Orbital Mechanics for Engineering Students, 4th Edition

Howard D. Curtis

ERRATA

Version: February 24, 2020

Chapter 1

Page 3 In the line following Equation 1.2, change "…consists of three axes, …" to "…consists of three mutually perpendicular axes, …".

Page 16 In Example 1.7, the third line after **Solution**, beginning "Since the projectile is in…" should belong to the line immediately above it. It is not a new paragraph.

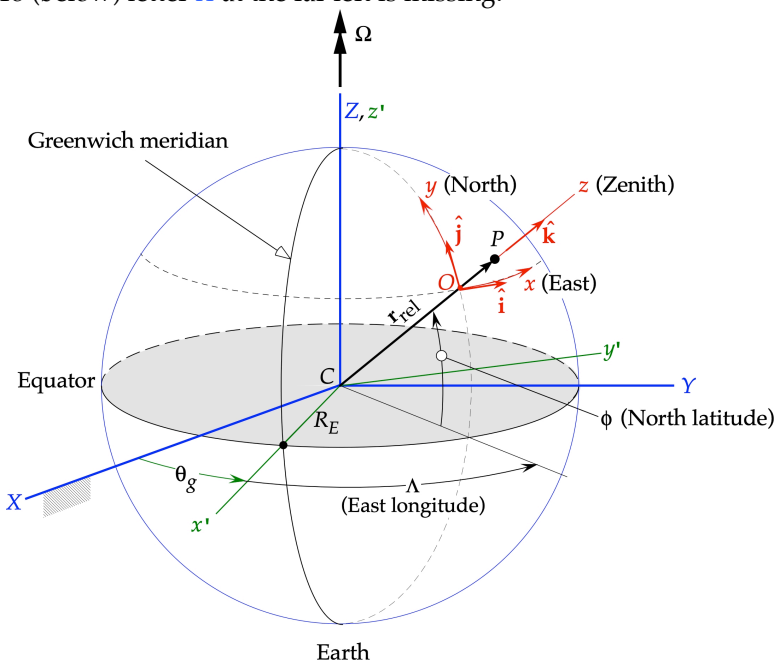
Page 27 In Example 1.13, the second of Equations (b) should read

$$\dot{\boldsymbol{\Omega}} = -1.0\hat{\mathbf{I}} + 0.3\hat{\mathbf{J}} - 0.4\hat{\mathbf{K}}\left(\text{rad}/\text{s}^2\right)$$

Page 28 The third of Equations (e) should read

$$\hat{\mathbf{K}} = 0.3714\hat{\mathbf{i}} - 0.8728\hat{\mathbf{j}} + 0.3166\hat{\mathbf{k}}$$

Page 29 In Figure 1.18 (below) letter X at the far left is missing.



Page 31 The equation after Equation 1.80 should read

$$\mathbf{a}_{\text{rel}})_{\text{neglecting earth's curvature}} = \ddot{x}\hat{\mathbf{i}} + \ddot{y}\hat{\mathbf{j}} + \ddot{z}\hat{\mathbf{k}}$$

Page 47 At the end of the second line up from the bottom, "Eq. (1.8)" should read "Eq. (1.36)".

Page 50 In Problem 1.5(j), "a_t" should read "a_n".

Page 51 In the second line of Problem 1.11, "$\mathbf{F} = (15 + 10)(\mathrm{N})$" should read "$\mathbf{F} = (15\hat{\mathbf{i}} + 10\hat{\mathbf{j}})(\mathrm{N})$".

Page 53 In Problem 1.17, "Eq. (1.114b) are valid" should read "Eqs. (1.114b) are valid".

Chapter 2

Page 57 At the beginning of the third line down, change "Eq. (1.40)" to "Eq. (1.31).

Page 59 The first of the three equations in Eq. (2.19a) should read

$$\ddot{X}_1 = Gm_2 \frac{X_2 - X_1}{r^3}$$

Page 59 The beginning of the second line above Algorithm 2.1 should read,
"system at a given time, given the state …". (*Insert a comma between "time" and "given".*)

Page 59 The beginning of the second line of Algorithm 2.1 should read

"time, given their values $\mathbf{R}_1^0$, $\mathbf{V}_1^0$ and $\mathbf{R}_2^0$, $\mathbf{V}_2^0$." (*Insert a space between* $\mathbf{V}_1^0$ *and* "and").

Page 59 Correct the bottom two equations on the page to read as follows:

$$\mathbf{R}_1 = X_1\hat{\mathbf{I}} + Y_1\hat{\mathbf{J}} + Z_1\hat{\mathbf{K}} \qquad \mathbf{V}_1 = \dot{X}_1\hat{\mathbf{I}} + \dot{Y}_1\hat{\mathbf{J}} + \dot{Z}_1\hat{\mathbf{K}}$$
$$\mathbf{R}_2 = X_2\hat{\mathbf{I}} + Y_2\hat{\mathbf{J}} + Z_2\hat{\mathbf{K}} \qquad \mathbf{V}_2 = \dot{X}_2\hat{\mathbf{I}} + \dot{Y}_2\hat{\mathbf{J}} + \dot{Z}_2\hat{\mathbf{K}}$$

(*insert the missing "+" signs in* $\mathbf{R}_1$ *and* $\mathbf{R}_2$.)

Page 89 Equation (a) should read

$$7923 = \frac{h^2}{398{,}600} \cdot \frac{1}{1 + e\cos 126°}$$

(*Note the space between the two fractions.*)

Page 89 Equation (b) should read

$$7230 = \frac{h^2}{398{,}600} \cdot \frac{1}{1 + e\cos 58°}$$

Page 96 The equation following the sentence, "Substituting Eqs. (2.104) and (2.106) into Eq. (2.108b) yields" must be replaced by

$$y = \frac{b}{\sqrt{e^2 - 1}} \frac{e^2 - 1}{1 + e\cos\theta} \sin\theta = b \frac{\sqrt{e^2 - 1}\sin\theta}{1 + e\cos\theta}$$

Page 96 The third line up from the bottom should be corrected to read

$$\frac{x^2}{a^2}-\frac{y^2}{b^2}=\left(\frac{e+\cos\theta}{1+e\cos\theta}\right)^2-\left(\frac{\sqrt{e^2-1}\sin\theta}{1+e\cos\theta}\right)^2$$

Page 100 The second line up from the bottom should be corrected to read

"(b) Substituting $v_\perp$ into Eq. (f) we get …"

Page 106 The last term of the equation between Eq. (2.132) and Eq. (2.133) should be corrected to read

$$\mathbf{v}_0=\dot{\bar{x}}_0\hat{\mathbf{p}}+\dot{\bar{y}}_0\left(\frac{1}{\bar{y}_0}\mathbf{r}_0-\frac{\bar{x}_0}{\bar{y}_0}\hat{\mathbf{p}}\right)=\frac{\bar{y}_0\dot{\bar{x}}_0-\bar{x}_0\dot{\bar{y}}_0}{\bar{y}_0}\hat{\mathbf{p}}+\frac{\dot{\bar{y}}_0}{\bar{y}_0}\mathbf{r}_0=-\frac{h}{\bar{y}_0}\hat{\mathbf{p}}+\frac{\dot{\bar{y}}_0}{\bar{y}_0}\mathbf{r}_0$$

Page 111 In Example 2.13, correct line (a) so that it reads as follows:

(a) $r_0=\sqrt{\mathbf{r}_0\cdot\mathbf{r}_0}=10,861\,\text{km}$ $v_0=\sqrt{\mathbf{v}_0\cdot\mathbf{v}_0}=8.8244\,\text{km/s}$

(*Put the comma in* 10,861 *and make all of the subscript* 0's *plain face instead of bold face.*)

Page 111 In Example 2.13, correct the line after the line labeled (d) so that it reads as follows:

$$=\frac{75,366^2}{398,600}\frac{1}{1+\left(\frac{75,366^2}{398,600\cdot 10,681}-1\right)\cos 120°-\frac{75,366\cdot(-5.2996)}{398,600}\sin 120°}$$

↑ This dot should be raised, as shown, to represent multiplication.

Page 112 Just before "Step 2:", insert the missing equation.

$$\dot{g}=\left(1+\dot{f}g\right)/f=\left[1+\left(-9.8666\cdot 10^{-4}\right)\cdot 1028.4\right]/0.11803=-0.12435\,(\text{dimensionless})$$

(*It belongs, but won't fit, with the list of equations at the bottom of Page 111,*

$$f=\cdots$$
$$g=\cdots$$
$$\dot{f}=\cdots$$
$$\dot{g}=\cdots$$

).

Page 120 Fourth line of Section 2.12.1, insert a space after "m_2".

