Errata List and New Additions for the AIAA Education Series Text Book

ANALYTICAL MECHANICS OF SPACE SYSTEMS

4th Edition

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This file contains various typos that were found in the 4rd edition of the text book. Please use these pages to update your book copy. Where possible, the changes are highlighted in red. If you find typos that are not listed here, please contact the author at

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and email the typo type, as well as the typo location within the manuscript. A revision history is provided at the end of the document.

- p. 19, equation in middle of page: Change to read rad/h at the end:

$$\dot{\gamma}_g \approx \frac{360 \text{ deg}}{24 \text{ h}} \approx 0.2618 \text{ rad/h}$$

- p. 106, Eq. (3.89): Change a sign toread:

$$\dot{\gamma} = \Big[[I_{3\times 3}] + \frac{1}{2}[\tilde{\gamma}] + \cdots$$

- p. 111, below 1st equation on this page in Example 3.7: Change to read:
  Using the direction cosine matrix definition in terms of (3, 1, 3) Euler angles in ...

- p. 112, (Eq. 3.103): Fix sign errors in the 4x4 matrix slots (2,1), (3,1), (4,2) and (3,4) to read:

$$\begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \beta_3 \end{pmatrix} = \begin{bmatrix} \beta_0'' & -\beta_1'' & -\beta_2'' & -\beta_3'' \\ \beta_1'' & \beta_0'' & \beta_3'' & -\beta_2'' \\ \beta_2'' & -\beta_3'' & \beta_0'' & \beta_1'' \\ \beta_3'' & \beta_2'' & -\beta_1'' & \beta_0'' \end{bmatrix} \begin{pmatrix} \beta_0' \\ \beta_1' \\ \beta_2' \\ \beta_3' \end{pmatrix}$$

- p. 122, line below Eq. (3.143): Change to read:
  ... is introduced. Substituting Eq. (3.96) into...

- p. 125, line above Eq. (3.153): Correct paper reference [34] to be [35]

- p. 128, Example 3.12, 3rd line from top of page: Change to read:
  ... rotation angle of Φ = 31.776 deg. The vector...

- p. 133, line after Eq. (3.179b): Change to read:
  The "+" sign corresponds to the case where $\beta_0 > a$ (shorter rotation), and ...

- p. 161, Problem 3.16 : Change to read:
  ... Prove the following useful...

- p. 161, Problem 3.21 : Change to read:
  ... Prove that any such $\boldsymbol{\rho}$ attitude set is going to be an ...

- p. 220, Eq. (4.141) : Add brackets and remove '$\times$' to read:

$$[I] = [I_s] + \sum_{i=1}^{N} [J_i] = [I_s] + \sum_{i=1}^{N} \left(J_{s_i} \hat{\boldsymbol{g}}_{s_i} \hat{\boldsymbol{g}}_{s_i}^T + J_{t_i} \hat{\boldsymbol{g}}_{t_i} \hat{\boldsymbol{g}}_{t_i}^T + J_{g_i} \hat{\boldsymbol{g}}_{g_i} \hat{\boldsymbol{g}}_{g_i}^T \right)$$

- p. 319, Problem 5.5: change text to read
  ... circular tube as shown in Fig. P5.5. The angular rate...

- p. 379, Eq. (7.92): Change to read:

$$\frac{\partial \mathcal{H}}{\partial \alpha} + \sum_{k=1}^{n} \left(\frac{\partial g_k}{\partial \alpha} Q_{q_k} - \frac{\partial f_k}{\partial \alpha} Q_{p_k} \right)$$

- p. 379, Eq. (7.93a): Change to read:

$$Q_{q_j}^* = \sum_{k=1}^{n} \left(\frac{\partial g_k}{\partial p_j^*} Q_{q_k} - \frac{\partial f_k}{\partial p_j^*} Q_{p_k} \right)$$

- p. 379, Eq. (7.93b): Change to read:

$$Q_{p_j}^* = \sum_{k=1}^{n} \left(\frac{\partial f_k}{\partial q_j^*} Q_{q_k} - \frac{\partial g_k}{\partial q_j^*} Q_{p_k} \right)$$

