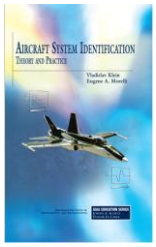

ERRATA

Aircraft System Identification: Theory and Practice

by Vladislav Klein and Eugene A. Morelli

Known errors are listed below. Please report any other errors to e.a.morelli@nasa.gov.

This list was last updated on Tuesday, September 27, 2011.

Page	Correction
x	Line 5, (GLS) should be deleted.
32	The expressions for body-axis inertia elements in Eq. (3.6) are incorrect. Eq. (3.6) should be: $I_x \equiv \int_{Volume} \left(y^2+z^2\right) dm \quad I_y \equiv \int_{Volume} \left(x^2+z^2\right) dm \quad I_z \equiv \int_{Volume} \left(x^2+y^2\right) dm$ $I_{xy} \equiv \int_{Volume} xy\, dm = I_{yx} \quad I_{yz} \equiv \int_{Volume} yz\, dm = I_{zy} \quad I_{xz} \equiv \int_{Volume} xz\, dm = I_{zx}$
37	The rotation matrices in Eq. (3.27) are incorrect. Eq. (3.27) should be: $\begin{bmatrix} \dot{x}_E \\ \dot{y}_E \\ \dot{z}_E \end{bmatrix} = \begin{bmatrix} \cos\psi & -\sin\psi & 0 \\ \sin\psi & \cos\psi & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi \\ 0 & \sin\phi & \cos\phi \end{bmatrix} \begin{bmatrix} u \\ v \\ w \end{bmatrix}$
39	The sign of the thrust term in Eq. (3.34c) should be negative, not positive. Eq. (3.34c) should be: $\dot{\beta} = \frac{\bar{q}S}{mV} C_{Y_W} + p\sin\alpha - r\cos\alpha + \frac{g}{V}\cos\beta\sin\phi\cos\theta$ $+ \frac{\sin\beta}{V}\left(g\cos\alpha\sin\theta - g\sin\alpha\cos\phi\cos\theta - \frac{T\cos\alpha}{m}\right)$

Page	Correction
41	The sign of the thrust term in Eq. (3.39c) should be negative, not positive. Eq. (3.39c) should be: $$\dot{\beta} = \frac{\bar{q}S}{mV} C_{Y_W} + p \sin\alpha - r \cos\alpha + \frac{g}{V} \cos\beta \sin\phi \cos\theta + \frac{\sin\beta}{V}\left(g \cos\alpha \sin\theta - g \sin\alpha \cos\phi \cos\theta - \frac{T \cos\alpha}{m} \right)$$
42	The first term inside the second set of parentheses in Eq. (3.43b) contains a typographical error. Eq. (3.43b) should be: $$\dot{y}_E = V \cos\alpha \cos\beta \sin\psi \cos\theta + V \sin\beta \left(\sin\psi \sin\theta \sin\phi + \cos\psi \cos\phi \right) + V \sin\alpha \cos\beta \left(\sin\psi \sin\theta \cos\phi - \cos\psi \sin\phi \right)$$
63	At the far right of the first line in Eq. (3.110a), ΔC_D should be deleted. Eq. (3.110a) should be: $$\dot{V} = -\frac{\bar{q}_o S}{m}\left(C_{D_V} \frac{\Delta V}{V_o} + C_{D_\alpha} \Delta\alpha + C_{D_q} \frac{q\bar{c}}{2V_o} + C_{D_\delta} \Delta\delta \right) - g \cos\gamma_o \left(\Delta\theta - \Delta\alpha \right) - \frac{T_o \sin\alpha_o}{m} \Delta\alpha$$
70	The sign of the thrust term in Eq. (3.137a) should be negative, not positive. Eq. (3.137a) should be: $$\dot{\beta} = \frac{\bar{q}_E S}{mV_E \cos\beta_E} C_{Y_W} + p \sin\alpha_E - r \cos\alpha_E + \frac{g}{V_E} \cos\beta_E \sin\phi_E \cos\theta_E + \frac{\sin\beta_E}{V_E}\left(g \cos\alpha_E \sin\theta_E - g \sin\alpha_E \cos\phi_E \cos\theta_E - \frac{T_E \cos\alpha_E}{m} \right)$$

