Mechanical and Structural Vibration: Theory and Applications

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Errata to the First Printing: 17 August 2001

Pg. 15, second line: ...and $L_2 + x_2 - x_1$, respectively, ...

Pg. 15, 2nd eq. and eq. (1.4.6): darken overdots above Δ for damping terms.

Pg. 16, eq. (1.4.8): insert overdots in damping term:

$$\ldots \begin{bmatrix} (c_1 + c_2) & -c_2 \\ -c_2 & c_2 \end{bmatrix} \begin{Bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{Bmatrix} + \ldots$$

Pg. 41, 6th line following figure: $\Delta_3 = \ldots = y\ldots$

Pg. 41, 2nd equation: $V_{\text{sp}} = \ldots + \frac{1}{2}k_3\,(y)^2$

Pg. 41, 3rd equation from bottom: $V = \frac{1}{2}(K_{11}x^2 + \cdots$

Pg. 45, 3 lines from bottom: ... express $\mathcal{P}_{\text{dis}}$ in terms ...

Pg. 51, 2nd and 3rd equations: delete all overdots in expressions for $\Delta\bar{r}_D$ and $\Delta\bar{r}_E$

Pg. 51, 3rd equation from bottom: Result should be $\mathcal{P}_{\text{in}} = 0.866LF_1\dot{\theta}$

Pg. 52, 2nd figure: the downward force on the small gear is $k\Delta_2 + \mu\dot{\Delta}_2$

Pg. 54, equation at top of page: insert overdots in damping term:

$$\ldots [C] \begin{Bmatrix} \dot{\psi} \\ \dot{\theta} \end{Bmatrix} + \ldots$$

Pg. 61, Exercise 1.47, third line: ...spring stiffness k_1.and ...

Pg. 61, Figure for Exercise 1.47: distance from pivot to force point is $2L/3$.

Pg. 67, eq. (2.1.45), 2nd equation: change + to −, i.e.

$$\ldots \sin(\omega t) = \frac{1}{2i}\left[\exp(\ i\omega t) - \exp(-\ i\omega t)\right]$$

Pg. 67, eq. (2.1.6), 2nd equation: insert parentheses around $i\omega t$ in both exponentials

Pg. 69, 3rd equation: $A = \ldots = 4.605 + 1.947i$

Pg. 69, 11 lines from bottom: ...we write $abs\,(z)$, while ...

Pg. 70, eq. (2.1.3): Change sign preceding ϕ_2 to a plus: $\ldots +\ A_2 \cos(\omega t + \phi_2)$

Pg. 70, eq. (2.1.4): Insert a minus sign before $i\phi_1$ in both lines, i.e. $\dfrac{A_1}{i}\exp(-i\phi_1)$

Pg. 98, 3rd equation: ...$\Longrightarrow n > \dfrac{x_0 - 4.905\,(10^{-5})}{4\Delta}$...

Pg. 109, eq. (2.3.20): $g(t-\tau) = \lim\limits_{T\to 0}$....

Pg. 110, 4th line from bottom: ...the force, $|F|/k \equiv$ ...

Pg. 111, Figure 2.19: the heading for the left graph should be $\zeta = 0.05$

Pg. 112, Exercise 2.5, Part (b), 2nd line from bottom: ... Write the complex amplitude in ...

Pg. 113, 2nd and 3rd lines of Exercise 2.14: Delete dots above Δ

Pg. 116, Exercise 2.31, 2nd line following Item 3: ... frequency ω_{nat}, the ratio ...

Pg. 117, figure for Exercise 2.35: delete subscript 1 from label for displacement arrow

Pg. 119, 4th line in Exercise 2.63: time $\omega_{\text{nat}}t$ over ...

