the lowest figure should be seen from behind, i.e. a positive bank angle should have right wing down.

page 47 — First paragraph under 2.5.2 second line. "In variant" should be "invariant"

page 51 — Second paragraph 8th line. "top" should be "to"

page 55, Eq (2.27) — should be $\left(\frac{d\varepsilon}{d\alpha}\right)_M = \frac{\left(\frac{d\varepsilon}{d\alpha}\right)_{M=0}}{\sqrt{\left(1-M^2\right)}}$

page 84, Eq (3.30) — in $\cos(\alpha + i_w - \varepsilon)$ "i_W" should be "i_h"

page 95 — Last full paragraph, 4th line. After "vortices" add "(at high angles of attack)"

page 63, Problem 2.3 — the set of data under data set "a" should be data set "c"

page 67 — change loose to lose.

page 72, Eqn (3.5) — C_{D_0} is the value of C_D for: $\alpha = i_h = \delta_e = 0$

page 77, Eqn (3.12) — C_{L_0} is the value of C_L for: $\alpha = i_h = \delta_e = 0$

page 80, Eqn (3.29) — C_{m_0} is the value of C_m for: $\alpha = i_h = \delta_e = 0$

page 84, Eqn (3.32) — Should be:

$$C_m = C_{m_{ac_{wf}}} + \left(C_{L_{0_{wf}}} + C_{L_{\alpha_{wf}}} \alpha \right)\left(\bar{x}_{cg} - \bar{x}_{ac_{wf}} \right) - C_{L_{\alpha_h}} \eta_h \frac{S_h}{S}\left(\bar{x}_{ac_h} - \bar{x}_{cg} \right)\left[\alpha - \left(\varepsilon_o + \frac{d\varepsilon}{d\alpha}\alpha \right) + i_h + \tau_e \delta_e \right]$$

4th line from bottom — A reference to Eqn (3.33) should be Eqn (3.32).

page 98, 11th line from top — 'three-vies' should be 'three-views'.

page 104 — change loose in lose.

page 108 — Figure 3.38, the subscripts "v" should be taken out from the two variables $F_{a_{y_{rudder}}}$ and $N_{A_{rudder}}$

Page 108 Eqn (3.71) — $C_{l_{\delta_r}} = C_{L_{\alpha_v}} \alpha_{\delta_r} \eta_v \frac{S_v x_{v_s}}{Sb}$ replaces $C_{l_{\delta_r}} = C_{L_{\alpha_v}} \alpha_{\delta_r} \bar{q}_v \frac{S_v x_{v_s}}{Sb}$

page 109, Eq (3.72) — multiply right side quantity by $\bar{q}Sb$

page 111, Eqn (3.76) — Should read: $F_{A_{y_v}} = C_{y_{\beta_v}} \beta \bar{q} S = -C_{L_{\alpha_v}} \left(1 - \frac{d\sigma}{d\beta} \right) \bar{q}_v S_v$

page 113 — Equation (3.78), the subscripts "v" should be taken out from the variables $F_{a_{y_{rudder}}}$

page 113 — Equation (3.80) should be multiplied by: $\bar{q}S$

page 122, Eqn (3.92a) — Should be

$$L_{T_{1_s}} = \ldots = \left[\sum_{i=0}^{i=n} T_i \left(-z_{T_i} \cos\phi_{T_i} \sin\psi_{T_i} - y_{T_i} \sin\phi_{T_i} \right) \right] \cos\alpha_1 + \ldots$$

page 122, Eqn (3.92c) Should be

$$N_{T_{1_S}} = \ldots = \ldots - \left[\sum_{i=0}^{i=n} T_i \left(-z_{T_i} \cos\phi_{T_i} \sin\psi_{T_i} - y_{T_i} \sin\phi_{T_i} \right) \sin\alpha_1 \right]$$

page 121, Eq (3.91) multiply right side quantity by $\bar{q}Sb$

page 137,
6th line from bottom Should read '... are affected by changes in angle of attack, α: ...'.

page 139 Equation (3.133), change the subscript "x" to "z" in $\frac{\partial F_{A_z}}{\partial \alpha}$

page 143,
right after *Eqn (3.146)* Should read '... multiplying by the non-dimensional moment ...'

page 147 Equation (3.162), replace the variable C_{L_1} in (2,1) entry to C_{D_1}

page 148 Equations (3.163a, b, c), the negative signs should be removed

page 148, Section 3.2.10 First paragraph "changes in sideslip, β" should be "changes in sideslip rate, $\dot{\beta}$"

page 167 Second paragraph "sideslip angle, β" should be "sideslip rate, $\dot{\beta}$"
Eq (3.214) Insert "+ u" in denominator.

$$F_{T_x} = \frac{n_p 550 \eta_p BHP}{U_1 + u}$$

page 173 First paragraph, 5th line. The word "be" is duplicated and should be deleted

page 186 Equation (4.3), remove the variable U_1

page 187 Entry (5,5), change $\frac{\partial(M_A + M_T)}{\partial \alpha} > 0$ to $\frac{\partial(M_A + M_T)}{\partial \alpha} < 0$

page 189 Equation (4.7), remove the negative sign

page 189 The line below Equation (4.7), change (4.1) to (4.6)

page 195 Equation (4.36), remove the variable U_1

page 198, 1st line '(4.22)' should be '(4.42)'.

