

Errata (June 2019)

PLANAR MULTIBODY DYNAMICS

Formulation, Programming with MATLAB, and Applications; Second Edition

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During the preparation of this textbook, a great deal of attention was paid to minimize the number of errors that normally occur either in the preparation phase or in the publication phase of a book. Despite that effort, some errors in the manuscript were not detected, as well as other errors that appeared during the publication phase. As such errors become known, they will be reported in this document. This document will be updated on a regular basis as new errors are found.

A note to the reader: If you come across any errors, please inform the author by sending an email to pen@email.arizona.edu. Thank you!

Chapter 1

- Page 4, line 5 following figure: “ ... 1.4 rad/s ” should be corrected to “ ... 0.4 rad/s² ”
- Page 5, line 1: change Eq. (1.1) to Eq. (1.2)

Chapter 2

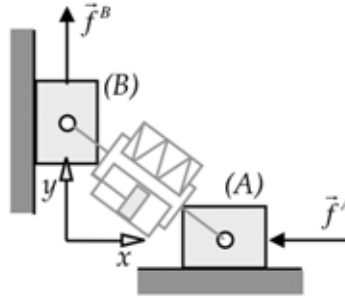
- Page 22, line 6: change “ a_{ij} is the ij th element of its transpose \mathbf{A}' ” to “ a_{ij} is the j th element of its transpose \mathbf{A}' ”
- Page 23, MATLAB results following Eq. (2.28), right panel: the top “M” should be lower-case “m”
- Page 25, 1st line of text: change $m \times P$ to $m \times p$
- Page 25, 2nd line of text: change $\boldsymbol{\alpha}' = \left\{ \alpha_1 \quad \alpha_2 \quad \alpha_m \right\} \neq \mathbf{0}$ to
$$\boldsymbol{\alpha}' = \left\{ \alpha_1 \quad \alpha_2 \quad \cdots \quad \alpha_m \right\} \neq \mathbf{0}$$
- Page 28; line before Eq. (2.57): change “The second time derivative ...” to “The time derivative ...”

Chapter 3

- Page 43, 2nd line of Sec. 3.2.2: change $\dot{\phi}_i$ to $\dot{\phi}$

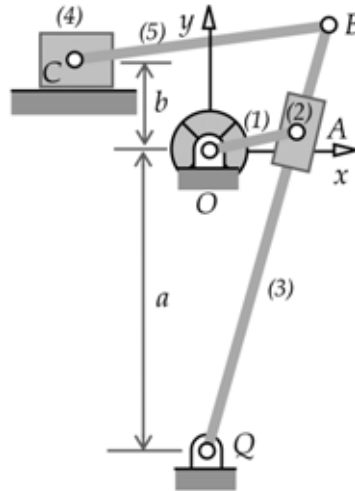
Chapter 4

- Page 67, last line: correct Eq. (4.19) from $n^O = \tilde{\mathbf{s}}'^{C,O} \mathbf{f}^P$ to $n^O = \tilde{\mathbf{s}}'^{P,O} \mathbf{f}^P$
- Page 84, last line: remove “L” from $x^B = 0.33 \text{ mL}$
- Page 85, last line in Problem 4.4: remove “L” from $y^B = 3 \text{ mL}$
- Page 85, figure in Problem 4.4: move the reference frame x - y to the position shown

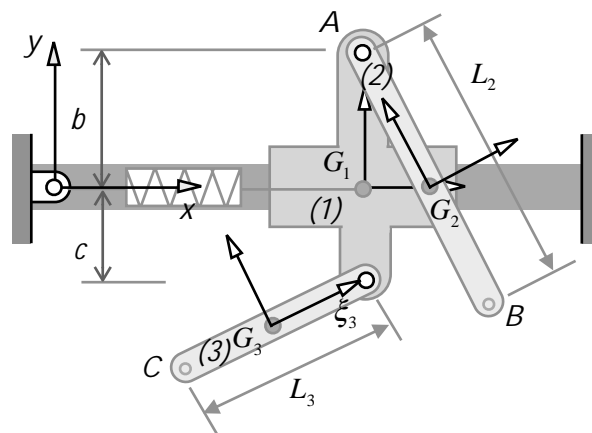


Chapter 5

- Page 92, Figure 5.4: in several of the figures, θ does not show properly
- Page 92, Figure 5.4: The character Sigma should be removed from the description
- Page 104, Figure 5.13: θ 's do not show properly
- Page 105, Figure 5.14(a): the labels a and b should be interchanged as shown



- Page 105, Figure 5.14(c): θ 's do not show properly
- Page 107, Figure 5.15(b): θ_5 does not show properly
- Page 109, figure (c): the x - y axes should be relocated as shown

