Chapter 2:
i) [First printing only] In tutorial 2.4, the solution for the critically damped case (starting at the bottom of page 33) solves for $\lambda_1, \lambda_2 = -\zeta \omega_0$. This is propagated through to the solution (Eq. (2.26)), which makes it appear as if $\zeta$ is a variable in the solution. This is misleading as $\zeta$ can only equal 1 in this case. The two equation should be rewritten without $\zeta$ (3 instances).

ii) [First printing only] In problem 2.16, the downward acceleration should be $g - \frac{c}{m} \dot{y}^2$.

Chapter 3:
i) [First printing only] In Section 3.4.1, the final equation on Page 68 defining the transformation matrix should be in terms of the scalar component magnitudes, not the unit vectors. That is, the elements of the two matrices should not be bold. It should thus read:

\[
\begin{bmatrix}
b_1 \\
b_2
\end{bmatrix}_B = \begin{bmatrix}
\cos \theta & \sin \theta \\
-\sin \theta & \cos \theta
\end{bmatrix}
\begin{bmatrix}
a_1 \\
a_2
\end{bmatrix}_A
\]

ii) [First printing only] In Section 3.8.4 on page 93 describing the vector Taylor series the vector (and components) were mistakenly written at $t + a$ rather than $t$. Thus, the sentence before Eq. (3.68), that equation, and the following two equations should be written:

First, write the vector \( r(t) \) as components in a frame \( \mathcal{A} = (O, a_1, a_2, a_3) \):

\[
r(t) = r_1(t)a_1 + r_2(t)a_2 + r_3(t)a_3.
\]

Then take the Taylor series of the scalar magnitude of each component. For \( i = 1, 2, 3 \), we have

\[
r_i(t) = r_i(a) + \frac{d}{dt} r_i \bigg|_{t=a} (t-a) + \frac{1}{2!} \frac{d^2}{dt^2} r_i \bigg|_{t=a} (t-a)^2 + \ldots
\]

Expanding and rearranging each coefficient in Eq. (3.68) yields

\[
r(t) = r_1(a)a_1 + r_2(a)a_2 + r_3(a)a_3
\]

\[
+ \frac{d}{dt} r_1 \bigg|_{t=a} (t-a)a_1 + \frac{d}{dt} r_2 \bigg|_{t=a} (t-a)a_2 + \frac{d}{dt} r_3 \bigg|_{t=a} (t-a)a_3
\]

\[
+ \frac{1}{2!} \frac{d^2}{dt^2} r_1 \bigg|_{t=a} (t-a)^2a_1 + \frac{1}{2!} \frac{d^2}{dt^2} r_2 \bigg|_{t=a} (t-a)^2a_2 + \frac{1}{2!} \frac{d^2}{dt^2} r_3 \bigg|_{t=a} (t-a)^2a_3
\]

\[
+ \ldots
\]

iii) In the caption of Figure 3.32 on page 97, the units of \( \mu \) should be m\(^{-1}\). (two times).
iv) [First printing only] In Problem 3.2, \( F_3 = (5 - 4\sqrt{6})e_y \) N.

v) [First printing only] Figure 3.45 is missing a downward gravity arrow labelled \( g \).

Chapter 4:

i) [First printing only] In Example 4.1 on pgs. 115-116, the expressions for \( x(t) \) and \( \dot{x}(t) \) should be written relative to the initial time \( t_2 \),

\[
x(t) = \frac{-F_P(t_1, t_2)}{m_P\omega_0} \sin [\omega_0(t - t_2)]
\]

\[
\dot{x}(t) = \frac{-F_P(t_1, t_2)}{m_P} \cos [\omega_0(t - t_2)]
\]

ii) [First printing only] On page 138, the first unnumbered equation should not have a minus sign.