page 199, after *Eqn (4.45)* — Should read: '$C_{L_1} \approx \frac{mg}{\bar{q}_1 S}$'. Note that $\cos\gamma_1 \approx 1.0$.

page 202, 6th line — Should read: '$C_{L_1} \approx \frac{mg}{\bar{q}_1 S}$'.

page 209, Fig 4.11b — The negative tail stall locus as shown in the diagram is wrong. The trim diagram should have a positive tail stall locus at $\alpha = 25^0$ and a negative tail stall locus at $\alpha = -12^0$. Both of these lines are out of the range of the diagram so none of them should be shown.

page 211, 11th line — The corresponding values for $\alpha_{\text{tail-stall}}$ should be -12^0 and 25^0, respectively. Also, the tail stall locus should not be shown in Figure 4.11b because they are outside the range of the diagram.

page 218, 8th line from bottom — '$F_{S_{TO}}$' should be '$V_{S_{TO}}$'.

page 221, Fig 4.16a — The lateral axis should be the Y-axis. Also, the bank angle is negative as shown.

page 226, Eq (4.90) — ψ_1 should read $\dot{\psi}_1$

page 228, Eq (4.100) — δ_{a_1} should read δ_{r_1}

page 233 — Third paragraph, 2nd line. The word "forward" should be changed to "aft"

page 235, Conclusion for *Sec. 4.4.1* — The inequality should be $\left|M_{ac_{wf}}\right| < L_{wf}\left(x_{cg} - x_{ac_{wf}}\right)$.

page 236, Conclusion for *Sec. 4.4.2* — The inequality should be $\left|M_{ac_{wf}}\right| < L_{wf}\left(x_{cg} - x_{ac_{wf}}\right)$.

page 244, Section 4.5.1 — Last paragraph, change $\eta_h = \frac{\bar{q}}{\bar{q}_h}$ to $\eta_h = \frac{\bar{q}_h}{\bar{q}}$

page 252, 2nd line — Should read '... differentiating Eqn (4.148) with respect to the angle of attack.'

page 252 (cont.), Eqn (4.154) — Last row: Delete the 'τ_e'.

page 253, Eqn 4.158 — Remove the 'τ_e' from the equation.

page 256,
Eqn (4.171)

Should be

$$MP_{free} = \bar{x}_{cg_{\partial Fs/\partial n=0}} = NP_{free} - \left(1 - \frac{C_{h_\alpha}\tau_e}{1.1 C_{h_{\delta_e}}}\right)\left(\frac{\rho S \bar{c} g}{4W}\right) C_{m_q}.$$

3rd line above *Fig 4.34* — 'stick-force-per-"g"' should be just 'stick-force'.

page 267 — Definitions for each variable should be: $C_{h_{\delta_r}}, C_{h_{\delta_{\eta}}}, C_{h_{\beta_v}}$ normally negative, negative, positive respectively

page 268 — Include in τ_r definition: $\tau_r = \frac{\partial \beta}{\partial \delta_r}$ and is normally negative

page 268, Fig 4.43 — Signs on hingemoment derivatives are reversed.

$$C_{h_{\beta_v}} > 0$$

$$C_{h_{\delta_r}} < 0$$

page 269,
Eqn. 4.197

$$C_{n_{\beta_{v\,free}}} = C_{L_{\alpha_v}} \eta_v \frac{S_v x_{v_s}}{Sb}\left(1 - \frac{C_{h_{\beta_v}}}{C_{h_{\delta_r}}}\left(1 - \frac{\partial \sigma}{\partial \beta}\right)\tau_r\right) - C_{L_{\alpha_v}} \eta_v \frac{S_v x_{v_s}}{Sb}\frac{\partial \sigma}{\partial \beta}$$

Eqn. 4.198

$$C_{n_{\beta\,free}} = C_{n_{\beta\,fix}} - C_{L_{\alpha_v}} \eta_v \frac{S_v x_{v_s}}{Sb}\frac{C_{h_{\beta_v}}}{C_{h_{\delta_r}}}\left(1 - \frac{\partial \sigma}{\partial \beta}\right)\tau_r$$

Eqn. 4.199

$$C_{n_{\beta\,free}} = C_{n_{\beta\,fix}} - C_{n_{\delta_r}} \frac{C_{h_{\beta_v}}}{C_{h_{\delta_r}}}\left(1 - \frac{\partial \sigma}{\partial \beta}\right)$$

Eqn. 4.203

$$\frac{\partial F_r}{\partial \beta} = \frac{G_r \eta_v \bar{q} S_r \bar{c}_r C_{h_{\delta_r}}}{C_{n_{\delta_r}}} C_{n_{\beta\,free}}$$

page 277,
1st line after *Eqn (4.221c)* — The symbol '$\overline{C}_{D_o}$' should be 'C_{D_o}'.

