ERRATA

for

Modern Flight Dynamics, 1st Ed.

by

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1. Corrected Eqn. (1.44) on Page 18.

$$C = ml\dot{\theta}^2 + mg\cos\theta \tag{1.44}$$

2. Corrected equation on Page 43. Term in last equation on page should be f_{A_X} instead of $f_{A_{X_0}}$.
3. Additional text under Eqn. (4.14) on Page 132, the sentence should read

   "If $\boldsymbol{d}_E$ is sufficiently small that only linear effects are considered, or if the elastic deformation and deformation rate are co-linear as is the case for beam- and plate-like structures, the third integral above may be neglected."

4. Corrected equations (4.63), Page 141. Each term on LHS of equations must be multiplied by mass *m*.

5. Corrected second equation in Eqns. (4.72) on Page 144.

$$\frac{d}{dt}\left(\frac{\partial \mathrm{T}}{\partial \dot{\theta}}\right) - \frac{\partial \mathrm{T}}{\partial \theta} = C_2\cos\phi - C_3\sin\phi$$

6. Corrected second equation in Eqns. (4.74) on Page 145.

$$\frac{d}{dt}\left(\frac{\partial \mathrm{T}}{\partial \dot{\theta}}\right) - \frac{\partial \mathrm{T}}{\partial \theta} + \cancel{\frac{\partial \mathrm{U}}{\partial \theta}} = C_2\cos\phi - C_3\sin\phi = Q_\theta$$

7. Corrected second equation in Eqns. (4.79) on Page 145.

$$C_2\cos\phi - C_3\sin\phi = M\cos\phi - N\sin\phi$$

8. Corrected Eqn. (5.92), Page 215.

$$\alpha_H = \left(1 - \frac{d\varepsilon}{d\alpha_W}\right)\alpha_W + \Delta i_H + \frac{d\varepsilon}{d\alpha_W}\alpha_{0_W} \tag{5.92}$$

9. Corrected first equation in Eqns. (7.94, cont'd) on page 366.

$$Q_{i_P} = C_{Q_{i_P}} q_\infty S_W \bar{c}_W = -\frac{q_\infty}{V_\infty} \int_{-b_W/2}^{b_W/2} c_{l_{\alpha_W}}(y) \nu_{Z_{i_W}}(y) c_W(y) y\, dy$$
$$-\frac{q_H}{V_\infty} \int_{-b_H/2}^{b_H/2} c_{l_{\alpha_H}}(y) \left(\nu_{Z_{i_H}}(y) - \frac{d\varepsilon_H}{d\alpha_W} \nu_{Z_{i_W}}(y) \right) c_H(y) y\, dy$$
$$-\frac{q_H}{V_\infty} \int_0^{b_V} c_{l_{\alpha_V}}(z) z_{AC}(z) \nu_{Y_{i_V}}(z) c_V(z)\, dz$$

10. Corrected last equation in Eqns. (7.94, cont'd) on page 366.

$$Q_{i_{\delta_A}} = C_{Q_{i_{\delta_A}}} q_\infty S_W \bar{c}_W = q_\infty \left(- \int_{-b_O/2}^{-b_I/2} c_{l_{\alpha_W}}(y) \alpha_{\delta_A}(y) \nu_{Z_{i_W}}(y) c_W(y)\, dy + \int_{b_I/2}^{b_O/2} c_{l_{\alpha_W}}(y) \alpha_{\delta_A}(y) \nu_{Z_{i_W}}(y) c_W(y)\, dy \right)$$

11. Corrected Eqn. (8.53), Page 417.

$$q_{local}(x,t) = q(t) - \sum_{i=1}^{n} \nu'_{Z_i}(x) \dot{\eta}_i(t) \tag{8.53}$$

12. Corrected **A** matrix, and associated matrices, in Example 8.5, Pages 433-434. First, the (1,1) elements of A and of term1, given at the bottom of Page 433, should be negative, or A(1,1) = -4.5100e-02 and term1(1,1) = -2.2550e-03. Second, the M matrix given at the top of Page 434 should be as given below. Note that only the (1,1) element has changed here.

M =

9.9774e-01	3.1740e-01	-1.6100e+00	0	0
-1.0500e-04	8.9878e-01	0	5.0000e-02	0
0	0	1.0000e+00	5.0000e-02	0
1.0500e-04	-3.4790e-01	0	8.4621e-01	0
0	-8.8000e+00	8.8000e+00	0	1.0000e+00

Third, the matrix term5 near the middle of Page 434 should be as given below. Here all the elements of the matrix except the last column have been modified.

term5 =

5.8690e-07	5.6646e-04	2.9163e-06	-2.7607e-04	0
1.1560e-07	1.0625e-04	5.9920e-07	-5.5582e-05	0
7.7737e-08	-4.0041e-06	7.0094e-07	-5.4623e-05	0
-1.0981e-07	3.8867e-04	-2.5031e-06	1.6470e-04	0
-5.5610e-07	4.6271e-03	-2.3068e-05	1.4420e-03	0