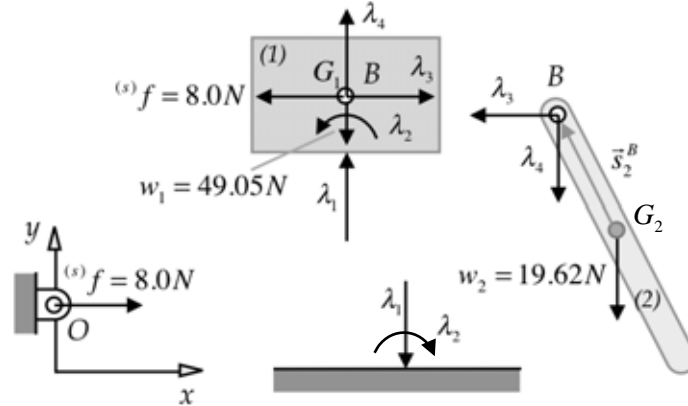


- Page 110, Problem 5.3, second line of data: remove “rad” at the end of the line
- Page 110, Problem 5.4, second line of data, change “ $\theta_2 = 285^\circ$ ” to $\theta_2 = 315^\circ$

- Page 110, Problem 5.4, second line of data: remove “rad” at the end of the line
- Page 110, Problem 5.4, third line of data: change “ $\theta_3 = 50^\circ$ rad/s” to “ $\dot{\theta}_3 = -0.3$ rad/s”

Chapter 6

- Page 113, last line of data: change “20 N sx/m” to “20 N s/m”
- Page 119, Figure 6.6: position of x - y frame should be corrected, x -axis should be at the ground level



- Page 122, third line from the bottom: adjust the size of $^{(a)}T$ (T is not the subscript of (a) ; (a) is the left superscript of T)
- Page 124, middle of the page: $\lambda_{1,2} = \begin{Bmatrix} \lambda_1 \\ \lambda_2 \end{Bmatrix}$ is repeated twice; remove one of them
- Page 131, figure (c) at the bottom of the page: the x - y axes should be relocated (same as on Page 109)
- Page 132, line 4: Insert the following before “In the configuration ...”: “Assume initial position of body (1) to be ${}^0x_1 = 0.07$ m.”
- Page 132, middle of the page: change “ $k = \text{L/m}$ ” to “ $k = \text{N/m}$ ”

Chapter 7

- Page 161, Problem 7.2, first line, remove “s” from “Vectors \vec{a} ...”
- Page 162, Problem 7.3, include $\phi_2 = 135^\circ$ to the data
- Page 168, Problem 7.27, first line following data: change “Assume the deformed length of the spring to be ${}^0L = 0.07$ m” to “Assume initial position of body (1) to be ${}^0x_1 = 0.07$ m”
- Page 168, figure (c) at the bottom of the page: the x - y axes should be relocated, same as on Page 109

Chapter 8

- Page 177, line 4 from the bottom: change “... and (0) respectively” to “... and (1) respectively”
- Page 182, in the middle of the page: correct $\text{N/m}^{-0.5}$ to $\text{N/m}^{1.5}$

Chapter 9

- Page 188, following Figure 9.4: replace the four stated equations with $\mathbf{r}_{i,j} = \mathbf{r}_i - \mathbf{r}_j$
- Page 196, 2nd line of the *Solution*: replace $\theta = \phi_3$ with $\theta_3 = \phi_3$

- Page 206, following the line “For the cut-joint, we can write ...”, correct the 5th entry of the matrix to $-\mathbf{I}$; i.e., ${}^*\mathbf{D} = \left[\begin{array}{cc|c|c} \mathbf{0} & \mathbf{0} & \mathbf{I} & \frac{L_2}{2}\tilde{\mathbf{u}}_2 \\ \hline & & & -\mathbf{I} \end{array} \right]$
- Page 223, Problem 9.1, first line of data, change “ ${}^{def}L = 0.07 \text{ m}$ ” to “ ${}^0x_1 = 0.07 \text{ m}$ ”
- Page 223, Problem 9.2, first line of data, change “ ${}^{def}L = 0.07 \text{ m}$ ” to “ ${}^0x_1 = 0.07 \text{ m}$ ”
- Page 223, Problem 9.3, first line of data, change “ ${}^{def}L = 0.07 \text{ m}$ ” to “ ${}^0x_1 = 0.07 \text{ m}$ ”
- Page 223, Problem 9.3, figure: the x-y axes should be relocated as on Page 109
- Page 225, Problem 9.10, line 1: change $a = 0.14$ to $L_0 = 0.14$
- Page 225, Problem 9.10, line 4: change “ ..., the matrix, ” to “..., the Jacobian matrix, ”

