Errata and Addenda for

Intermediate Engineering Dynamics: A Unified Treatment of Newton-Euler and Lagrangian Mechanics. Cambridge University Press (2008).

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I am grateful to Ming Gong, Daniel Kaneko, Narges Kaynia, Ali Lahijanian, Anirudh Narla, Marek Rudnicki, and Karla Vega for pointing out several typographical errors. The errors which are more difficult to see are colored in red.

page 43: $\dot{\Psi}_2 = \nabla\psi_2 \cdot \mathbf{v} + \frac{\partial \Psi_2}{\partial t} = 0.$ should read $\dot{\Psi}_2 = \nabla\Psi_2 \cdot \mathbf{v} + \frac{\partial \Psi_2}{\partial t} = 0.$

page 61: The expression for the normal vector $\mathbf{e}_n$ should read

$$\mathbf{e}_n = \frac{\text{sgn}\left(f''\right)}{\sqrt{1+f'^2}}\left(\mathbf{E}_2 - f'\,\mathbf{E}_1\right),$$

page 69: In Problem 2.7(i), replace "remain on the surface" with "remain on the outer surface".

page 82: In the unlabeled equation prior to Equation (3.13) $\Delta s = \int_{u_1}^{u_2} \sum_{i=1}^n \sum_{k=1}^n \tilde{a}_{ik} \frac{\partial q^i}{\partial u} \frac{\partial q^k}{\partial u} du$ should read $\Delta s = \int_{u_1}^{u_2} \sum_{i=1}^n \sum_{k=1}^n \sqrt{\tilde{a}_{ik} \frac{\partial q^i}{\partial u} \frac{\partial q^k}{\partial u}} du.$

page 82: In Equation (3.13) $\Delta s = \int_{t_1}^{t_2} \sum_{i=1}^n \sum_{k=1}^n \tilde{a}_{ik} \dot{q}^i \dot{q}^k dt$ should read $\Delta s = \int_{t_1}^{t_2} \sqrt{\sum_{i=1}^n \sum_{k=1}^n \tilde{a}_{ik} \dot{q}^i \dot{q}^k} dt$

page 83: In Equation (3.15) $ds = \sum_{i=1}^n \sum_{k=1}^n \tilde{a}_{ik} \dot{q}^i \dot{q}^k dt$ should read $ds = \sqrt{\sum_{i=1}^n \sum_{k=1}^n \tilde{a}_{ik} \dot{q}^i \dot{q}^k} dt$

page 84: $d^3(t)$ should read $d(t)$

page 98: The expression for $\mathbf{N}$ in Exercise 3.6 (d) should read

$$\mathbf{N} = \left(-\frac{2E_0}{R_0} + 3mg\cos(\phi)\right)\mathbf{e}_R.$$

page 105: At the end of the last equation on this page, the period should be replaced by a comma.

page 108: $q^{6-k} = \mathbf{r}_3 \cdot \mathbf{E}_k$ should read $q^{6+k} = \mathbf{r}_3 \cdot \mathbf{E}_k$

page 109: "when ψ is not an explict" should "when Ψ is not an explicit"

page 110: "rearranging" is misspelled in the line prior to (4.9).

page 111: In the expressions for $\mathbf{F}_{\text{con1}}$ and $\mathbf{F}_{\text{con2}}$ following (4.10) replace $\frac{K}{2}$ with K.

page 126: The row index in the matrix equation following (4.31) should read M instead of $3N$:

$$\begin{bmatrix} a_{1(M+1)} & a_{1(M+2)} & \cdots & a_{1(3N)} \\ a_{2(M+1)} & a_{2(M+2)} & \cdots & a_{2(3N)} \\ \vdots & \vdots & \ddots & \vdots \\ a_{M(M+1)} & a_{M(M+2)} & \cdots & a_{M(3N)} \end{bmatrix} = \begin{bmatrix} 0 & 0 & \cdots & 0 \\ 0 & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & 0 \end{bmatrix}.$$

page 127: In the expression for C_2 replace $mR\sin(\phi)\cos(\phi)\dot{\theta}^2$ with $mR^2\sin(\phi)\cos(\phi)\dot{\theta}^2$.

page 127: In (4.34) replace $\frac{m\sin(\phi)\cos(\phi)}{R}$ with $m\sin(\phi)\cos(\phi)$.

page 138: Replace "system for particles" with "system of particles"

page 139: Replace "nonintegrable" with "integrable" This change needs to be made in three places in the section at the bottom half of this page.

page 150: In the third of the equations of motion, the following correction is needed to the left-hand side: m_2 should replace m_1. That is,

$$\frac{d}{dt}\left(m_2\left(L_0-r_1\right)^2\dot{\phi}_2\right)-m_2\left(L_0-r_1\right)^2\dot{\theta}_2^2\sin\left(\phi_2\right)\cos\left(\phi_2\right)=m_2g\left(L_0-r_1\right)\sin\left(\phi_2\right),$$

page 151: In the two expressions for $\dot{E}$, m_2 should be replaced by m_1

page 165: In the first footnote, insert "the" following "found"

page 166: $\dot{\mathbf{t}}_k=\dot{\mathbf{R}}\mathbf{p}_k+\dot{\mathbf{R}}\cancelto{\mathbf{0}}{\dot{\mathbf{p}}_k}$ should read $\dot{\mathbf{t}}_k=\dot{\mathbf{R}}\mathbf{p}_k+\mathbf{R}\cancelto{\mathbf{0}}{\dot{\mathbf{p}}_k}$