iii) [First printing only] In Tutorial 4.3, the second-to-last line on page 140 should say “The magnitude of the specific angular impulse...” Also, the two moment expressions on page 141 should be divided by the satellite mass to correspond to the change in specific angular momentum, i.e., the left-hand-side of the two unnumbered equations should be \( ||\hat{M}_{A/O}(t_1, t_2)||/m_P \) and \( ||\hat{M}_{B/O}(t_1, t_2)||/m_P \), respectively.

iv) [First printing only] In Problem 4.11 on page 146, the feedback equation for the base motion should be for the acceleration \( \ddot{u} \) of the base and not \( \mu \), i.e., the equation should read

\[
\ddot{u} = -\frac{g \sin \theta + k \theta + b \dot{\theta}}{\cos \theta}
\]

Chapter 5:

i) [First printing only] Top of page 155 should not be gray box, up to the start of Example 5.3.

ii) [First printing only] On page 163, in Example 5.8, the middle unnumbered equation has a typo; the sign is wrong on the last term. It should read:

\[
Tb_1 - \mu_c Nb_1 + Nb_2 - m_P g \sin \theta b_1 - m_P g \cos \theta b_2 = 0
\]

iii) [First printing only] On page 183, in Figure 5.18, right side, the length of the string should be longer so that the height of the white particle is the same as the height of the black particle.
iv) [First printing only] On page 183, the ellipse in Figure 5.19 should be taller so that it only intersects the circle at point P, i.e., it completely encloses the circular orbit of radius \( \rho \).

v) [First printing only] In Problem 5.14, page 184, the value given for \( C \) in part (b) is actually the square root of the correct value. \( C \) should equal 0.33, not -0.58.

Chapter 6:

i) On page 193, the first line after Equation (6.7), the right-side of the inline equation should use \( F_{j,i} \) not \( F_{j,i} \).

ii) [First printing only] Equation 6.10 on page 193 should use \( F^{(\text{ext})}(t_1, t_2) \) instead of \( F^{(\text{ext})} \). The following line should read “where \( F^{(\text{ext})}(t_1, t_2) \) is the total external impulse acting on the system from \( t_1 \) to \( t_2 \).”

iii) [First printing only] The second line of Equation 6.23 on page 203 should be

\[
= -\frac{k(m_1 + m_2)}{m_1 m_2} \left( \| \mathbf{r}_{2/1} \| - l_0 \right) \mathbf{\hat{r}}_{2/1}.
\]

iv) [First printing only] Figure 6.14(b) on page 214 is incorrect. It should be altered as below.

![Figure 1 Corrected figure 6.14(b).](image)

v) [First printing only] On page 235, the unnumbered equation in the second bullet of the Key Ideas should use \( F^{(\text{ext})}(t_1, t_2) \) instead of \( F^{(\text{ext})} \). The following line should read “where \( F^{(\text{ext})}(t_1, t_2) \) is the total external impulse from \( t_1 \) to \( t_2 \).”
vi) [First printing only] In Problem 6.7 on p. 239, the lower summation index should be \(i\) not \(j\), so that it reads \(\sum_{i=1}^{N}\).

vii) [First printing only] In Problem 6.23 on p. 244, the value for the exhaust velocity should be 2.75 km/s, not 1 km/s.

viii) [First printing only] In Problem 6.24 on p. 244, the value for the spring rest length should be \(l_0 = 1\) m, and the damper constant should be \(b = 25\) N\(\cdot\)s/m. The second-to-last sentence should read “...in the rocket, starting with the spring at its rest length.”

ix) [First printing only] In Problem 6.25 on p. 244, the second and third sentences should read “Assume the model rocket weighs 2 kg and the fuel weighs 3 kg. Assume a mass flow rate of 0.1 kg/s and an exhaust velocity of 500 m/s.”