Page	Correction
85	There should be a transpose on the second $\boldsymbol{\Phi}$ on the right side of Eq. (4.47). Eq. (4.47) should be: $$\boldsymbol{P}(i\,|\,i-1)=\boldsymbol{\Phi}(i-1)P(i-1\,|\,i-1)\boldsymbol{\Phi}^T(i-1)+\boldsymbol{\Gamma}_w(i-1)\boldsymbol{Q}(i-1)\boldsymbol{\Gamma}_w^T(i-1)$$
117	In the first sentence of the last paragraph, the word "variables" should be inserted after "independent". The first sentence of the last paragraph should be: For all flight test data sets and many wind tunnel data sets, the measured values of the independent variables are not uniformly spaced over an interval.
126	The element in the second row, second column of the $\boldsymbol{X}$ matrix should have index 2 instead of 1. The equation in the middle of page 126 should be: $$\boldsymbol{X}=\begin{bmatrix} 1 & \beta(1) & \frac{b}{2V_o}p(1) & \frac{b}{2V_o}r(1) & \delta_a(1) & \delta_r(1) \\ 1 & \beta(2) & \frac{b}{2V_o}p(2) & \frac{b}{2V_o}r(2) & \delta_a(2) & \delta_r(2) \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ 1 & \beta(N) & \frac{b}{2V_o}p(N) & \frac{b}{2V_o}r(N) & \delta_a(N) & \delta_r(N) \end{bmatrix}$$
144	The subscript for υ on the left side of Eq. (5.135) should be z, not 2. Eq. (5.135) should be: $$\upsilon_z(i)=z(i)-\hat{\theta}_0-\hat{\theta}_1\xi_1(i) \qquad i=1,2,\ldots,N$$
162	The quantity t_{kj} in the numerators of Eq. (5.162) should be squared. Eq. (5.162) should be: $$\phi_{kj}\equiv\frac{t_{kj}^2}{\lambda_j} \qquad \text{and} \qquad \phi_k\equiv\sum_{j=1}^{n}\frac{t_{kj}^2}{\lambda_j}=\sum_{j=1}^{n}\phi_{kj}$$
164	The strict inequality $m<n_p$ after Eq. (5.169) should be $m\le n_p$.

Page	Correction
165	The inverse of $\boldsymbol{B}$ in Eq. (5.173) should be the pseudo-inverse. Eq. (5.173) and the following text should be: $$J_{ME} = \frac{1}{2}\begin{bmatrix}(\boldsymbol{z}-\boldsymbol{X\theta})^T \\ (\boldsymbol{d}-\boldsymbol{B\theta})^T\end{bmatrix}\begin{bmatrix}\boldsymbol{I} & 0 \\ 0 & \boldsymbol{V}\end{bmatrix}^{-1}\begin{bmatrix}(\boldsymbol{z}-\boldsymbol{X\theta}) \\ (\boldsymbol{d}-\boldsymbol{B\theta})\end{bmatrix}$$ $$= \frac{1}{2}(\boldsymbol{z}-\boldsymbol{X\theta})^T(\boldsymbol{z}-\boldsymbol{X\theta}) + \frac{1}{2}(\boldsymbol{d}-\boldsymbol{B\theta})^T\boldsymbol{V}^{-1}(\boldsymbol{d}-\boldsymbol{B\theta})$$ $$= \frac{1}{2}(\boldsymbol{z}-\boldsymbol{X\theta})^T(\boldsymbol{z}-\boldsymbol{X\theta}) + \frac{1}{2}\left[\boldsymbol{\theta}-\boldsymbol{B}^T\left(\boldsymbol{BB}^T\right)^{-1}\boldsymbol{d}\right]^T\boldsymbol{B}^T\boldsymbol{V}^{-1}\boldsymbol{B}\left[\boldsymbol{\theta}-\boldsymbol{B}^T\left(\boldsymbol{BB}^T\right)^{-1}\boldsymbol{d}\right]$$ (5-173) which is the form of the cost function for the Bayesian estimator, cf. Eq. (4-28) with $\boldsymbol{\theta}_p = \boldsymbol{B}^T\left(\boldsymbol{BB}^T\right)^{-1}\boldsymbol{d}$ and $\boldsymbol{\Sigma}_p^{-1} = \boldsymbol{B}^T\boldsymbol{V}^{-1}\boldsymbol{B}$.
185	There should be a factor of ½ in front of the second derivative term in Eq. (6.13). Eq. (6.13) should be: $$J(\boldsymbol{\theta}_o+\Delta\boldsymbol{\theta}) = J(\boldsymbol{\theta}_o) + \Delta\boldsymbol{\theta}^T\left.\frac{\partial J}{\partial\boldsymbol{\theta}}\right|_{\boldsymbol{\theta}=\boldsymbol{\theta}_o} + \frac{1}{2}\Delta\boldsymbol{\theta}^T\left.\frac{\partial^2 J}{\partial\boldsymbol{\theta}\partial\boldsymbol{\theta}^T}\right|_{\boldsymbol{\theta}=\boldsymbol{\theta}_o}\Delta\boldsymbol{\theta} + \ldots$$
186	There should be a factor of ½ in front of the second derivative term in Eq. (6.14). Eq. (6.14) should be: $$J(\boldsymbol{\theta}_o+\Delta\boldsymbol{\theta}) \approx J(\boldsymbol{\theta}_o) + \Delta\boldsymbol{\theta}^T\left.\frac{\partial J}{\partial\boldsymbol{\theta}}\right|_{\boldsymbol{\theta}=\boldsymbol{\theta}_o} + \frac{1}{2}\Delta\boldsymbol{\theta}^T\left.\frac{\partial^2 J}{\partial\boldsymbol{\theta}\partial\boldsymbol{\theta}^T}\right|_{\boldsymbol{\theta}=\boldsymbol{\theta}_o}\Delta\boldsymbol{\theta}$$
192	The transpose in Eq. (6.30) should be applied to the residual vector on the left, not the one on the right. Eq. (6.30) should be: $$J(\boldsymbol{\theta}) = \frac{1}{2}\sum_{i=1}^{N}\boldsymbol{v}^T(i)\,\hat{\boldsymbol{R}}^{-1}\boldsymbol{v}(i)$$ $$= \frac{1}{2}\sum_{i=1}^{N}\left[\boldsymbol{z}(i)-\boldsymbol{y}(i)\right]^T\,\hat{\boldsymbol{R}}^{-1}\left[\boldsymbol{z}(i)-\boldsymbol{y}(i)\right]$$