Finally, the final result for the M matrix, given at the middle of Page 434 should be

```
»M=M+(1/120)*term5


M =

  9.9773e-01   3.0505e-01  -1.6082e+00  -3.0905e-02        0
 -9.7061e-05   8.9601e-01   8.0247e-05   4.3893e-02        0
  2.7754e-06  -7.9812e-03   1.0000e+00   4.6214e-02        0
  1.1369e-04  -3.0538e-01  -8.9367e-05   8.4988e-01        0
  4.4666e-04  -8.3698e+00   8.7998e+00   6.9591e-03   1.0000e+00
```

Also note that due to the above errors, the surge velocity u and the altitude h time histories in Figs. 8.3(a) and 8.5(b) are slightly in error. The time histories should agree closely with those shown in Fig. 8.15.

13. Corrected commands for defining the control-input time history in Example 8.5, at the top of Page 435. These commands should be

```
»t=0;.05;10;
»u(1:40)=-1/57.3;
»u(41:80)=1/57.3;
»u(81:201)=0;
»k=200;
```

The control-input time history shown in Fig. 8.3(b) is correct.

14. Corrected the **A** and **M** matrices in Example 8.6, Pages 437-439. The (1,1) element of **A**, shown in both the command line and the result below it on Page 437, should be negative, or A(1,1) = -0.0451. Likewise for the **A** matrix shown on Page 438. As a result, the **M** matrix given at the top of Page 439 should be

```
a =
          x1          x2          x3          x4          x5
x1    0.99773     0.30505    -1.6082   -0.030905           0
x2 -9.7061e-05     0.89601  8.0247e-05    0.043893           0
x3  2.7754e-06  -0.0079812           1    0.046214           0
x4 0.00011369    -0.30538 -8.9367e-05     0.84988           0
x5 0.00044666     -8.3698      8.7998   0.0069591           1
```

15. Corrected **A** matrix in Example 8.7, Page 440. The (1,1) element of **A** should be negative, or A(1,1) = -0.0451. Also note that due to this sign error, the surge velocity u and the altitude h time histories in Fig. 8.6 are slightly in error. The time histories should agree closely with those shown in Fig. 8.15.

16. Corrected first of Eqns. (8.135), Page 454.

$$Q_{local}(x,t) = Q(t) - \sum_{i=1}^{n} v'_{Z_i}(x)\dot{\eta}_i(t) \tag{8.135}$$

17. Corrected problem statement on Page 465, Example 8.10. Problem should read "… simulate the longitudinal dynamics of the Navion for 10 seconds…"

18. Corrected line of code on Page 468, Example 8.10. Last line of code on the page, above Figure 8.20, should be

```
[x,u,t]=navNLsim(x0,0,10);
```

19. Corrected Eqns. (9.12), Page 484. Equations are for the case of climbing turns, for which $\gamma_0 \neq 0$. Therefore,

$$\begin{aligned}
&-m\left(V_0 R_0\right) + mg\sin\gamma_0 = F_{A_{x_0}} + F_{P_{x_0}} && -I_{xz}P_0Q_0 + \left(I_{zz} - I_{yy}\right)Q_0R_0 = L_{A_0} + L_{P_0} \\
&m\left(R_0U_0\right) - mg\cos\gamma_0\sin\Phi_0 = F_{A_{y_0}} + F_{P_{y_0}} && \left(I_{xx} - I_{zz}\right)P_0R_0 + I_{xz}\left(P_0^2 - R_0^2\right) = M_{A_0} + M_{P_0} \\
&m\left(P_0V_0 - Q_0U_0\right) - mg\cos\gamma_0\cos\Phi_0 = F_{A_{z_0}} + F_{P_{z_0}} && I_{xz}Q_0R_0 + \left(I_{yy} - I_{xx}\right)P_0Q_0 = N_{A_0} + N_{P_0}
\end{aligned} \tag{9.12}$$

$$\begin{aligned}
&\dot{\Phi}_0 = P_0 + \tan\gamma_0\left(Q_0\sin\Phi_0 + R_0\cos\Phi_0\right) && P_0 = -\dot{\Psi}_0\sin\gamma_0 \\
&\dot{\Theta}_0 = Q_0\cos\Phi_0 - R_0\sin\Phi_0 = 0 && Q_0 = \dot{\Psi}_0\cos\gamma_0\sin\Phi_0 \\
&\dot{\Psi}_0 = \left(Q_0\sin\Phi_0 + R_0\cos\Phi_0\right)\sec\Phi_0 = \text{constant} && R_0 = \dot{\Psi}_0\cos\gamma_0\cos\Phi_0
\end{aligned}$$