Pg. 123, Figure 3.2, lower "0" label for vertical axis to the bottom left corner

Pg. 126, 5th line in Example 3.2, insert: $L = 2$ m. It may be assumed that the wheel remains in contact with the ground. (See Exercise 3.36)

Pg. 129, last equation: ...$\left[\hat{F}\exp(i\Omega t) + \hat{F}^*\exp(-i\Omega t)\right]$

Pg. 134, 2nd line following figure: ...The two curves intersect the ...

Pg. 143, first graph: right label should be 200

Pg. 144, Figure 3.11: labels for spring and dashpot should be capitalized

Pg. 144, eq. (3.4.1): ...$-m\omega^2\bar{r}_{G/O}$

Pg. 145, eq. (3.4.2): ...$-\bar{F}\cdot\bar{j} - Kq - C\dot{q} = M\ddot{q}$

Pg. 149, 5th equation: $y = \left\{...e^{i\Omega t}\right\}$

Pg. 151, 7th equation: $V = ... = \dfrac{1}{2}k\theta^2 \quad \Longrightarrow$

Pg. 151, 2nd line after equation for V : $2a\dot{\theta}$, which (i.e. insert overdot)

Pg. 156, 2nd equation: ...$\hat{F}_n^*\exp(-in\omega_1 t)$

Pg. 160, 4th line from bottom of page: and $G_{(-N/2+1)}$ to $G_{N/2}$ are ...

Pg. 161, eq. (3.7.25), 1st line: ...$k = -\dfrac{N}{2} + 1,\ -\dfrac{N}{2} + 2, ..., \dfrac{N}{2}$

Pg. 178, 3rd paragraph, 2nd line: ... is well below the accelerometer's natural ...

Pg. 178, eq. (3.7.57), 2nd line:

$$U_n = \frac{K + in\omega_1 C}{K + in\omega_1 C - n^2\omega_1^2 M} Z_n \equiv \frac{1 + 2inr_1\zeta}{1 + 2inr_1\zeta - n^2 r_1^2} Z_n$$

Pg. 180, 2nd set of figures, heading for the left graph should be $\omega_{\text{nat}}T = 40\pi$

Pg. 183, eq. (3.8.9) and 4 lines before : subscript in τ_{d} should be roman type.

Pg. 202, last line: Figure 3.26, as ...

Pg. 214, Exercise 3.42:

$$z(x) = \begin{cases} h\left(1 - x^2/w^2\right) \ \mathit{if} \ |x| \le w \\ 0 \ \mathit{if} \ w \le |x| < L/2 \\ z(x \pm L) \ \mathit{if} \ |x| > L/2 \end{cases}$$

Pg. 215, 2 lines before Exercise 3.45: ...90% of the highest critical

Pg. 224, eq. (4.2.4): $|[K] - \omega^2 [M]| = 0$

Pg. 225, eq. (4.2.7): lower left element of rectangular matrix should be

$$\left(K_{(N-1)1} - \omega_j^2 M_{(N-1)1}\right)$$

Pg. 226, eq. (4.2.8), 1st line: last element of column matrix is ϕ_{Nj}

Pg. 230, 5th line after figure: ...Because θ is the pitch ...

Pg. 235, 2nd equation: lower left element of matrix should be $-1.8\left(10^{-5}\right)$

Pg. 239, 2nd equation: $... + 3Nx_N = 0$

Pg. 240, 1st line: $j = 1 : N;\ phi\_norm(:,j) = phi\_sort(:,j)/sqrt(mu(j,j));\ end.$

Pg. 248, eq. (4.2.49), 2nd line...$+\alpha_{22}\left\{\phi'_{j+1}\right\}^{\mathrm{T}}[M]\left\{\phi'_{j+1}\right\} = 0$

Pg. 248, eq. (4.2.50), second line:

$$\alpha_{22} = -\frac{\left\{\phi'_{j+1}\right\}^{\mathrm{T}}[M]\left\{\phi_{j+2}\right\}}{\left\{\phi'_{j+1}\right\}^{\mathrm{T}}[M]\left\{\phi'_{j+1}\right\}}$$