Page 121 Eq. (2.200) should be corrected to read

$$r_{12}{}^2=\left(x+\pi_2 r_{12}-r_{12}\right)^2+y^2$$

Page 126 In the first three equations under **2.12.2 Jacobi Constant,** correct the spacing so they read as follows:

$$\ddot{x}\,\dot{x} - 2\Omega\dot{x}\dot{y} - \Omega^2 x\dot{x} = -\frac{\mu_1}{r_1^3}(x\dot{x} + \pi_2 r_{12}\dot{x}) - \frac{\mu_2}{r_2^3}(x\dot{x} - \pi_1 r_{12}\dot{x})$$

$$\ddot{y}\,\dot{y} + 2\Omega\dot{x}\dot{y} - \Omega^2 y\dot{y} = -\frac{\mu_1}{r_1^3}y\dot{y} - \frac{\mu_2}{r_2^3}y\dot{y}$$

$$\ddot{z}\,\dot{z} = -\frac{\mu_1}{r_1^3}z\dot{z} - \frac{\mu_2}{r_2^3}z\dot{z}$$

(Note the proper (unambiguous) placement of the dots and double-dots over the letters, and the spacing between adjacent letters having overhead dots.)

Page 126 The second equation up from the bottom of the page, correct the spacing so it reads as follows:

$$\ddot{x}\,\dot{x} + \ddot{y}\,\dot{y} + \ddot{z}\,\dot{z} - \Omega^2(x\dot{x} + y\dot{y}) = -\left(\frac{\mu_1}{r_1^3} + \frac{\mu_2}{r_2^3}\right)(x\dot{x} + y\dot{y} + z\dot{z}) + r_{12}\left(\frac{\pi_1\mu_2}{r_2^3} - \frac{\pi_2\mu_1}{r_1^3}\right)\dot{x}$$

Page 126 In Eq. (2.207), correct the spacing so it reads as follows:

$$\ddot{x}\,\dot{x} + \ddot{y}\,\dot{y} + \ddot{z}\,\dot{z} - \Omega^2(x\dot{x} + y\dot{y}) = -\frac{\mu_1}{r_1^3}(x\dot{x} + y\dot{y} + z\dot{z} + \pi_2 r_{12}\dot{x}) - \frac{\mu_2}{r_2^3}(x\dot{x} + y\dot{y} + z\dot{z} - \pi_1 r_{12}\dot{x})$$

Page 127 In Eq. (2.208), correct the spacing so it reads as follows:

$$\ddot{x}\,\dot{x} + \ddot{y}\,\dot{y} + \ddot{z}\,\dot{z} = \frac{1}{2}\frac{\mathrm{d}}{\mathrm{d}t}(\dot{x}^2 + \dot{y}^2 + \dot{z}^2) = \frac{1}{2}v^2$$

Page 128 In the last line change "nrgative" to "negative".

Page 131 Change the second line of Example 2.18 to read as follows:

"Use Eqs. (2.192a), (2.192b), and (2.192c), the circular restricted three-body …"

(*Insert the comma.*)

Page 132 Correct the line just after **PROBLEMS** so that $\mu = 398{,}600\ \mathrm{km}^3/\mathrm{s}^2$ instead of $\mu = 398,\ 600\ \mathrm{km}^3/\mathrm{s}^2$.

Page 133 In **Problem 2.6**, change

"If **r**, in meters, is given by $\mathbf{r} = t\sin t\hat{\mathbf{I}} + t^2\cos t\hat{\mathbf{J}} + t^3\sin^2 t\hat{\mathbf{K}}$, where …"

to

"If **r**, in meters, is given by $\mathbf{r} = t\sin t\hat{\mathbf{I}} + t^2\cos t\hat{\mathbf{J}} + t^3\sin^2 t\hat{\mathbf{K}}$, where …"

(*Insert a space between* "by" *and* "**r**".)

Page 133 In **Problem 2.7**, change " $\dot{r} = \mathbf{v} \cdot \hat{\mathbf{u}}$ " to " $\dot{r} = \mathbf{v} \cdot \hat{\mathbf{u}}_r$ ".

Page 134 Add wording to **Problem 2.17** so it reads as follows:

2.17 Calculate the area A swept out during the time $t = T/4$ since periapsis, where T is the period of the elliptical orbit. See the figure below.
{Ans.: $0.7854ab$}

Page 134 Add wording to **Problem 2.18** so it reads as follows:

2.18 Determine the true anomaly θ of the point(s) on an elliptical orbit at which the speed equals the speed of a circular orbit with the same radius (i.e., $v_{\text{ellipse}} = v_{\text{circle}}$). See the figure on the next page.

{Ans.: $\theta = \cos^{-1}(-e)$, where e is the eccentricity of the ellipse}

Page 134 In the wording of **Problem 2.19**, change "… Problem 2.19" to "… Problem 2.18".

Page 137 Revise the wording of **Problem 2.35** to read as follows:

2.35 What velocity increase is required for the earth to escape the solar system on a parabolic path?
{Ans.: 12.34 km/s}

Page 137 Add wording to **Problem 2.37** so it reads as follows:

2.37 A meteoroid is first observed approaching the earth when it is 402,000 km from the center of the earth with a true anomaly of 150°, as shown in the figure below. If the speed of the meteoroid at that time is 2.23 km/s, calculate:
(a) the eccentricity of the trajectory;
(b) the altitude at closest approach;
(c) the speed at the closest approach.
{Ans.: (a) 1.086; (b) 5088 km; (c) 8.516 km/s}

Chapter 3

Page 142 Equation (3.3) must be corrected to read

$$\int \frac{dx}{(a+b\cos x)^2} = \frac{1}{(a^2-b^2)^{3/2}}\left[2a\tan^{-1}\left(\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right) - \frac{b\sqrt{a^2-b^2}\sin x}{a+b\cos x}\right]$$

Page 142 Equation (3.5) must be corrected to read

$$\int \frac{dx}{(a+b\cos x)^2} = \frac{1}{(b^2-a^2)^{3/2}}\left[\frac{b\sqrt{b^2-a^2}\sin x}{a+b\cos x} - a\ln\left(\frac{\sqrt{b+a}+\sqrt{b-a}\tan(x/2)}{\sqrt{b+a}-\sqrt{b-a}\tan(x/2)}\right)\right]$$

Page 151 In **Example 3.3**, correct Eq. (a) so that it reads

$$e = \frac{r_a - r_p}{r_a + r_p} = \frac{(6378+5000)-(6378+500)}{(6378+5000)+(6378+500)} = 0.24649 \qquad \text{(a)}$$

Page 151 In **Example 3.3**, in revise the equation just before "(a) If the apogee is …" so that it reads

$$T = \frac{2\pi}{\sqrt{\mu}}a^{3/2} = \frac{2\pi}{\sqrt{\mu}}9128^{3/2} = 86{,}791.1 \text{ s } (2.1409 \text{ h})$$

(*Insert the comma as shown.*)

Page 158 Correct the third line from the bottom so that it reads

$$h = r_p v_p = 7972 \cdot 10 = 79{,}720 \text{ km}^2/\text{s}$$

↑ raise the dot so it represents multiplication

Page 164 At the bottom of the page, $F_0 = 3$ should be *centered*, **not** left justified:

$$F_0 = 3$$

Chapter 4

Page 185 Correct the first sentence of **Section 4.3** to read as follows

"At any given time, the state vector of a satellite comprises its position **r** and orbital velocity **v**."

Page 190 In the third line up, change "Algorithm4.2" to "Algorithm 4.2". (*Insert the space.*)

Page 214 Change the third line up from the end of **Example 4.8** to read as follows,

$$\dot{\omega} = -1.0465(10^{-6}) \cdot \frac{(5/2)\sin^2 51.43° - 2}{\cos 51.43°} = +7.9193(10^{-7}) \text{ rad/s}$$

Page 218 At the end of the 6th line down, change "$t_1 = 631.00$ s" to "$t_0 = 631.00$ s".