Chapter 7:

i) [First printing only] In Example 7.4 on p. 254 there is a typo in the third equation (definition of the angular momentum of the center of mass about the origin). The unnumbered equation reads “\(I_G/O = r_G \times \ldots\)” but should be “\(I_G/O = r_G/O \times \ldots\).”

ii) [First printing only] In Example 7.8 on p. 265 there is a typo in the expression for \(T_{G/O}\). The square should be on \(\dot{y}_G\) not outside the parenthesis, i.e.,

\[
T_{G/O} = \frac{1}{2} m_G \|\vec{v}_{G/O}\|^2 = \frac{1}{2} m_G (\dot{x}_G^2 + \dot{y}_G^2).
\]

iii) [First printing only] In Example 7.11 on p. 273, the unit vectors of the polar frame have been defined as \(e_r\) and \(e_\theta\) so the \(b_1\) and \(b_2\) are incorrect. The equations for \(r_{P/G}\) and \(\vec{\tau}v_{P/G}\) should be written

\[
\begin{align*}
r_{P/G} & = -\frac{r}{2} e_r \\
\vec{\tau}v_{P/G} & = -\frac{r}{2} e_r - \frac{r}{2} \dot{\theta} e_\theta.
\end{align*}
\]

Likewise, in the sentence that follows, the unit vector \(b_1\) should be replaced by \(e_r\).

iv) [First printing only] In Example 7.11 on p. 274, the final conditions in the last paragraph are not correct. The rotation rate at infinity should be \(\dot{\theta}(\infty) = 2h_G/r_0^2\). The expression for the nonconservative work should be

\[
W^{(\text{nc,int})} = \frac{mh_G^2}{r_0^2} - \frac{m}{4} \left(\dot{r}(0)^2 + \frac{4h_G^2}{r(0)^2}\right) - \frac{1}{2} k (r(0) - r_0).
\]
v) [First printing only] On p. 274, penultimate paragraph there should be a leading Eqs. before (7.11) and (7.12).

vi) [First printing only] On p. 275, Figure 7.10(b), the depiction of $\theta$ is not correct. It should be the angle measured counter-clockwise from the $e_1$ axis to the $e_r$ axis. The figure should be corrected as annotated here.

vii) [First printing only] On p. 277 the final equation for the angular momentum relative to the center of mass is incorrect. The correct equation is

$$\vec{I}_G = \frac{m_1m_2}{m_1 + m_2} r^2 \hat{\theta} e_3,$$

viii) [First printing only] On p. 277 in the description following the second unnumbered equation for $\vec{I}_G$, the specific angular momentum from Tutorial 4.2 should be $h_O$ rather than $h_P$.

ix) [First printing only] On p. 287, everywhere in the last bullet should use $E_O$ instead of $E$ (four times).

x) [First printing only] On p. 289, Problem 7.5, the last sentence before the hint should read “...when the baton falls, assuming it starts nearly upright.”

xi) [First printing only] On p. 290, Problem 7.7, the text of the problem should read “initial speed $v_0$” rather than “initial velocity $v_0$”. Also, in part (a), it should read “final speed $v_f$” rather than “final velocity $v_f$”. Part (b) is correct as written.
Chapter 8:

i) [First printing only] On p. 298, in Example 8.2, the equation at the bottom of the page should be

\[ \mathcal{I} \vec{v}_{O'/O} = -\omega_B \vec{e}_3 \times (-Re_2) = -R\omega_B \vec{e}_1 \]

Likewise, both of the \( \mathbf{b} \) unit vectors in the preceeding paragraph should be \( \mathbf{e} \) unit vectors.

ii) [First printing only] On p. 315, In the second equation, the velocity should be with respect to frame \( \mathcal{B} \) rather than \( \mathcal{I} \). The equation should thus be:

\[ \mathcal{B} \vec{a}_{P/L} = -\frac{f_1}{m_P} \dot{\vec{r}}_{P/L} - 2\omega_r \vec{b}_3 \times \mathcal{B} \vec{v}_{P/L} - \omega_r^2 \vec{b}_3 \times (\vec{b}_3 \times \vec{r}_{P/L}). \]

iii) Original Kindle Edition Only Problem 8.1(a), \( \mathcal{I} \vec{v}_{P/O'} \) should be \( \mathcal{I} \vec{v}_{P/O}. \)

iv) [First printing only] On p. 330, in Problem 8.3, the radius \( r_B \) from the problem statement is missing from Figure 8.24. It is the radius of the back gear, which has center \( O'' \).