Pg. 250, last equation:

$$\phi^{<k>} := \phi^{<k>} - \frac{\left(\phi^{<k-1>^{\mathrm{T}}} * M * \phi^{<k>}\right)_{1,1}}{\left(\phi^{<k-1>^{\mathrm{T}}} * M * \phi^{<k-1>}\right)_{1,1}} * \phi^{<k-1>}$$

Pg. 255, first equation: $\bar{v}_{2m} = \dot{q}_1\bar{\imath},\ ...$

Pg. 256, 5th line of equations: $-m(\cos\theta)\,\omega_n^2 + \left(k - m\omega_n^2\right)\phi_{2n} = ...$

Pg. 267, 2nd text line: ..$[M]$ is $\kappa_G = L/\sqrt{8}$

Pg. 272, 6th line of Exercise 4.10: $... = \dot{x}_2 = 0$ at $t = 0$...

Pg. 284, Exercise 4.5, 7th line: and (b) $m_1 = 5$ kg, $m_2 = ...$ (Then delete the following sentence)

Pg. 286, Exercise 4.12, part (d) $[K] = ...$N/m, $\omega_2 = ...$

Pg. 286, Exercise 4.12, part (d), list line: Determine the *normal* mode $\{\Phi_2\}$.

Pg. 286, Exercise 4.13, 2nd line of 4th item: described above is ...

Pg. 287, Exercise 4.20, equation: $w = ...$

Pg. 287, Exercise 4.21, last line: and normal modes of this system.

Pg. 291, Exercise 4.47, one line before end: $q_n = \text{Re}\left[Y_n \exp\left(i20t\right)\right]$ and ...

Pg. 298, eq. (5.2.2): $\left[G\left(\omega\right)\right] = \left[\left[K\right]\left(1 + i\gamma\right) - \omega^2\left[M\right]\right]^{-1}$

Pg. 309, equation: $V = \frac{1}{2}k_0 y_6^2 + ...$

Pg. 314, 7 lines before eq. (5.4.9). Insert: , $Q_j\left(k\Delta\right) = \beta_j f\left(k\Delta\right),\ k = 0, 1, ..., K - 1$. Simultaneously, ...

Pg. 314, eq. (5.4.9), 2nd line: $m = 0, 1, ...,\ K/2$

Pg. 319, Exercise 5.12, 9th line: ...cases, $\gamma = 0.001$ and $\gamma = 0.01$. ...

Pg. 322, Exercise 5.23, part(b), last line: ...platform at a designated ...

Pg. 322, Exercise 5.23, part (c)7th line. Insert: ...part(b) corresponding to 20 Hz. Use...

Pg. 325, 2nd paragraph, 3rd line: .. work of the Swiss mathematician....

Pg. 328, eq. (6.1.7), change superscript:

$$\mathcal{P}_{\text{dis}} = \int_0^L \gamma EA\left(\frac{\partial \dot{u}}{\partial x}\right)^2 dx + \sum c\,\dot{u}\left(x_c, t\right)^2$$

Pg. 339, eq. (6.1.27): $\theta = ...$

Pg. 340, 2nd line: $\left[K\right]\left\{q\right\} = \left\{Q\right\}$. (i.e. delete repeated terms)

Pg. 344, eq. (6.1.37): ...

$$... = K_{nj} = \int_0^L EI\frac{d^2\psi_j}{dx^2}\frac{d^2\psi_n}{dx^2}\,dx + ...$$
$$... = C_{nj} = \int_0^L \left[\gamma EI\frac{d^2\psi_j}{dx^2}\frac{d^2\psi_n}{dx^2} + c_v\psi_j\psi_n\right] dx + ...$$

Pg. 349, 4 th line of Matlab commands: $...*psi(n)*H,\ y,\ 0,\ 1)$

Pg. 409, Exercise 6.17, 7th, 8th, and 9th lines: where ω is 95% and 105% of the fundamental and second natural frequencies, plot the

Pg. 409, Exercise 6.19, insert at end of last sentence: ...at midspan as a function of ω.