Page 218 In the 8th line down, change

"$t_f = t_1 + \Delta t = 631.00 + 345{,}000 = 345{,}600$ s"

to

"$t_f = t_0 + \Delta t = 631.00 + 345{,}000 = 345{,}600$ s"

Page 223 In line 3, make the corrections shown in red below:

$$\dot{\Omega} = -\left[\frac{3}{2}\frac{\sqrt{\mu}J_2R^2}{(1-e^2)^2 a^{7/2}}\right]\cos i_0 = -\left[\frac{3}{2}\frac{\sqrt{398{,}600}\cdot 0.0010836\cdot 6378^2}{(1-0.19760^2)^2\cdot 8350^{7/2}}\right]\cos 60° = -2.3394(10^{-5})°/\text{s}$$

Page 223 In line 4, make the corrections shown in red below:

$$\dot{\omega} = \dot{\Omega}\frac{(5/2)\sin^2 i_0 - 2}{\cos i_0} = -2.3394\times 10^{-5}\left[\frac{(5/2)\sin^2 60° - 2}{\cos 60°}\right] = 5.8484(10^{-6})°/\text{s}$$

Page 223 In line 9, center justify the equation, as shown below:

Step 3: $t = t_0 + 45 \text{ min} = -2339.7 + (45\times 60) = 360.33 \text{ s} \quad (360.33 \text{ s after perigee})$

Page 223 In line 14, center justify the equation, as shown below:

(b) $\Omega = \Omega_0 + \dot{\Omega}\Delta t = 270° + (-2.3394\times 10^{-5})(2700 \text{ s})$

Page 223 Correct the fifth line up so that it reads as follows (*change* 2α *to* α)

$$\mathbf{r} = 2710.3\hat{\mathbf{i}}' - 2835.4\hat{\mathbf{j}}' + 5568.6\hat{\mathbf{k}}' \quad \overset{\text{Algorithm 4.1}}{\Rightarrow} \quad \boxed{\alpha = 313.7° \quad \delta = 54.84°}$$

Chapter 5

Page 232 Correct the equation preceding Eq. (5.2) so that it reads as follows

$$\mathbf{v}\times\mathbf{h}=\mu\left(\frac{\mathbf{r}}{r}+\mathbf{e}\right)$$

↑ bold face

Page 237 Correct the last equation to read as follows

$$\begin{aligned}\mathbf{v}_2&=\sqrt{\frac{\mu}{ND}}\left(\frac{\mathbf{D}\times\mathbf{r}_2}{r_2}+\mathbf{S}\right)\\&=\sqrt{\frac{398{,}600}{(4.0971(10^9))(5.1728(10^5))}}\times\\&\left[\frac{\begin{vmatrix}\hat{\mathbf{I}} & \hat{\mathbf{J}} & \hat{\mathbf{K}}\\ 2.8797\times10^6 & -3.4321\times10^6 & 2.5856\times10^6\\ -1365.5 & 3637.6 & 6346.8\end{vmatrix}}{7441.7}+\left(-34{,}276\hat{\mathbf{I}}+478.57\hat{\mathbf{J}}+38{,}810\hat{\mathbf{K}}\right)\right]\end{aligned}$$

Page 246 In the line just after "Step 6", change "yields" to "yield".

Page 251 Revise the last line of **Example 5.5** to read as follows, (*add the parentheses*)

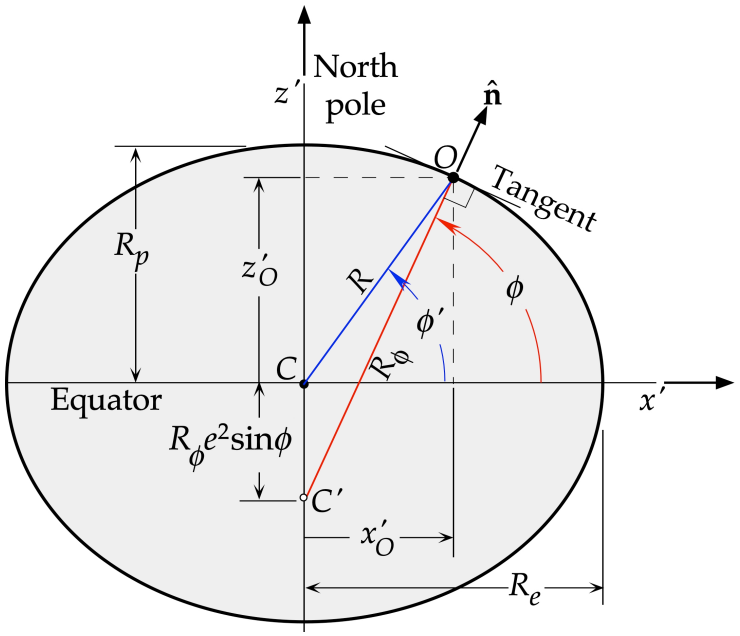
$$\Delta JD=2{,}453{,}138.1149-2{,}436{,}116.3100=17{,}021.805\,\text{days}\quad\boxed{(46\,\text{years},\,220\,\text{days})}$$

Page 252 In step 4 of Algorithm 5.3, change "θ_{G}" to "θ_G".

Page 255 In Fig. 5.9,

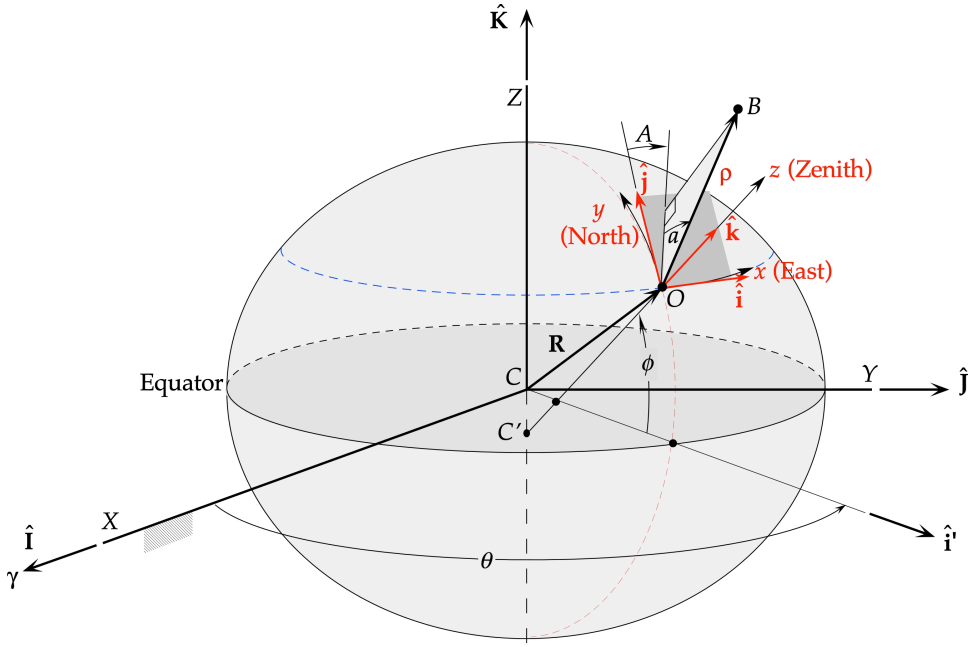
(1) the length of the red line from C' to O should be labeled R_ϕ, as shown below, *not* R.

(2) the arrow on the vertical line through z'_O should be at the *top* of the line, as shown below, not at the bottom.

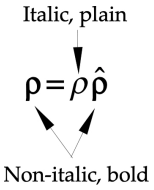


Page 258 In Fig. 5.11,

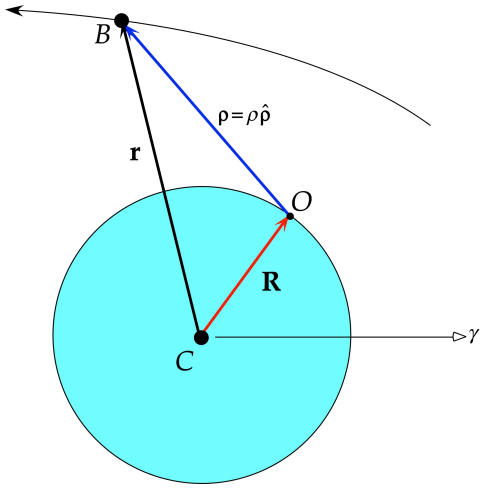
(1) the bottom C on the vertical Z axis should be labeled C', as shown below.
(2) the letter $\hat{\mathbf{i}}$ at the far lower right should be $\hat{\mathbf{i}}'$, as shown below.



Page 262 In Fig. 5.12, $\rho = \rho\hat{\rho}$ should be written



as shown below



Page 262 In the third line after Eq. (5.65), "$\Omega = \omega_E \hat{\mathbf{K}}$" should be written "$\mathbf{\Omega} = \omega_E \hat{\mathbf{K}}$" ($\mathbf{\Omega}$ *is bold face, non-italicized*).