v) [First printing only] p. 331, Problem 8.4, the problem does not constrain the initial orientation of the astronaut’s velocity vector with respect to the station’s velocity vector. To remove ambiguity, the problem should state that when the astronaut is at \( O' \) (when \( r = 0 \)), she starts moving in the same direction as \( \mathcal{I} \vec{v}_{O'/O} \).

vi) [First printing only] p. 331, Problem 8.7. Delete the word “massless” from the first line.

vii) [First printing only] p. 332, Problem 8.8, the first letters of itemized problem statements (a) and (b) should be capitalized.

viii) [First printing only] p. 333, Problem 8.10, the first line should read “Consider a disk of radius \( R = 1 \) m that is...”

Chapter 9:

i) On page 352, the second line should read, “its signed magnitude \( h_G \), which can be positive or negative depending on the sign of the angular velocity. We do so...”

ii) [First printing only] On p. 365, in the middle of the page, the phrase “...fixed, implying that \( \mathcal{I} \vec{a}_{P/O} = 0 \) in Eq. (9.30)” should read “...fixed. Although \( \mathcal{I} \vec{a}_{P/O} \neq 0 \), it is perpendicular to the ramp, implying \( \vec{r}_{Q/G} \times \mathcal{I} \vec{a}_{Q/O} = 0 \) in Eq. (9.30), where \( Q \) is replaced by \( P \) here.”
iii) [First printing only] On p. 384, the sentence before Eq. (9.61) should read “...two unknowns $\dot{\theta}$ and $I_\omega^B.$”

iv) [First printing only] On p. 389, all of the expressions for the moment about the center of mass, $M_G$, are missing the unit vector in the $b_3$ direction, which should appear at the end of each equation (4 times).

v) [First printing only] On p. 399, Problem 9.5. In figure, the distance $l$ should go to the center of the bar, not the edge. Also, the arrow on $\theta$ should be reversed.

vi) [First printing only] On p. 401, Problem 9.7, the area moment of inertia should be $J = a^4/12$.

vii) [First printing only] On p. 405, Problem 9.19 the equation of motion for the motor has an incorrect sign on the motor torque. It should read:

$$I_G\ddot{\theta} = -b\dot{\theta} + ki.$$

Also, in text for part (b) it should read “the inductance $L$ to 0.75 H” rather than “the inductance $h$ to 0.75 H”.

Chapter 10:

i) [First printing only] On p. 418, the second-to-last equation should start “$\ddot{\beta} - \dot{\theta}^2$...”

ii) [First printing only] On p. 422 the third unnumbered equation from the top should have $\sqrt{x^2 + y^2}$ in the denominator instead of $x^2 + y^2$ (two times).

iii) [First printing only] On p. 430, the paragraph following Eq. (10.37), in the second-to-last sentence, $C_{ij} = b_i \cdot e_j$ should be $\mathcal{I}C_{ij}^B = b_j \cdot e_i$

iv) [First printing only] On p. 439, in the first row of Eq. (10.50) and in the first of the following unnumbered set of three equations, csc $\theta$ should be sec $\theta$ (two times).