20. Corrected Eqns. (9.71) on Page 524, to be consistent with corrected Eqns. (9.12).

$$\begin{aligned}
&(0 \text{ if } \beta_0 = 0) = -m\left(V_0R_0\right) = -mg\sin\gamma_0 + F_{A_{x_0}} + F_{P_{x_0}} && m\left(R_0U_0\right) = mg\cos\gamma_0\sin\Phi_0 + F_{A_{y_0}} + F_{P_{y_0}} \\
&(-mQ_0U_0 \text{ if } \beta_0 = 0)) = m\left(P_0V_0 - Q_0U_0\right) && -I_{xz}P_0Q_0 + \left(I_{zz} - I_{yy}\right)Q_0R_0 = L_{A_0} + L_{P_0} \\
&\qquad = mg\cos\gamma_0\cos\Phi_0 + F_{A_{z_0}} + F_{P_{z_0}} && I_{xz}Q_0R_0 + \left(I_{yy} - I_{xx}\right)P_0Q_0 = N_{A_0} + N_{P_0} \\
&\left(I_{xx} - I_{zz}\right)P_0R_0 + I_{xz}\left(P_0^2 - R_0^2\right) = M_{A_0} + M_{P_0} &&
\end{aligned} \tag{9.71}$$

21. Corrected Eqns. (9.72) on Page 524, to be consistent with corrected Eqns. (9.12).

$$\begin{aligned}
P_0 &= -\dot{\Psi}_0\sin\gamma_0 \\
Q_0 &= \dot{\Psi}_0\cos\gamma_0\sin\Phi_0 \\
R_0 &= \dot{\Psi}_0\cos\gamma_0\cos\Phi_0
\end{aligned}$$

22. Corrected equation in Eqns. (10.77), Page 574.

$$\frac{a_Z(s)}{\bullet(s)} = \mathrm{U}_0 s\frac{\alpha(s)}{\bullet(s)} - \left(xs^2 + \mathrm{U}_0 s\right)\frac{\theta(s)}{\bullet(s)} \tag{10.77}$$

23. Corrected Eqn. (11.33), Page 653.

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\begin{Bmatrix} -\delta_E \\ \delta T \end{Bmatrix}, \quad -\delta_E = \delta_{Stick} - K_q q$$

$$\dot{\mathbf{x}} = \mathbf{A}\mathbf{x} + \mathbf{B}\begin{Bmatrix} \delta_{Stick} - K_q q \\ \delta T \end{Bmatrix} = \left(\mathbf{A} - \mathbf{b}_{-\delta_E} K_q \mathbf{c}_q\right)\mathbf{x} + \mathbf{B}\begin{Bmatrix} \delta_{Stick} \\ \delta T \end{Bmatrix} \tag{11.33}$$

$$\triangleq \mathbf{A}_{aug}\mathbf{x} + \mathbf{B}\begin{Bmatrix} \delta_{Stick} \\ \delta T \end{Bmatrix}$$

24. Corrected Eqn. (11.40), Page 658.

$$1 - K_\alpha \frac{N^{\alpha u}_{\delta_E \delta T}(s)}{N^{u}_{\delta T}(s)} = 1 + K_\alpha \frac{0.383s\left(s + 101.7\right)}{2.73\, s\,(s^2 \;+\; 1.214s \;+\; 3.707)} = 0 \tag{11.40}$$

25. Corrected Eqn. (11.46), Page 661.

$$\delta_E(s) = -\delta_{Stick} - K_{a_Z} a_{Z\,\mathrm{cg}} \approx -\delta_{Stick} - K_{a_Z}\left(Z_\alpha \alpha(s) + Z_{\delta_E}\delta_E(s)\right) \tag{11.46}$$

26. Corrected data for Problem 11.5, Page 684. The washout time constant should be T_W = 1sec.

27. Second-to-last line on Page 711 should read "… in Example 11.3, …", instead of "… Example 11.3.1…".

28. Corrected third MABLAB equation on Page 715.

```
bcl=ba*3.16
```
Final asterisk in equation shown in book should be deleted.

29. Corrected code on Page 764 (Section 12.6.1 Longitudinal Path Guidance, *Glide Slope Coupler w. Auto-Throttle*). First two lines of code should be interchanged to read

```
ckg(5,:)=[0 -1 1 0 0 0];dkg=[dkg;0];
```
Add γ to responses of system w. AT

```
sysacAT=ss(aclat,bcl,ckg,dkg);
```
System w. attitude control and auto-throttle, θ_c input

…

30. Correct Eqns. (12.81) and prior text, on Page 772.

"… mode's excitation may be represented as (see Eqn, (8.53) and Fig. 8.2)"

$$z_E(t) = v_Z\left(x,y,z\right)\eta_i(t)$$
$$\theta_E(t) = -v'_Z\left(x,y,z\right)\eta_i(t) \tag{12.81}$$

31. In Example 12.7, on Page 785, the first sentence in parentheses in the third paragraph should read "(There are eight large loops because four correspond to positive frequencies and four correspond to negative frequencies. …)". Also, later in the same paragraph another phrase in parentheses should read "(moving the open-loop short-period poles in Figure 12.86 farther to the left).