Page 263 In Eq. (5.77) change "φ" everywhere to "ϕ", so that it reads

$$\begin{Bmatrix} L_X \\ L_Y \\ L_Z \end{Bmatrix} = \begin{bmatrix} -\sin\theta & -\cos\theta\sin\phi & \cos\theta\cos\phi \\ \cos\theta & -\sin\theta\sin\phi & \sin\theta\cos\phi \\ 0 & \cos\phi & \sin\phi \end{bmatrix} \begin{Bmatrix} \sin A\cos a \\ \cos A\cos a \\ \sin a \end{Bmatrix} \tag{5.77}$$

Page 263 In the equation just before Eq. (5.78a), change "φ" everywhere to "ϕ", so that it reads

$$\begin{Bmatrix} \cos\alpha\cos\delta \\ \sin\alpha\cos\delta \\ \sin\delta \end{Bmatrix} = \begin{bmatrix} -\sin\theta & -\cos\theta\sin\phi & \cos\theta\cos\phi \\ \cos\theta & -\sin\theta\sin\phi & \sin\theta\cos\phi \\ 0 & \cos\phi & \sin\phi \end{bmatrix} \begin{Bmatrix} \sin A\cos a \\ \cos A\cos a \\ \sin a \end{Bmatrix}$$

Page 265 In Eq. (5.84) change "φ" everywhere to "ϕ", so that it reads

$$\dot{\delta} = \frac{1}{\cos\delta}\left[-\dot{A}\cos\phi\sin A\cos a + \dot{a}\left(\sin\phi\cos a - \cos\phi\cos A\sin a\right)\right] \tag{5.84}$$

Page 267 In the line after "Step 8:", change "φ" everywhere to "ϕ", so that it reads

$$\dot{\alpha} - \omega_E = \frac{\dot{A}\cos A\cos a - \dot{a}\sin A\sin a + \dot{\delta}\sin A\cos a\tan\delta}{\cos\phi\sin a - \sin\phi\cos A\cos a}$$

Page 273 In the line just after Eq. (5.112c), insert a comma between "(5.109b)" and "(5.111a)".

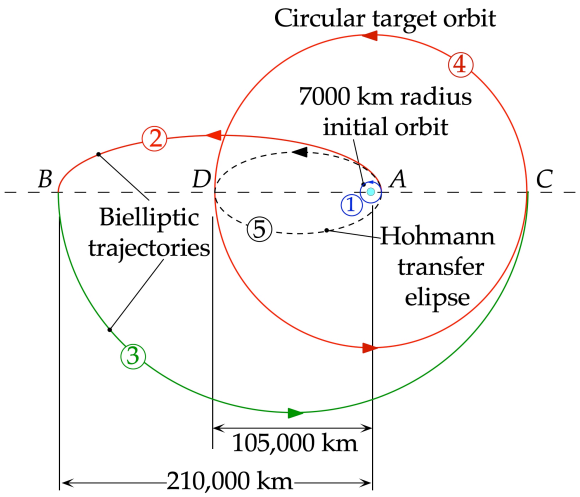
Chapter 6

Page 292 In the third line of the second paragraph, insert a space between "Eq. (6.2)" and "to".

Page 296 In Eq. (6.4b), increase the spacing between the last two terms, as shown below:

$$\Delta\bar{v}_{\mathrm{H}} = \frac{\Delta v_{\mathrm{total}}}{v_0}\Bigg)_{\mathrm{Hohmann}} \qquad \Delta\bar{v}_{\mathrm{BE}} = \frac{\Delta v_{\mathrm{total}}}{v_0}\Bigg)_{\mathrm{bi-elliptical}} \qquad \alpha = \frac{r_C}{r_A} \qquad \beta = \frac{r_B}{r_A} \tag{6.4b}$$

Page 297 In Fig. 6.9 the dotted orbit 5 is too light (barely visible). It should appear as shown below:



Page 297 In the equation at the bottom of the page, the second line appears to be too light. It should look like this:

$$\begin{aligned}\Delta v_{\mathrm{total}}\big)_{\mathrm{bi\text{-}elliptical}} &= \Delta v_A + \Delta v_B + \Delta v_C \\ &= \left|v_A\big)_2 - v_A\big)_1\right| + \left|v_B\big)_3 - v_B\big)_2\right| + \left|v_C\big)_4 - v_C\big)_3\right| \\ &= \left|10.498 - 7.546\right| + \left|1.1249 - 0.34994\right| + \left|1.9484 - 2.2498\right|\end{aligned}$$

Page 301 In the 8th line down, correct the equation to read as follows

$$r_D = 2a_2 - r_A = 2 \cdot 9182.1 - 6800 = 11{,}564\,\mathrm{km}$$

(*Change the first minus sign to an equals sign and change the decimal point to a raised dot* [*multiplication symbol*]).

Page 305 The equation three lines down from Eq. (6.10) should be corrected to read as follows

$$\varepsilon = \frac{\mathbf{v}\cdot\mathbf{v}}{2} - \frac{\mu}{r}$$

(The *r* is *not* bold, and it is italicized.)

Page 314 In the fifth line after "**Solution**", the equation should be corrected to read

$$h_1 = \sqrt{2 \cdot 398{,}600}\sqrt{\frac{8100 \cdot 18{,}900}{8100 + 18{,}900}} = 67{,}232 \text{ km}^2/\text{s}$$

Page 316 The MATLAB script starting at the top of the page should be reformatted to read as follows:

```
clear
global mu
deg      = pi/180;
mu       = 398600;
e        = 0.4;
h        = 67232;
theta1   = 45*deg;
theta2   = 190.57*deg;
delta_t  = 3600;
rB       = h^2/mu/(1 + e*cos(theta1))...
           *[cos(theta1),sin(theta1),0];
rC_prime = h^2/mu/(1 + e*cos(theta2))...
           *[cos(theta2),sin(theta2),0];
string   = 'pro';
[vB2 vC_prime_2] = lambert(rB, rC_prime, delta_t, string)
```

Page 335 Correct the answer to **Problem 6.6** so that it reads "{Ans.: $\Delta v = 77.2$ m/s }".

Page 350 In **Problem 6.47**, the sentence beginning, "About 89 min later…" should *not* be indented.

Chapter 7

Page 357 In the tenth line up from the bottom, change "… as shown at the bottom of the figure …" to "… as shown at the right in the figure …".

Page 358 In the third line up, change "*arrow*" to "arrow" (no italics).

Page 363 In Eq. (7.36), change h_0 to h, so that it reads

$$\mathbf{y}=\begin{Bmatrix}\delta x\\ \delta y\\ \delta z\\ \delta\dot{x}\\ \delta\dot{y}\\ \delta\dot{z}\end{Bmatrix}\qquad \dot{\mathbf{y}}=\begin{Bmatrix}\delta\dot{x}\\ \delta\dot{y}\\ \delta\dot{z}\\ \delta\ddot{x}\\ \delta\ddot{y}\\ \delta\ddot{z}\end{Bmatrix}\qquad \mathbf{f}(t,\mathbf{y})=\begin{Bmatrix} y_4\\ y_5\\ y_6\\ \left(\dfrac{2\mu}{R^3}+\dfrac{h^2}{R^4}\right)y_1-\dfrac{2(\mathbf{V}\cdot\mathbf{R})h}{R^4}y_2+2\dfrac{h}{R^2}y_5\\ \left(\dfrac{h^2}{R^4}-\dfrac{\mu}{R^3}\right)y_2+\dfrac{2(\mathbf{V}\cdot\mathbf{R})h}{R^4}y_1-2\dfrac{h}{R^2}y_4\\ -\dfrac{\mu}{R^3}y_3\end{Bmatrix} \tag{7.36}$$

Page 371 In the first line of **Example 7.4**, change "…are in orbits with…" to "…are in earth orbits with…".

Page 371 In the last line, correct the equation to read as follows:

$$n=\frac{V}{r}=\frac{7.7258}{6678}=0.00115691\ \text{rad/s} \tag{a}$$

Page 372 The first equation on the page should be corrected to read

$$\delta\mathbf{v}=\overbrace{-7.35170\hat{\mathbf{I}}+0.463828\hat{\mathbf{J}}+2.46906\hat{\mathbf{K}}}^{\mathbf{v}}-\overbrace{\left(-7.29936\hat{\mathbf{I}}+0.492329\hat{\mathbf{J}}+2.48304\hat{\mathbf{K}}\right)}^{\mathbf{V}}$$
$$\overbrace{-(0.00115691)\begin{vmatrix}\hat{\mathbf{I}} & \hat{\mathbf{J}} & \hat{\mathbf{K}}\\ 0.219846 & -0.604023 & 0.766044\\ -9.64015 & 5.08235 & 32.8822\end{vmatrix}}^{\boldsymbol{\Omega}_{\text{space station}}\times\delta\mathbf{r}}$$

(*The first overhead vee is lower case bold face.*)

Page 373 The equation following the sentence, "The delta-v at the conclusion of the maneuver is" should be changed from

$$\left\{\Delta v_f\right\}=\left\{\delta\mathbf{v}_f^+\right\}-\left\{\delta\mathbf{v}_f^-\right\}=\begin{Bmatrix}0\\0\\0\end{Bmatrix}-\begin{Bmatrix}-0.0257978\\-0.000470870\\-0.0244767\end{Bmatrix}=\begin{Bmatrix}-0.0257978\\-0.000470870\\0.0244767\end{Bmatrix}(\text{km/s})$$

to read as follows

$$\{\Delta\mathbf{v}_f\} = \{\delta\mathbf{v}_f^+\} - \{\delta\mathbf{v}_f^-\} = \begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix} - \begin{Bmatrix} -0.0257978 \\ -0.000470870 \\ -0.0244767 \end{Bmatrix} = \begin{Bmatrix} 0.0257978 \\ 0.000470870 \\ 0.0244767 \end{Bmatrix} \text{(km/s)}$$

(*The vee on the far left is bold lower case, and the numbers in the last column are all positive.*)

Page 375 Revise the seventh line down to read as follows:

$$= \begin{Bmatrix} 9.4824(10^{-6}) \\ -1.2225(10^{-4}) \end{Bmatrix}$$

Page 375 In the seventh line up, correct the equation so it reads

$$= -9.4824 \times 10^{-6}\,\hat{\mathbf{i}} + 1.2225 \times 10^{-4}\,\hat{\mathbf{j}}\ \text{(km/s)}$$

Page 375 Correct Eq. (i) so it reads as follows:

$$\Delta v_{\text{total}} = \|\Delta\mathbf{v}_0\| + \|\Delta\mathbf{v}_f\| = \boxed{0.2452\ \text{m/s}}$$

(*The vee on the left should be non-bold, italic.*)

Page 377 In the line just after Eq. (7.64), insert a comma between "$\mathbf{r} = \mathbf{R} + \delta\mathbf{r}$" and "we".