v) [First printing only] On p. 448, the second and third unnumbered equations, and the line between them, should read as follows:

$$\mathcal{I}C_{ij}^B = e_i \cdot b_j \quad i, j = 1, 2, 3.$$

Using the fact that $b_j = e_j$ prior to the rotation, we can substitute for $b_j$ from Eq. (10.60) to obtain

$$\mathcal{I}C_{ij}^B = e_i \cdot (e_j \cos \theta - (e_j \times k) \sin \theta + (e_j \cdot k) k(1 - \cos \theta)).$$
vi) [First printing only] On p. 448, the last unnumbered equation should read

\[ IC_{11}^B = \cos \theta + k_1^2(1 - \cos \theta) \]
\[ IC_{12}^B = -k_3 \sin \theta + k_1 k_2(1 - \cos \theta) \]
\[ IC_{13}^B = k_2 \sin \theta + k_1 k_3(1 - \cos \theta) \]
\[ IC_{21}^B = k_3 \sin \theta + k_1 k_2(1 - \cos \theta) \]
\[ IC_{22}^B = \cos \theta + k_2^2(1 - \cos \theta) \]
\[ IC_{23}^B = -k_1 \sin \theta + k_2 k_3(1 - \cos \theta) \]
\[ IC_{31}^B = -k_2 \sin \theta + k_3 k_1(1 - \cos \theta) \]
\[ IC_{32}^B = k_1 \sin \theta + k_2 k_3(1 - \cos \theta) \]
\[ IC_{33}^B = \cos \theta + k_3^2(1 - \cos \theta). \]

vii) [First printing only] On p. 449, Eqs. (10.63)–(10.66) should read

\[
\theta = 2\arccos \left( \sqrt{1 + \frac{I_{C_{11}}^B + I_{C_{22}}^B + I_{C_{33}}^B}{2}} \right)
\]
\[
k_1 = \frac{I_{C_{32}}^B - I_{C_{23}}^B}{2 \sin \theta}
\]
\[
k_2 = \frac{I_{C_{13}}^B - I_{C_{31}}^B}{2 \sin \theta}
\]
\[
k_3 = \frac{I_{C_{21}}^B - I_{C_{12}}^B}{2 \sin \theta}.
\]

viii) [First printing only] On p. 462, Problem 10.7, change “when it reaches the bottom of the funnel” to “when it reaches a height of \( h/2 \).” (Note that a solution exists only for sufficiently small \( s_0 \).)”

ix) [First printing only] On p. 463, Problem 10.12 is worded incorrectly. The proper wording is “…Sensors on the plane measure the position and velocity of the released vehicle relative to the C-130, \( \mathbf{r}_{P/O'} \) and \( \mathbf{v}_{P/O'} \). The C-130 telemeters…”

Chapter 11:

i) [First printing only] On p. 467, in the second-to-last sentence of Example 11.1, “Because \( m = p \int_B dV \)” should be “Because \( m = \rho \int_B dV \)”.

ii) [First printing only] On p. 471, the first equation at the top of the page has two sign errors. It should read:

\[ 0 = -2m_l l^2 \ddot{\theta} \dot{\phi} \cos \phi - m_p l^2 \ddot{\phi} \sin \phi + h \dot{\phi} \]
On p. 471, Eq. (11.5) has a sign error. It should read

\[ \ddot{\theta} + 2\dot{\theta}\dot{\phi} \cot \phi - \frac{h\dot{\phi}}{mpl^2 \sin \phi} = 0 \]

On p. 492, the first line after Eq. (11.43) should be "As long as \( \omega_n^2 > 0 \) . . . "

On p. 494, Eq. (11.45), \( \csc \theta \) should be \( \sec \theta \).

On p. 496, the unnumbered equation before (11.53) should have \( dm \) instead of \( i \) (four times).

On p. 501, Example 11.13, in the first line of the long equation at the bottom of the page, the leading \( I_2 \) in the second row of the first matrix should be deleted, so it reads \( \frac{d}{dt}(I_2 \dot{\psi} \sin \theta + h) \).

On p. 509, Example 11.16, first equation on page should be

\[ \mathbf{r}_{O/G_2} = -\frac{l_2}{2} \mathbf{c}_1 - l_1 \mathbf{b}_1 - \frac{h}{2} \mathbf{a}_1 \]

On page 516, in the first line below the two unnumbered equations below Equation (11.80), the first inline equation should be \( \omega_1(t_0) = -\omega_0 \).