<table>
<tr><th>Page</th><th>Correction</th></tr>
<tr><td>250</td><td>Some of the numbers in Table 7.3 are incorrect. Table 7.3 should be:

Table 7.3 Parameter estimation results for Schroeder sweep forced oscillation on an F-16XL 2.5 percent model
<table><tr><td></td><td colspan="2">Frequency-domain equation-error</td><td colspan="2">Frequency-domain output-error</td></tr><tr><td>Parameter</td><td>$\hat{\theta}$</td><td>$s(\hat{\theta})$</td><td>$\hat{\theta}$</td><td>$s(\hat{\theta})$</td></tr><tr><td>A</td><td>8.58×10^{-1}</td><td>3.25×10^{-2}</td><td>8.32×10^{-1}</td><td>3.44×10^{-2}</td></tr><tr><td>B</td><td>3.22×10^{0}</td><td>3.84×10^{-2}</td><td>3.21×10^{0}</td><td>3.17×10^{-2}</td></tr><tr><td>C</td><td>1.82×10^{-1}</td><td>7.05×10^{-2}</td><td>1.95×10^{-1}</td><td>2.80×10^{-2}</td></tr><tr><td>b_1</td><td>1.46×10^{-1}</td><td>2.64×10^{-2}</td><td>1.55×10^{-1}</td><td>1.19×10^{-2}</td></tr></table></td></tr>
<tr><td>259</td><td>The year of publication for Reference 4 should be 1997, not 1977.</td></tr>
<tr><td>343</td><td>Eq. (10.16) should be the same as Eq. (3.49). Eq. (10.16) should be:
$$\beta = tan^{-1}\left(tan\beta_f \; cos\alpha\right)$$</td></tr>
<tr><td>354</td><td>After Eq. (11.3), replace the material up to and including Eq. (11.4) with:
The value of $g(t)$ when $t = 0$ can be obtained using L'Hôpital's rule,
$$g(0) = \frac{(\omega_t + \omega_c)}{2\pi}$$
In discrete-time form, for $t_k = k\Delta t$,
$$g_k = \begin{Bmatrix} \frac{\pi}{2k\Delta t}\left[\frac{\sin\omega_t k\Delta t + \sin\omega_c k\Delta t}{\pi^2 - (\omega_t - \omega_c)^2 (k\Delta t)^2}\right] & k \neq 0 \\ \frac{(\omega_t + \omega_c)}{2\pi} & k = 0 \end{Bmatrix} \qquad (11.4)$$</td></tr>
</table>

Page	Correction
356	Eqs. (11.12) should be: $$5a_0 + 10(\Delta t)^2 a_2 = \sum_{k=i-2}^{i+2} z(k)$$ $$10\Delta t\, a_1 = \sum_{k=i-2}^{i+2} (k-i) z(k)$$ $$10a_0 + 34(\Delta t)^2 a_2 = \sum_{k=i-2}^{i+2} (k-i)^2 z(k)$$
356	Eq. (11.13) should be: $$\hat{y}_i = \hat{a}_0 = \frac{34}{70} \sum_{k=i-2}^{i+2} z(k) \; - \; \frac{1}{7} \sum_{k=i-2}^{i+2} (k-i)^2 z(k)$$
379	There should not be a power of 2 applied to *N* in the denominator on the right side of Eq. (11.66). Eq. (11.66) should be: $$\frac{1}{N} \sum_{i=0}^{N-1} u^2(i) = \frac{1}{N \sum_{i=0}^{N-1} w^2(i)} \sum_{k=0}^{N-1} U_w(k) U_w^*(k)$$
412	In section 12.8.1, all instances of the text “compat_lon_demo” and “compat_lat_demo” in any font should be “dca_lon_demo” and “dca_lat_demo”, respectively, in the same font as the original.