Page 381 The beginning of **Problem 7.10** should read, "At time $t = 0$ a particle …". (*Italicized* t).

Page 382 In the second line of **Problem 7.16**, change "… a 280-km-by-250-km orbit… " to

"… a 280 km by 250 km orbit… ". (*Remove the hyphens.*)

Chapter 8

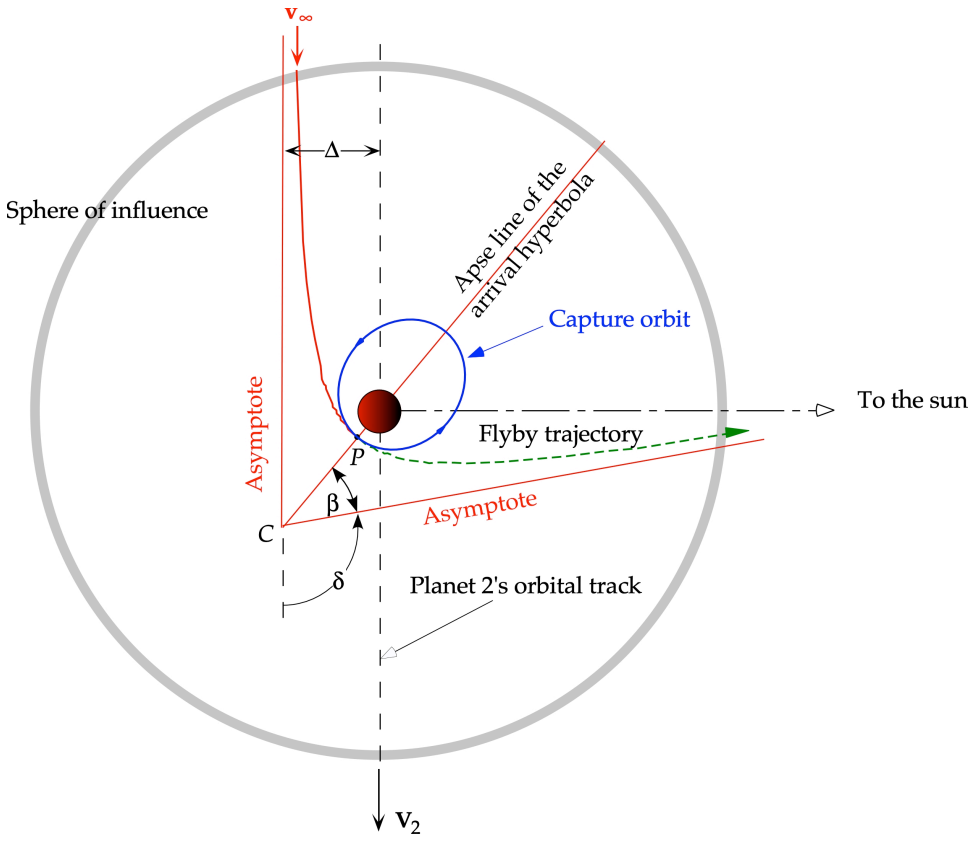
Page 398 Correct Eq. 8.37 so that it reads

$$h = \frac{\mu_1 \sqrt{e^2 - 1}}{v_\infty}$$

Page 402 Correct the equation in the sixth line down so that it reads

$$v_c = \sqrt{\frac{\mu_{\text{earth}}}{R_{\text{earth}} + 300}} = \sqrt{\frac{398{,}600}{6678}} = 7.726\,\text{km/s}$$

Page 407 In Fig. 8.14, the arrow at the top, labeled $\mathbf{v}_\infty$, should be pointed *downward*, as shown below.



Page 418 Change the line just before "(a) *Dark-side approach*" to read as follows:

"(+103.6°), whereas for the sunlit side approach, it is clockwise (−103.6°)."

Page 429 In the second line of **Example 8.8**, change "…September, 12, 1997…" to "…September 12, 1997…".

Page 429 In the line after "Step 1:", put a period after "… Mars".

Chapter 9

Page 476 The statement of **Problem 9.12 (a)** should be corrected to read, "Show that the path around the moon is retrograde." (*Delete* "and find" *and insert a period at the end*.)

Chapter 10

Page 480 In the second line from the top, change

"… for numerically integrating Eq. 10.2 (namely, Cowell's method and Encke's method)."

to

"… for numerically integrating Eq. 10.2, namely, Cowell's method and Encke's method."

Page 486 In the second line of **Example 10.1**, insert a space between "km" and "altitude".

Page 486 In the third line of **Example 10.1**, insert a space between "km" and "altitude".

Page 486 Correct Eq. (b) of **Example 10.1** so that it reads as follows:

$$\frac{\mathrm{d}}{\mathrm{d}t}\begin{Bmatrix}\mathbf{r}\\ \mathbf{v}\end{Bmatrix}=\begin{Bmatrix}\mathbf{v}\\ \mathbf{a}\end{Bmatrix}=\begin{Bmatrix}\mathbf{v}\\ -\mu\dfrac{\mathbf{r}}{r_3}+\mathbf{p}\end{Bmatrix} \tag{a}$$

(*Change bold* $\boldsymbol{\rho}$ *to bold* $\mathbf{p}$.)

Page 498 Correct Eq. (10.50d) so that it reads as follows:

$$\frac{\mathrm{d}\Omega}{\mathrm{d}t}=\frac{1}{\sqrt{\mu a\left(1-e^2\right)}\sin i}\frac{\partial R}{\partial i} \tag{10.50d}$$

Page 498 Correct Eq. (10.50f) so that it reads as follows:

$$\frac{\mathrm{d}\omega}{\mathrm{d}t}=-\frac{1}{\sqrt{\mu a\left(1-e^2\right)}\tan i}\frac{\partial R}{\partial i}+\frac{\sqrt{1-e^2}}{\sqrt{\mu a e}}\frac{\partial R}{\partial e} \tag{10.50f}$$

Page 501 Correct the title of Section 10.7.1 so that it reads as follows:

10.7.1 VARIATION OF THE SPECIFIC ANGULAR MOMENTUM *h*

(*Change the* ***H*** *at the end to* ***h***.)

Page 507 Correct the equation just before **Example 10.4** so that it reads as follows

$$\text{Mean anomaly (Eq. 3.6):}\quad M=2\tan^{-1}\left(\sqrt{\frac{1-e}{1+e}}\tan\frac{\theta}{2}\right)-\frac{e\sqrt{1-e^2}\sin\theta}{1+e\cos}$$

Page 508 Correct Eq. (10.86) so that it reads

$$p_v = -\frac{1}{2}\rho v^2 B \tag{10.86}$$

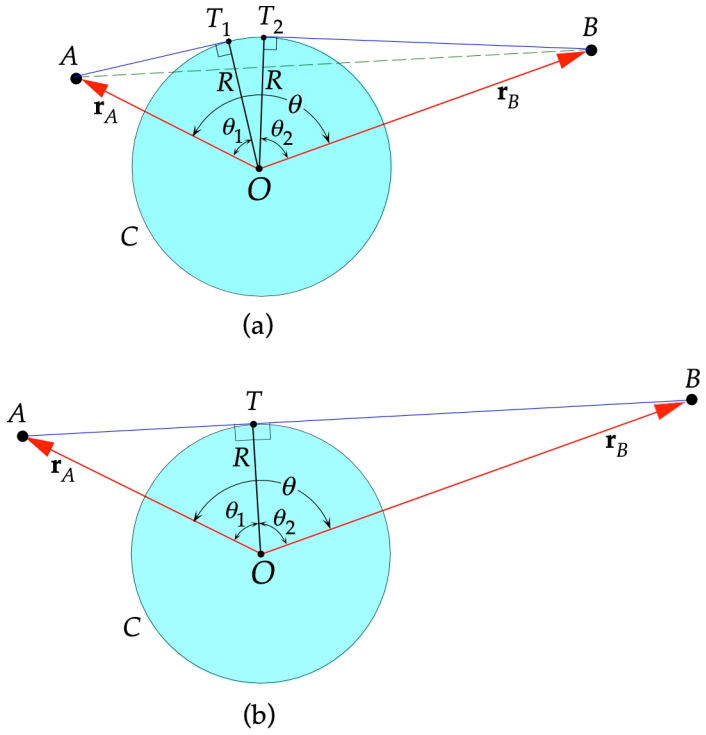
Page 511 Correct the sentence just after Eq. (d) of **Example 10.6** to read as follows:

"Use Gauss' variational equations (Eqs. 10.89) to determine…".