page 169: Replace "It also" with "It is also"

page 186: Replace

$$\begin{bmatrix} g^{11} & g^{21} & g^{31} \\ g^{12} & g^{22} & g^{32} \\ g^{13} & g^{23} & g^{33} \end{bmatrix}\begin{bmatrix} -\sin(\theta) & \sin(\phi)\cos(\theta) & \cos(\phi)\cos(\theta) \\ 0 & \cos(\phi) & -\sin(\phi) \\ 1 & 0 & 0 \end{bmatrix}=\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

with

$$\begin{bmatrix} -\sin(\theta) & \sin(\phi)\cos(\theta) & \cos(\phi)\cos(\theta) \\ 0 & \cos(\phi) & -\sin(\phi) \\ 1 & 0 & 0 \end{bmatrix}\begin{bmatrix} g^{11} & g^{21} & g^{31} \\ g^{12} & g^{22} & g^{32} \\ g^{13} & g^{23} & g^{33} \end{bmatrix}=\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

page 191: insert ' following brothers: brothers'

page 192: In the first line of the Rodrigues vector section, remove ":" following vector.

page 196: In equation (6.40) $\mathbf{\Omega}^T$ should read $\mathbf{\Omega}^T_{\mathbf{R}}$

page 209: In the seventh line following (7.5) replace θ with ϕ. In equation (7.6) and the discussion following it on page 210, replace $\mathbf{Q}(t)$ with $\mathbf{Q}(t)\mathbf{Q}^T(t_0)$

page 210: In the footnote. replace "$\mathbf{s}$ is the zero eigenvalue of $(\mathbf{I}-\mathbf{Q}(t)(t_0))$ " with "$\mathbf{s}$ is in the null space of $\left(\mathbf{I}-\mathbf{Q}(t)\mathbf{Q}^T(t_0)\right)$".

page 225: Replace "$\boldsymbol{\omega}_0$ is the axial vector of $\dot{\mathbf{Q}}^T\mathbf{Q}$" with "$\boldsymbol{\omega}_0$ is the axial vector of $\mathbf{Q}^T\dot{\mathbf{Q}}$"

page 227: Remove erroneous "of" following "the point X" in Exercise 7.2 (d).

page 230: In Exercise 7.6(b), replace "an expression" with "expressions"

page 260: In the discussion of the work done by the moment $M\mathbf{E}_3$ should read "this moment does work equal to $-M\pi$." In the third footnote "(6.5)" should read "(6.51)"

page 266: In Exercise 8.5, replace "center of mass C" with "center of mass $\bar{X}$".

page 311: In the second footnote $\frac{\partial T}{\partial \tilde{\gamma}^i}$ should read $\frac{\partial T}{\partial \nu^i}$

page 314: At the top of this page, $\mathbf{0}\boldsymbol{\omega}$ should read $\mathbf{O}\boldsymbol{\omega}$

page 325: In equation (10.25), $\mathbf{J}_O$ should read $\mathbf{J}_0$

page 327: In equation (10.31), $\dot{u}^2\mathbf{E}_1$ should read $\dot{u}^2\mathbf{E}_2$

page 329: Two terms are missing from the left-hand side of equation $(10.35)_4$. The corrected equation is

$$\left(\lambda + mR^2\cos^2(\theta)\right)\ddot{\theta} - mR^2\cos(\theta)\sin(\theta)\dot{\theta}^2 + \lambda_3\left(\dot{\phi} + \dot{\psi}\cos(\theta)\right)\dot{\psi}\sin(\theta) - \lambda\dot{\psi}^2\sin(\theta)\cos(\theta) = \Phi_4,$$

page 330: On the last line of this page, $\mathbf{M}_c = -R\mathbf{e}_1' \times \mathbf{F}_c$ should read $\mathbf{M}_c = -R\mathbf{e}_2' \times \mathbf{F}_c$

page 332: In the equation halfway down the page, $\mathbf{x}_0$ should read $\mathbf{x}_O$

page 334: In the expression for U, u^3 should read u^6

page 335: In the final equations on this page, the correct expression for $\tilde{T}$ for the Poisson top is

$$\begin{aligned}\tilde{T} &= \frac{\lambda_t}{2}\omega_1^2 + \frac{\lambda_t}{2}\omega_2^2 + \frac{\lambda_a}{2}\omega_3^2 \\ &\quad + \frac{m}{2}\left(\left(\boldsymbol{\omega} \times \sum_{k=1}^{3} L_k\mathbf{e}_k\right)\cdot\mathbf{E}_3\right)^2 + \frac{m}{2}\left(\dot{x}_1^2 + \dot{x}_2^2\right),\end{aligned}$$

and $\tilde{U} = U =$ should read $\tilde{U} =$

page 336: In Exercise 10.1, replace "center of mass C" with "center of mass $\bar{X}$".

page 338: In equation (10.47), $\tilde{U} = mgL_0\cos(\theta)$ should read $\tilde{U} = -mgL_0\cos(\theta)$

page 339: In the first equation of Problem 10.3, $\mathbf{J}_O =$ should read $\mathbf{J}_0 =$

page 363: The definition of the Kronecker delta should read

$$\delta_{ij} = \begin{cases} 1 & i = j, \\ 0 & i \neq j. \end{cases}$$

page 366: "this representation" should read "the representation"

page 384: In reference 160 replace "potential energies" with "potentials,"