On page 516, in Equation (11.81), the first term should be negative and the second term positive, so it reads

\[ T h_G = -I_O \omega_0 \cos \omega_n t \mathbf{b}_1 + I_O \omega_0 \sin \omega_n t \mathbf{b}_2 + J\dot{\omega}_3 \mathbf{b}_3 \]

On page 518, in the first line below the third unnumbered equation, the inline equation should be \( \dot{\psi} = h_G/I_O \).

On p. 529, in Problem 11.11, Figure 11.30, arrow on rotary pendulum for angle \( \dot{\psi} \) should point the other way.

On p. 531, in Problem 11.17, Figure 11.34 makes it look as if the cord is attached to an arbitrary point along the rod, whereas it should be attached at the end of the rod (point A).

On p. 533, in Problem 11.19, the value given for \( D \) is actually the value of \( D/I_T \), so that the problem should read "...\( D/I_T = 0.5 \)..."

Chapter 12:
i) **[First printing only]** On p. 540, in the first unnumbered equation, all of the “\(\cos \omega d t\)” terms should be replaced by “\(\cos(\omega d t)\)” (three times) and all of the “\(\sin \omega d t\)” terms should be replaced by “\(\sin(\omega d t)\)” (three times).

ii) **[First printing only]** On p. 540, in the second line of the second unnumbered equation, the “\(\cos 2\omega d t\)” term should be replaced by “\(\cos(2\omega d t)\)” and the “\(\sin \omega d t\)” term should be replaced by “\(\sin(2\omega d t)\)”.

iii) **[First printing only]** On p. 541, the last equation on p. 541 should be

\[
x(t) = \frac{g}{\omega_0^2} e^{-\zeta \omega_0 t} \left( \sqrt{\frac{2gl\omega_0^2 - g \zeta}{\omega_0^2 \sqrt{1 - \zeta^2}}} \sin(\omega_0 d t) - \frac{g}{\omega_0^2} \cos(\omega_0 d t) \right).
\]

iv) **[First printing only]** On p. 553, the first of the two unnumbered equations before Eq. (12.19) should be “\(\dot{y}_1 = y_2\)”.

v) **[First printing only]** On p. 558, the final unnumbered equation and the preceding sentence should be “...from the initial conditions \(y(0)\) and \(\dot{y}(0)\):

\[
y(0) = c_1 v_1 + c_2 v_2
\]

\[
\dot{y}(0) = \lambda_1 c_1 v_1 + \lambda_2 c_2 v_2.
\]

Chapter 13:

i) **[First printing only]** On p. 583, bottom of the page, boxed equation should read

\[
f_k(r_{1/O}, r_{2/O}, \ldots, r_{N/O}, t) = 0, \quad k = 1, \ldots, K.
\]

ii) **[First printing only]** On p. 591, the right side of the first unnumbered equation should be

\[
\sum_{i=1}^{N_C} \sum_{j=1}^{N} E_{j}^{(act)} \cdot \frac{T \partial r_{j/O}}{\partial q_i} \delta q_i \]

\[
\hat{Q}_i
\]

Appendix A:

i) **[First printing only]** On p. 625, the sentence following Definition A.2 should read “Figure A.2 shows examples of continuous functions with continuous and discontinuous derivatives.”
ii) [First printing only] On pgs. 628-630, Examples A.1, A.2, and A.3 should be in gray background like all other examples.

Appendix C:

i) [First printing only] On p. 647, Example C.1 should have gray background like all other examples.

ii) [First printing only] On p. 658, fifth line of text, “TSPAN” should be “TSPAN”.

iii) [First printing only] On p. 658, seven lines from the bottom, lowercase “l” should be uppercase “L” (two times).