Chapter 10

- Page 241, third equation: replace -3^2 with -3.0^2

Chapter 11

- Page 264, Eq. (11.12): correct the equation to $\Delta \dot{\mathbf{r}}^i = {}^{(+)}\dot{\mathbf{r}}^i - {}^{(-)}\dot{\mathbf{r}}^i$, $\Delta \dot{\mathbf{r}}^j = {}^{(+)}\dot{\mathbf{r}}^j - {}^{(-)}\dot{\mathbf{r}}^j$
- Page 265, 2nd line following Eq. (11.14): in both integrals, zero should be in bold-face
- Page 267, line 4 of the text: “... a discontinue change” should be corrected to “... a discontinuous change”.
- Page 267: correct Eq. (11.20) to $\mathbf{u}' (\Delta \dot{\mathbf{r}}_i^P - \Delta \dot{\mathbf{r}}_j^P) = -(e+1)\mathbf{u}' {}^{(-)}\mathbf{v}_{i,j}^P$
- Page 273: correct Eq. (11.30) to

$$\left[\begin{array}{cc} \mathbf{M} & -\mathbf{D}'_{i,j}(\mathbf{u} + \mu \tilde{\mathbf{u}}) \\ (\mathbf{u} + \mu \tilde{\mathbf{u}})' \mathbf{D}_{i,j} & \mathbf{0} \end{array} \right] \left\{ \begin{array}{c} \Delta \dot{\mathbf{c}} \\ \pi \end{array} \right\} = \left\{ \begin{array}{c} \mathbf{0} \\ -((1+e)\mathbf{u} + \mu(1-e)\tilde{\mathbf{u}})' \mathbf{D}_{i,j} {}^{(-)}\dot{\mathbf{c}} \end{array} \right\}$$

- Page 278, in Eqs. (11.36) and (11.37): correct $h_i = \frac{1-v_k^2}{\pi E_k}$ to $h_k = \frac{1-v_k^2}{\pi E_k}$
- Page 279, 2nd line in the shaded box: correct $0 < e < 1.0$ to $0 \leq e \leq 1.0$
- Page 280, line 6 of Example 11.6: correct $\text{N/m}^{-0.5}$ to $\text{N/m}^{1.5}$
- Page 280, results should be corrected:

... for $e = 0.15$:

$$\text{Eq. (11.42): } f_N = \dots = 4.05 \times 10^6 \text{ N}$$

$$\text{Eq. (11.43): } f_N = \dots = 1.42 \times 10^7 \text{ N}$$

For $e = 0.95$ we have:

$$\text{Eq. (11.42): } f_N = 3.25 \times 10^6 \text{ N}$$

$$\text{Eq. (11.43): } f_N = 3.26 \times 10^6 \text{ N}$$

Chapter 12

- Page 307, Problem 12.3, line 5: change “tad/s” to “rad/s”

Chapter 13

- Page 315, second line of *Solution*: change `Ex_9_3` to `Example_9_3`
- Page 328, last line: change “stiff” to “stiffness”
- Page 334, Example 13.9, line 4: “... coefficient of restitution ...” should be “... coefficient of restitution ...”
- Page 339; two lines before Eq. (13.56): correct the equation to

$$\mathbf{M}({}^{(+)}\dot{\mathbf{c}} - {}^{(-)}\dot{\mathbf{c}}) - \mathbf{D}'({}^{(+)}\boldsymbol{\sigma} - {}^{(-)}\boldsymbol{\sigma}) - \mathbf{D}'_{new}({}^{(+)}\boldsymbol{\sigma}_{new} - {}^{(-)}\boldsymbol{\sigma}_{new}) = \mathbf{0}$$

- Page 346, first line: change “ $m_1 = 2 \text{ kg}$ ” to “ $m_2 = 2 \text{ kg}$ ”.
- Page 347, Problem 13.19, last line: correct $J = 0.004$ to $J_1 = 0.004$; also add $J_2 = 0.01 \text{ kg.m}^2$ and $e = 0.8$

Chapter 14

- Page 352, line 8 from the bottom, change “Ex_14_2_eqm” to “Ex_14_2”
- Page 357, Eq. (14.10) and in the following 2 lines: v_{ij} should be corrected to $v_{i,j}$
- Page 357, Eq. (14.11) and in the following lines 3 and 4: ${}^s\mu$ should be corrected to μ_s
- Page 358, line 6 of the *Solution*: “Ex_14_3 and Ex_14_4” should be corrected to “Ex_14_3_a and Ex_14_3_a”
- Page 359, 1st line following Figure 14.8: correct $|v_{ij}| \geq v_t$ to $|v_{i,j}| \geq v_t$
- Page 360, line 6 of the program: correct “if abs(v_ij) > v_t” to
“if abs(v_i,j) >= v_t”
- Page 362, Problem 14.3, line 4: change $k = 100 \text{ N/m}$ to $k = 35 \text{ N/m}$
- Page 362, figure (c) at the bottom of the page: the x - y axes should be relocated (same as on Page 109)
- Page 363, Problem 14.7, line 3: revise the coordinate values and include values for the angles

$$\mathbf{r}_1 = \begin{Bmatrix} 0.06 \\ 0.01 \end{Bmatrix}, \phi_1 = 0, \mathbf{r}_2 = \begin{Bmatrix} 0.07 \\ 0.015 \end{Bmatrix}, \phi_2 = \frac{\pi}{4}, \mathbf{r}_3 = \begin{Bmatrix} 0.06 \\ -0.03 \end{Bmatrix}, \phi_3 = -\frac{\pi}{4}$$

Chapter 15

- Page 369, Figure 15.4(b), for link (3), change C to B

Appendix A

Appendix B

Appendix C