Page 522 Correct the sentence just after Eq. (10.101) to read as follows:

To use Gauss' planetary equations (Eqs. 10.84) to determine…".

Page 525 In Fig. 10.15, add the missing letter *C* in two places and revise the font sizes so that it appears as shown below:



Page 525 Correct the caption of Fig. 10.15 so it reads as follows:

"(a) *AB* intersects the central body $(\theta_1 + \theta_2 < \theta)$. (b) *AB* is tangent to the central body $(\theta_1 + \theta_2 = \theta)$."

Page 526 The beginning of the sentence following Eq. (10.113) should be corrected to read:

"In Fig. 10.15a, T_1 and T_2 are …"

(*Change* "10.15A" *to* "10.15a" *and insert a space between* "and" *and* "T_2".)

Page 526 Fix the three lines following Eq. (10.114) so they read as follows:

"If, as in Fig. 10.15a, the line *AB* intersects the central body, which means there is no line of sight, then $\theta_1 + \theta_2 < \theta$. If the *AB* is tangent to *C* (Fig. 10.15b) or lies outside it, then $\theta_1 + \theta_2 \geq \theta$ and there is line of sight."

Page 529 Correct the third line down in three places, so that it reads as follows:

"Eqs. C.2 give the absolute accelerations $\mathbf{a}_1 = \mathrm{d}^2\mathbf{R}_1/\mathrm{d}t^2$, $\mathbf{a}_2 = \mathrm{d}^2\mathbf{R}_2/\mathrm{d}t^2$ and $\mathbf{a}_3 = \mathrm{d}^2\mathbf{R}_3/\mathrm{d}t^2$ of the… "

Page 537 In the first line of **Problem 10.2**, change " $\mathrm{v}_0 = \sqrt{\mu/r_0}$ " to " $v_0 = \sqrt{\mu/r_0}$ ".

Chapter 11

Page 563 In the sentence just before Eq. (c), change "Fig 11.10A" to "Fig. 10a".

Page 564 In the line following Eq. (11.45), change "…(Eqs. 11.39a and 11.39b)…" to "(…Eq. 11.39) ...".

Page 566 In the second line of the **Solution**, change "Fig 11.10C" to "Fig. 10c".

Page 572 Revise the sentence after Eq. (11.60) to read as follows

"Of course, Eq. 11.39 requires"

Page 576 Correct Eq. (11.68) to read

$$\mathbf{M}_{\text{net}} = \dot{\mathbf{H}})_{\text{rel}} + \boldsymbol{\Omega} \times \mathbf{H} \tag{11.68}$$

($\boldsymbol{\Omega}$ *is bold face.*)

Page 577 The end of the line just before Eq. (11.72a) should read as follows:

"… Euler equation of motion, namely," (*Change the colon to a comma.*)

Page 581 The equation in the third line down should read as follows:

$$\boxed{\mathbf{M}_G)_{\text{net}} = 0.3203\hat{\mathbf{i}} - 0.6698\hat{\mathbf{j}} - 0.1164\hat{\mathbf{k}}\ (\text{N}\cdot\text{m})}$$

(N·m *not* N m).

Page 591 In the sixth line above **Example 11.18**, change "…then Eq. (11.116b) are three…" to "…then Eqs. (11.116b) are three …"

Page 591 In the second line above **Example 11.18**, change "…that Eq. (11.116b) 'blow up'…" to "…that Eqs. (11.116b) 'blow up'…"

Page 592 Eight lines up, change

"Substituting $\theta = 114.36°$ and $\psi = 116.33°$ together with the angular velocities of Eq. (d) into Eqs. (11.116a) and (11.116b) yields"

to

"Substituting $\theta = 114.36°$ and $\psi = 116.33°$ together with the angular velocities of Eq. (d) into Eqs. (11.116) yields"

Page 593 In the second line after **Solution**, change "…function of time…" to "…functions of time…".

Page 594 After the eighth line down, change "N m" to "N·m" in three places.

Page 595 In the second line down, change "Eq. (11.115)" to "Eqs. (11.115)".

Page 595 In the line just after Eq. (b), change "Fig. 11.10C" to Fig. 11.10c".

Page 596 In the seventh line down, change "(Eqs. 11.72a and 11.72b)" to "(Eqs. 11.72)".

Page 597 In the second line, change "The problem of Euler angle relations…" to "The problem of the Euler angle relations…".

Page 597 In the fourth line down, change "…into the triad of body-fixed *xyz* axes triad by means of…" to "…into the triad of body-fixed *xyz* axes by means of…". (*Delete the second* "triad".)

Page 602 In line 17, change "…(Eqs. 11.116a and 11.116b)…" to "…(Eqs. 11.116)…".

Page 602 In line 18, change "…(Eq. (11.126))… " to "…(Eqs. 11.130)…".

Page 603 In the second line, put additional space between the two equations:

$$(\hat{\mathbf{p}}+\hat{\mathbf{q}})+\hat{\mathbf{r}}=\hat{\mathbf{p}}+(\hat{\mathbf{q}}+\hat{\mathbf{r}}) \qquad \hat{\mathbf{p}}+\hat{\mathbf{q}}=\hat{\mathbf{q}}+\hat{\mathbf{p}}$$

Page 603 Correct Eq. (a) of **Example 11.21** so that it reads as follows:

$$\hat{\mathbf{p}}=\left\{\begin{array}{c}\mathbf{p}\\ \hline p_4\end{array}\right\}=\left\{\begin{array}{c}\hat{\mathbf{j}}\\ \hline 1\end{array}\right\} \qquad \hat{\mathbf{q}}=\left\{\begin{array}{c}\mathbf{q}\\ \hline q_4\end{array}\right\}=\left\{\begin{array}{c}0.5\hat{\mathbf{i}}+0.5\hat{\mathbf{j}}+0.75\hat{\mathbf{k}}\\ \hline 1\end{array}\right\} \tag{a}$$

($\hat{\mathbf{i}},\hat{\mathbf{j}},\hat{\mathbf{k}}$ *are* bold *face.*)

Page 603 Correct the equation following **Solution** so that it reads as follows

$$\begin{aligned}\hat{\mathbf{p}}\otimes\hat{\mathbf{q}}&=\left\{\begin{array}{c}p_4\mathbf{q}+q_4\mathbf{p}+\mathbf{p}\times\mathbf{q}\\ \hline p_4q_4-\mathbf{p}\cdot\mathbf{q}\end{array}\right\}\\ &=\left\{\begin{array}{c}\overbrace{0.5\hat{\mathbf{i}}+0.5\hat{\mathbf{j}}+0.75\hat{\mathbf{k}}}+\overbrace{1\cdot\hat{\mathbf{j}}}+\overbrace{\hat{\mathbf{j}}\times(0.5\hat{\mathbf{i}}+0.5\hat{\mathbf{j}}+0.75\hat{\mathbf{k}})}^{-0.5\hat{\mathbf{k}}+0.75\hat{\mathbf{i}}}\\ \hline \underbrace{1\cdot 1}_{1}-\underbrace{\hat{\mathbf{j}}\cdot(0.5\hat{\mathbf{i}}+0.5\hat{\mathbf{j}}+0.75\hat{\mathbf{k}})}_{0.5}\end{array}\right\}\\ &=\left\{\begin{array}{c}(0.5+0.75)\hat{\mathbf{i}}+(0.5+1.0)\hat{\mathbf{j}}+(0.75-0.5)\hat{\mathbf{k}}\\ \hline 0.5\end{array}\right\}\end{aligned}$$

($\hat{\mathbf{i}},\hat{\mathbf{j}},\hat{\mathbf{k}}$ *are* bold *face.*)

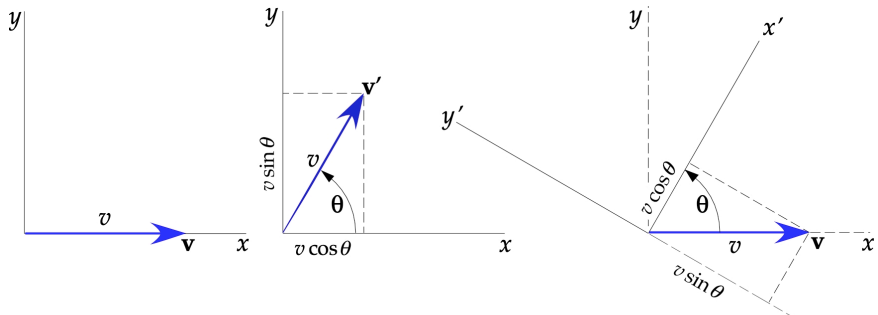
Page 604 Correct Eq. (11.148) to read as follows:

$$\hat{\mathbf{1}} = \left\{ \begin{array}{c} \mathbf{0} \\ \hline 1 \end{array} \right\} \tag{11.148}$$

(*The* 1 *on the left is* bold *face.*)

Page 611 The equation fonts are not of uniform size.