- p. 404, 2nd equation from top: Add m to the last term to read:

$$\dddot{V} = -2\frac{c}{m^2}((c\dot{x} + kx)^2 + c^2\dot{x}^2 + ckx\dot{x} - mk\dot{x}^2)$$

- p. 415, Example 8.11, large matrix equation at top of page : change the (2,3) and (3,2) elements to read:

$$M(\boldsymbol{q}) = \begin{bmatrix} (m_1 + m_2 + m_3) l_1^2 & (m_2 + m_3) l_1 l_2 \cos(\theta_2 - \theta_1) & m_3 l_1 l_3 \cos(\theta_3 - \theta_1) \\ (m_2 + m_3) l_1 l_2 \cos(\theta_2 - \theta_1) & (m_2 + m_3) l_2^2 & m_3 l_2 l_3 \cos(\theta_3 - \theta_2) \\ m_3 l_1 l_3 \cos(\theta_3 - \theta_1) & m_3 l_2 l_3 \cos(\theta_3 - \theta_2) & m_3 l_3^2 \end{bmatrix}$$

- p. 432, starting line 6: Delete the following sentence:
  ~~Therefore, this product of $\boldsymbol{\omega}$ and $\boldsymbol{\omega}_r$ are relatively small, and this cross-product is not scaled by any feedback gains.~~

- p. 437, Eq. (8.87): change the dot over ω to a prime symbol to read:

$$\ddot{V} = -2\delta\boldsymbol{\omega}^T[P]\delta\boldsymbol{\omega}'$$

- p. 438, Eq. (8.93): change the dot over $\boldsymbol{L}$ to a prime symbol to read:

$$[I]\delta\boldsymbol{\omega}'' + [P]\delta\boldsymbol{\omega}' + \frac{K}{4}[B(\boldsymbol{\sigma})]\delta\boldsymbol{\omega} = \Delta\boldsymbol{L}' \approx 0$$

- p. 443, 1st equation in Example 8.18 : change sign to read:

$$\boldsymbol{u} - K\boldsymbol{\sigma} + [\tilde{\boldsymbol{\omega}}]I]\boldsymbol{\omega} - \cdots$$

- p. 483, just above (8.216): replace equation reference 4.127 with 4.143 to read:
  After substituting Eqs. (4.143) and (8.214) into ...

- p. 484, last line on page: replace equation reference 4.127 with 4.143 to read:
  After substituting Eqs. (4.143) and (8.214) into ...

- p. 489, Eq. (8.235) : Change the transpose operator on $[D_1]$ matrices to read:

$$\mathcal{O} = \frac{1}{\bar{h}^2}\frac{\boldsymbol{L}_r^T[D_1][D_1]^T\boldsymbol{L}_r}{||\boldsymbol{L}_r||^2}$$

- p. 490, 4 lines above Eq. (8.236) : Change to
  of $\dot{\boldsymbol{\omega}}$ and $\ddot{\boldsymbol{\gamma}}$. Although the gimbal-angular accelerations can...

- p. 536, Eq. (9.52): Remove the sign to read:

$$\dot{r} = \frac{r^2\dot{f}e\sin f}{p}$$

- p. 536, Eq. (9.55): Remove the sign to read:

$$\dot{r} = \frac{he\sin f}{p}$$

- p. 546, Eq. (9.109): the last term on the right should remove m_2 in the denominator to read

$$-\frac{\mu}{r} = -\frac{G(m_1+m_2)}{r} \approx -\frac{Gm_1}{r} = V(r)$$

- p. 677, Eq. 139 2nd line should start with a "+", not a negative sign, to read:

$$\begin{aligned}\frac{\mathrm{d}\omega}{\mathrm{d}t} = \frac{\partial\omega}{\partial\boldsymbol{v}}\boldsymbol{a}_d = &-\frac{1}{he}\left(\frac{r}{p}(\cos f + e) + e\right)\boldsymbol{r}^T\boldsymbol{a}_d \\ &+\frac{r}{h^2e}(p+r)\sin f\boldsymbol{v}^T\boldsymbol{a}_d - \frac{r\sin\theta}{h\tan i}\,\hat{\boldsymbol{\imath}}_h^T\boldsymbol{a}_d\end{aligned}$$