page 281 — List at end of page is inconsistent with Figure 4.49

page 291 — Last paragraph, 1st line. The word "are" should be "area"

page 299, Problem 4.5 — 'Eqn (4.155)' should be 'Eqn (4.159)'.

page 307, Eqn (5.1a) — Insert θ after mg.

$$m\dot{u} = -mg\theta\cos\theta_1 + \bar{q}_1 S\left\{-\left(C_{D_u} + 2C_{D_1}\right)\frac{u}{U_1} + \left(C_{T_{x_u}} + 2C_{T_{x_1}}\right)\frac{u}{U_1} + \right.$$
$$\left. -\left(C_{D_\alpha} - C_{L_1}\right)\alpha - C_{D_{\delta_e}}\delta_e\right\}$$

page 307, Eqn (5.1b) Insert θ after mg.

$$m\left(\dot{w}-U_1 q\right)=-mg\theta\sin\theta_1+\bar{q}_1 S\left\{-\left(C_{L_u}+2C_{L_1}\right)\frac{u}{U_1}-\left(C_{L_\alpha}+C_{D_1}\right)\alpha+\right.$$
$$\left.-C_{L_{\dot{\alpha}}}\frac{\dot{\alpha}\bar{c}}{2U_1}-C_{L_q}\frac{q\bar{c}}{2U_1}-C_{L_{\delta_e}}\delta_e\right\}$$

page 307, Eqn (5.1c) Should be

$$I_{yy}\dot{q}=\bar{q}_1 S\bar{c}\left\{\left(C_{m_u}+2C_{m_1}\right)\frac{u}{U_1}+\left(C_{m_{T_u}}+2C_{m_{T_1}}\right)\frac{u}{U_1}+C_{m_\alpha}\alpha+C_{m_{T_\alpha}}\alpha+\right.$$
$$\left.+C_{m_{\dot{\alpha}}}\frac{\dot{\alpha}\bar{c}}{2U_1}+C_{m_q}\frac{q\bar{c}}{2U_1}+C_{m_{\delta_e}}\delta_e\right\}$$

page 318, 5th line Should read '$w=U_1\alpha$'.

page 319 Table 5.1, third last equation, change C_{m_α} to $C_{m_{\dot{\alpha}}}$

page 332, Eq (5.53) the equation should have a minus " - " before $\zeta_{1,2}\omega_{n1,2}$ and $\zeta_{sp}\omega_{nsp}$

page 333, Eq (5.54) the equation should have a minus " - " before $\zeta_{3,4}\omega_{n3,4}$ and $\zeta_{ph}\omega_{nph}$

page 333, Eq (5.56) the equation should have a minus " - " before $\zeta_{3,4}\omega_{n3,4}$ and $\zeta_{3rd}\omega_{n3rd}$

page 338 Equation (5.69), $\dfrac{\theta(s)}{\delta_e(s)}=-\dfrac{\left(Z_{\delta_e}s-X_u Z_{\delta_e}+X_{\delta_e}Z_u\right)}{U_1\left(s^2-X_u s-\dfrac{gZ_u}{U_1}\right)}$

page 340 3rd line. The word "ration" should be "ratio"

page 340 Equation (5.76), the term $Z_{\delta_e}M_\alpha$ should be $-Z_{\delta_e}M_\alpha$

page 340 Equations (5.76) to (5.78), change D_1 to $\bar{D}_1$

page 346, Eqn (5.94) The (3,3) element of the transformation matrix should be '$\cos 2\alpha_1$' instead of '$\cos^2\alpha_1$'.

page 357, 2nd line The '(pitching moment of inertia)' should be replaced by '(moments and products of inertia)'.

page 371 Equations (5.136) to (5.138), change D_2 to $\bar{D}_2$

page 372, last line '$\psi(\tau)$' should be '$\psi(t)$'.

page 383 Remove the two lines before *Section 5.4.3*.

page 400,
4th line above *Sec. 5.6.1* — 'Eqns (5.76)' should be 'Eqns (1.76)' instead.

page 411, Problem 5.13 — Last sentence should read: 'How well do these results agree with your conclusions from problem 5.12?'.

page 424, Table 6.4 — The Civilian Requirements FAR-23 are updated to the following:

For wheel controllers:

$$\frac{\partial F_s}{\partial n} > \frac{(W_{TO}/100)}{n_{limit}} \text{ and } \frac{20.0}{n_{limit}}$$

but not more than: $\dfrac{50.0}{n_{limit}}$

For stick controllers:

$$\frac{\partial F_s}{\partial n} > \frac{W}{140} \text{ and } \frac{15.0}{n_{limit}}$$

but not more than: $\dfrac{35.0}{n_{limit}}$

page 453,
Table 6.22 — The number on the last column is referenced from Figure 6.16 instead of Figure 6.15.

page 456,

Eqn (6.26) — Should be: $\Delta\delta_{e_{gust}} = \dfrac{(1.10 - 0.0322 S_h)}{-0.023 S_h} \Delta\alpha_{gust}$.

page 457, Fig 6.18 — The '$\Delta\delta_{e_{gust}}$' curve is plotted with $\Delta\alpha_{gust} = 1.8\,\text{deg}$.

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