Page 612 Fig. 11.29 needs to be corrected as shown below. The one in the book has errors and the lines are so faint as to be barely readable.

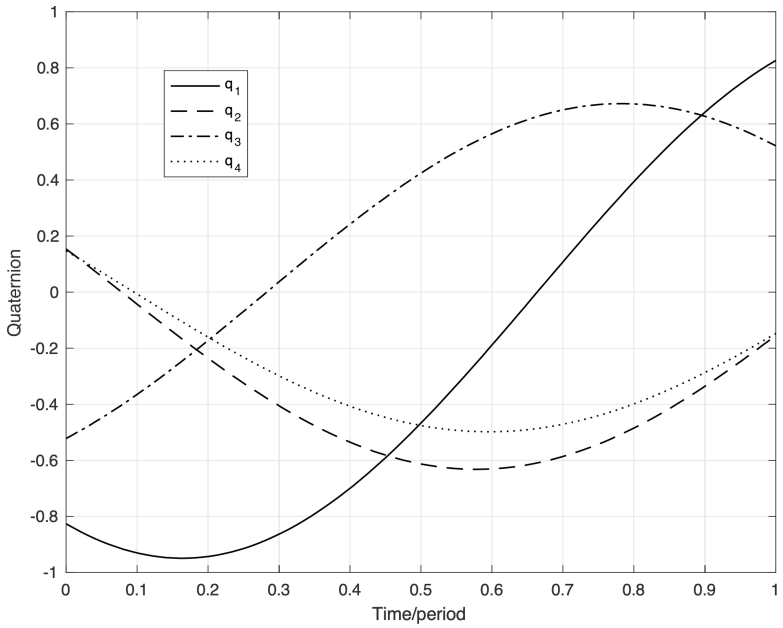


Before rotation	After vector rotation	After frame rotation
$v_x = v$	$v'_x = v\cos\theta$	$v_{x'} = v\cos\theta$
$v_y = 0$	$v'_y = v\sin\theta$	$v_{y'} = -v\sin\theta$

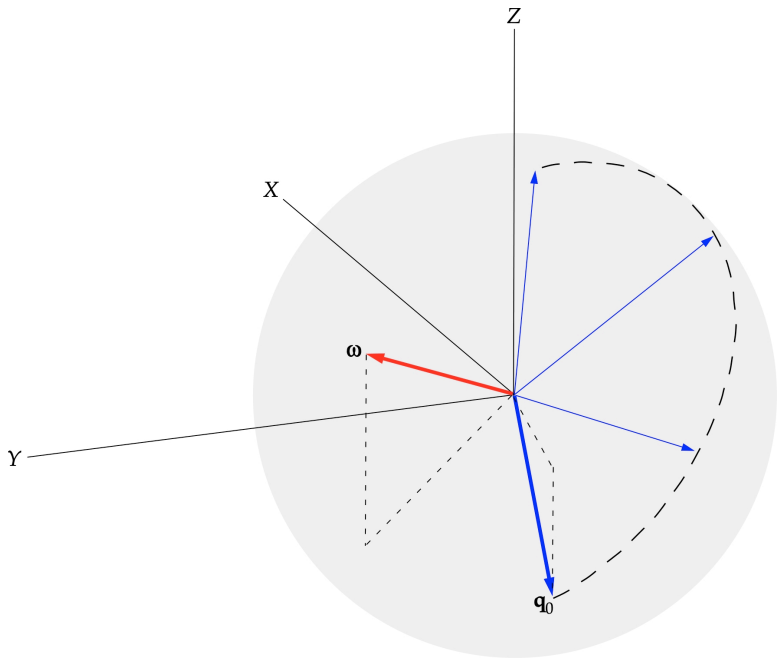
Page 612 In the first line below the figure, change "…(Eq. 11.72)…" to "…(Eqs. 11.72)…".

Page 616 In line 15 down, change "…by means of Eq. (11.146)," to "…by means of Eq. (11.153),".

Page 616 Correct Fig. 11.30 as shown below. In the book, the curve for q_4 is nearly invisible.



Page 618 Fig. 11.33 should be as shown below. In the book some of the lines are nearly invisible.



Page 620 In the second line after "Step 3:", change "…Eq. (11.115)…" to "…Eqs. (11.115)…".

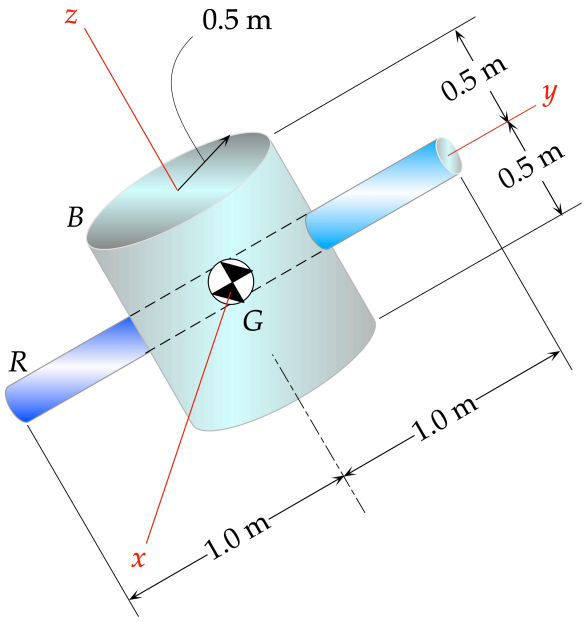
Chapter 12

Page 643 In the line after Eqs. (12.31), change "Eq. (12.31_3) implies…" to "Eq. (12.31_3) implies…". (*Close the gap*.)

Page 644 In the first line, change "Differentiating Eq. (12.31_1) with…" to "Differentiating Eq. (12.31_1) with…". (*Close the gap*.)

Page 645 In the line just before Eq. (b), change "The Euler equations (Eq. 12.4) …" to "The Euler equations of motion (Eq. 12.4) …"

Page 649 Fig. 12.10 is missing the "*B*" and "*R*" shown below:



Page 651 In the eighth line up, change

$$H_G^2 = (C_r\omega_r + C_p\omega_p)^2 + A_\perp{}^2\omega_\perp{}^2$$

to

$$H_G{}^2 = (C_r\omega_r + C_p\omega_p)^2 + A_\perp{}^2\omega_\perp{}^2$$

Page 651 In the seventh line up, change dH_G^2/dt to $dH_G{}^2/dt$.

Page 655 In the line just after Eq. (12.69), change "…parentheses…" to "…brackets…".

Page 658 Correct the fourth of Eqs. (12.89) so that they read as follows:

$$\begin{aligned} AD\delta\omega_x + (C-B)\omega_o\delta\omega_y &= 0 \\ \left[A-C-(1-\mu)mR^2\right]\omega_o\delta\omega_x + \left[B+(1-\mu)mR^2\right]D\delta\omega_y - (1-\mu)mR\left(D^2+\omega_o{}^2\right)\delta z_m &= 0 \\ \left[C+(1-\mu)mR^2\right]D\delta\omega_z &= 0 \\ (1-\mu)mR\omega_o\delta\omega_x - (1-\mu)mRD\delta\omega_y + \left[(1-\mu)mD^2 + cD + k\right]\delta z_m &= 0 \end{aligned} \tag{12.89}$$

Page 659 In **Example 12.7**, change Eqs. (c) to read as follows

$$\begin{aligned} r_1 &= +1.188(10^6)\ \text{kg}^3\cdot\text{m}^4 \\ r_2 &= +18.44(10^6)\ \text{kg}^3\cdot\text{m}^4/\text{s} \\ r_3 &= +1.228(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^2 \\ r_4 &= +92{,}820\ \text{kg}^3\cdot\text{m}^4/\text{s}^3 \\ r_5 &= +8.271(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^4 \end{aligned} \tag{c}$$

Page 659 In **Example 12.7**, change Eqs. (e) to read as follows

$$\begin{aligned} r_1 &= +1.980(10^6)\ \text{kg}^3\cdot\text{m}^4 \\ r_2 &= +30.74(10^6)\ \text{kg}^3\cdot\text{m}^4/\text{s} \\ r_3 &= +2.048(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^2 \\ r_4 &= -304{,}490\ \text{kg}^3\cdot\text{m}^4/\text{s}^3 \\ r_5 &= +7.520(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^4 \end{aligned} \tag{e}$$

Page 660 In **Example 12.7**, change Eqs. (g) to read as follows

$$\begin{aligned} r_1 &= +1.485(10^6)\ \text{kg}^3\cdot\text{m}^4 \\ r_2 &= +22.94(10^6)\ \text{kg}^3\cdot\text{m}^4/\text{s} \\ r_3 &= +1.529(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^2 \\ r_4 &= -192{,}800\ \text{kg}^3\cdot\text{m}^4/\text{s}^3 \\ r_5 &= -4.323(10^9)\ \text{kg}^3\cdot\text{m}^4/\text{s}^4 \end{aligned} \tag{g}$$

Page 661 In the 16th line down from the top, delete the comma after ω_s.