- p. 843, Eq. (14.233): Add negative sign to read:

$$\boldsymbol{u} = -([B]^T[B])^{-1}[B]^T[P]\Delta\text{œ}$$

- p. 854, Eq. (14.276): change h^2 to be h on the right hand side to read:

$$\cdots = \frac{h}{2a^2}\Delta a$$

- p. 861, Prob. 14.4: Replace "nonlinear" with "linearized" to read:
  Starting with the linearized relative equations of motion in Eq. (14.19), derive ...

- p. 885, Eq. F.11: Add 3 $\sin(2\omega)$ terms to read:

$$\begin{aligned}
M' + \omega' + \Omega' = M + \omega + \Omega &+ \frac{\gamma_2'}{8}\eta^3\Big(1 - 11\cos^2 i - 40\frac{\cos^4 i}{1-5\cos^2 i}\Big)\sin(2\omega)\\
&- \frac{\gamma_2'}{16}\Big(2 + e^2 - 11(2+3e^2)\cos^2 i\\
&- 40(2+5e^2)\frac{\cos^4 i}{1-5\cos^2 i} - 400e^2\frac{\cos^6 i}{(1-5\cos^2 i)^2}\Big)\sin(2\omega)\\
&+ \frac{\gamma_2'}{4}\Big(-6*(1-5\cos^2 i)(f - M + e\sin f)\\
&+ (3 - 5\cos^2 i)(3\sin(2\omega+2f) + 3e\sin(2\omega+f)\\
&+ e\sin(2\omega+3f))\Big)\\
&- \frac{\gamma_2'}{8}e^2\cos i\Big(11 + 80\frac{\cos^2 i}{1-5\cos^2 i} + 200\frac{\cos^4 i}{(1-5\cos^2 i)^2}\Big)\sin(2\omega)\\
&- \frac{\gamma_2'}{2}\cos i\Big(6(f - M + e\sin f)\\
&- 3\sin(2\omega+2f) - 3e\sin(2\omega+f) - e\sin(2\omega+3f)\Big)
\end{aligned}$$

- p. 885, Eq. F.12: Add $\sin(2\omega)$ terms to read:

$$\begin{aligned}
(e\delta M) = \frac{\gamma_2'}{8}e\eta^3&\Big(1 - 11\cos^2 i - 40\frac{\cos^4 i}{1-5\cos^2 i}\Big)\sin(2\omega)\\
&- \frac{\gamma_2'}{4}\eta^3\Big\{2(3\cos^2 i - 1)\left(\left(\frac{a\eta}{r}\right)^2 + \frac{a}{r} + 1\right)\sin f\\
&+ 3(1-\cos^2 i)\Big[\left(-\left(\frac{a\eta}{r}\right)^2 - \frac{a}{r} + 1\right)\sin(2\omega+f)\\
&+ \left(\left(\frac{a\eta}{r}\right)^2 + \frac{a}{r} + \frac{1}{3}\right)\sin(2\omega+3f)\Big]\Big\}
\end{aligned}$$

- p. 885, Eq. F.13: Add $\sin(2\omega)$ terms to read:

$$\begin{aligned}
\delta\Omega = &-\frac{\gamma_2'}{8}e^2\cos i\Big(11 + 80\frac{\cos^2 i}{1-5\cos^2 i} + 200\frac{\cos^4 i}{(1-5\cos^2 i)^2}\Big)\sin(2\omega)\\
&- \frac{\gamma_2'}{2}\cos i\Big(6(f - M + e\sin f) - 3\sin(2\omega+2f)\\
&- 3e\sin(2\omega+f) - e\sin(2\omega+3f)\Big)
\end{aligned}$$