Page 661 In the 17th line down from the top, insert a comma after ω_p.

Page 661 In the 19th line down from the top, insert a comma between "thrusters" and "both".

Page 667 In lines 2 and 3, change "satellite" to "spacecraft" (2 places).

Page 667 Correct the line following Eq. (12.104) so it reads as follows:
"$R\sqrt{mK/(m+M)}$ is the system's initial radius of gyration, where M is the spacecraft mass."

Page 682 In the fifth line down, change "N m" to "N·m".

Page 688 Two lines above Eq. (12.163), change "N m" to "N·m".

Page 690 Correct Eqs. (12.169 so they read as follows:

$$\begin{aligned}\dot{\omega}_x &= \ddot{\psi}_{\text{roll}} + n\dot{\phi}_{\text{yaw}} \\ \dot{\omega}_y &= \ddot{\theta}_{\text{pitch}} \\ \dot{\omega}_z &= \ddot{\phi}_{\text{yaw}} - n\dot{\psi}_{\text{roll}}\end{aligned} \tag{12.169}$$

Page 691 Change Eq. (12.174) to read as follows:

$$I_{\text{pitch}}\ddot{\theta}_{\text{pitch}} + 3\left(I_{\text{roll}} - I_{\text{yaw}}\right)n^2\theta_{\text{pitch}} = 0 \tag{12.174}$$

(*Not* $I_{\text{pitch}}\ddot{\theta}_{\text{pitch}} + 3\left(I_{\text{roll}} - I_{\text{yaw}}\right)n^2\theta_{\text{pitch}} \quad = 0$).

Page 692 Vertically align the two equations following Eq. (12.178) as follows:

$$\begin{aligned}\left[\left(I_{\text{pitch}} - I_{\text{roll}}\right)n^2 + I_{\text{yaw}}q^2\right]Y + &\quad \left[\left(I_{\text{pitch}} - I_{\text{roll}} - I_{\text{yaw}}\right)nq\right]R = 0 \\ \left[\left(I_{\text{roll}} - I_{\text{pitch}} + I_{\text{yaw}}\right)nq\right]Y + &\left[4\left(I_{\text{pitch}} - I_{\text{yaw}}\right)n^2 + I_{\text{roll}}q^2\right]R = 0\end{aligned}$$

Page 692 Vertically align Eqs. (12.179) as follows:

$$\begin{aligned}\left(\frac{I_{\text{pitch}} - I_{\text{roll}}}{I_{\text{yaw}}}n^2 + q^2\right)Y + &\quad \left(\frac{I_{\text{pitch}} - I_{\text{roll}}}{I_{\text{yaw}}} - 1\right)nqR = 0 \\ \left(1 - \frac{I_{\text{pitch}} - I_{\text{yaw}}}{I_{\text{roll}}}\right)nqY + &\left(4\frac{I_{\text{pitch}} - I_{\text{yaw}}}{I_{\text{roll}}}n^2 + q^2\right)R = 0\end{aligned} \tag{12.179}$$

Page 692 Vertically align the two equations preceding Eq. (12.181) as follows:

$$\begin{aligned}\left(k_Y n^2 + q^2\right)Y + &\quad \left(k_Y - 1\right)nqR = 0 \\ \left(1 - k_R\right)nqY + &\left(4k_R n^2 + q^2\right)R = 0\end{aligned}$$

Page 693 At the beginning of the line just after Eq. (12.190), change "Fig. 12.30" to "Fig. 12.33".

Page 693 At the end of the third line down from Eq. (12.190), delete (Fig. 12.33) and put a period after "positive".

Page 694 Two lines above Eq. (12.191) change "Eq. (12.176)" to "Eq. (12.175)".

Page 698 In **Problem 12.5**, change "At a given instant, a box-shaped…" to "At a given instant, the above box-shaped…".

Page 699 In **Problem 12.6**, change "An 8-kg thin ring in torque-free motion…" to "The above 8-kg thin ring in torque-free motion…".

Page 699 In **Problem 12.7**, change "A rectangular block has …" to "The above rectangular block has …".

Page 699 In **Problem 12.8**, change "A solid right circular cylinder…" to "The above solid right circular cylinder…".

Page 700 In **Problem 12.10**, change "Let the object in Example 11.11 be…" to "Let the object in Example 11.11 (redrawn above) be…".

Page 700 In **Problem 12.11**, change "A dissipative torque-free cylindrical satellite has…" to "The above dissipative torque-free cylindrical satellite has…".

Page 701 In **Problem 12.12**, change "For a nonprecessing, dual-spin satellite,…" to "For the above nonprecessing, dual-spin satellite,…".

Page 701 In **Problem 12.13**, change "For a rigid axisymmetric satellite,…" to "For the above rigid axisymmetric satellite,…".

Page 702 In the third line of **Problem 12.14**, change " 15 N s " to " 15 N·s ".

Page 702 In **Problem 12.16**, change

"The body-fixed *xyz* axes are principal axes of inertia passing through the center of mass of a 300-kg cylindrical satellite, which is spinning at 1 rev/s about the *z* axis. What impulsive torque…"

to

"The body-fixed *xyz* axes are principal axes of inertia passing through the center of mass of the 300-kg cylindrical satellite pictured above. It is spinning at 1 rev/s about the *z* axis. What impulsive torque…"

Page 702 Change the answer to **Problem 12.16** from " 6740 N m s " to " 6740 N·m·s ".

Page 703 In the answer to **Problem 12.19**, change " 0.00420 N m " to " 0.00420 N·m ".

Page 704 In the answer to **Problem 12.21**, change "(N m)" to "(N·m)".

Chapter 13

Page 715 In the second line down change

$$\mathbf{f} = \begin{bmatrix} \overbrace{\frac{T}{m} - \frac{D}{m} - g\sin\gamma}^{\dot{v}} & \overbrace{-\frac{1}{v}\left(g - \frac{v^2}{R_E + h}\right)\cos\gamma}^{\dot{\gamma}} & \overbrace{\frac{R_E}{R_E + h} v\cos\gamma}^{\dot{x}} & \overbrace{v\sin\gamma}^{\dot{h}} & \overbrace{-\frac{D}{m}}^{\dot{v}_D} & \overbrace{-g\sin\gamma}^{\dot{v}_G} \end{bmatrix}^T$$

to

$$\mathbf{f} = \begin{bmatrix} \overbrace{\frac{T}{m} - \frac{D}{m} - g\sin\gamma}^{\dot{v}} & \overbrace{-\frac{1}{v}\left(g - \frac{v^2}{R_E + h}\right)\cos\gamma}^{\dot{\gamma}} & \overbrace{\frac{R_E}{R_E + h} v\cos\gamma}^{\dot{x}} & \overbrace{v\sin\gamma}^{\dot{h}} & \overbrace{-\frac{D}{m}}^{\dot{v}_D} & \overbrace{-g\sin\gamma}^{\dot{v}_G} \end{bmatrix}^T$$

(*Put more space between the components.*)

Page 715 In the second of the boxed results, vertically align on the colon. That is, change

Due to drag: 0.298 km/s
Due to gravity: 1.410 km/s

to

Due to drag: 0.298 km/s
Due to gravity: 1.410 km/s

Page 716 In Eq. 13.30 change

$$\frac{\Delta_m}{m_0} = 1 - e^{-\Delta v/\left(I_{sp} g_0\right)} \tag{13.30}$$

to

$$\frac{\Delta m}{m_0} = 1 - e^{-\Delta v/\left(I_{sp} g_0\right)} \tag{13.30}$$

Page 726 In the second line after **13.5 Optimal Staging**, change "…structural ratio ε_{i_i} …" to "…structural ratio ε_i …".