Pg. 410, Exercise 6.27, last line: $k = 2000EI/L^3$.

Pg. 413, Exercise 6.56, reword 1st sentence: When a cantilerbeam is modeled by a certain Ritz series, the inertia ...

Pg. 440, first figure: change + to 4 in vertical axis.

Pg. 444, 2nd equation: $\left(\psi_j\left(x\right)\right)_{\text{asymptotic}} = ...$ Also, insert close brace at end of equation.

Pg. 445, 2nd line of text: ... by letting $1/\cosh(\alpha) = 0$. This...

Pg. 445, 4th line of equation for B_4 :

$$= C_1 \lim_{\alpha_j \to \infty} \{2[\sin(\alpha_j) - ....\}$$

Pg. 449, line following equation for ψ : where $\alpha^4 = \rho A L^4 \omega^2 / EI$

Pg. 453, Figure 7.12: Spring force on the right mass should be $k\ w|_{x=L}$

Pg. 455, 2 lines before eq. (7.6.26): ... are not inertially coupled. Interestingly...

Pg. 464, 4th equation, 2nd line: insert close brace at end of equation

Pg. 481, 4th line of equations: $\exp(-kL) = 1/\varepsilon_1,\ \ \exp(-0.8kL) = 1/\varepsilon_2$

Pg. 494, eq. (7.9.40), 2nd line:

$$= \frac{1}{2} \sum_j \sum_n \left[\int_0^L (\rho A \Psi_{wj} \Psi_{wn} + \rho I \Psi_{wj} \Psi_{wn})\, dx \right] \dot{\eta}_j \dot{\eta}_n$$

Pg. 495, 10 lines before end of Example 7.14: ... function of α, L_d, and σ

Pg. 496, 1st line: cross-section rotation χ at this frequency....

Pg. 501, Exercises 7.25 and 7.26, insert at beginning of second sentence: Use Appendix C to decompose ...

Pg. 501, Exercise 7.29, 2nd line: Example 7.5 and Exercise 7.12. What...

Pg. 501, Exercise 7.33, change second sentence to: A torque $\Gamma h(t)$ is applied at the midpoint.

Pg. 503, Exercise 7.52, last line: range $0 < \omega < 2000$ rad/s

Pg 513, equation for $[K^e]$: The denominators for $K^e_{2,6}$, $K^e_{3,5}$, $K^e_{5,3}$, and $K^e_{6,2}$ should be L^2.

Pg. 520, 1st line: Once we have formed $\left[\hat{M}\right]$, $\left[\hat{K}\right]$, and $\left\{\hat{Q}\right\}$, we ...

Pg. 529, Exercise 8.6, 7th line: ...Derive linear interpolating functions ... Also, delete parenthetical last sentence.

Pg. 530, Exercise 5.16, 3rd line: ...Use a single finite element for bar BD,

Pg. 539, 2nd line of equations: $a_{2(j+3N)} = 1$,

Pg. 541, 3rd line of equation for V^1 : index in first summation sign should be j

Pg. 544, eq. (9.1.31), 2nd line: $= [B]^{\mathrm{T}} \{Q\} + [B]^{\mathrm{T}} [a]^{\mathrm{T}} \{\lambda\}$

Pg. 546: 3rd line of equations: $M_{jn} = \frac{1}{2} \rho A L \delta_{jn}$

Pg. 546: equation for V, 2nd line: delete exponent two for q_j term

Pg. 546: equation for V, 3rd line: delete exponent 2 and x from second factor

Pg. 546: equation for V, 4th line: $K_{jn} = j^4 \dfrac{\pi^4 EI}{2L^3} \delta_{jn} + ...$

Pg. 556, 2nd equation: $\psi_{wj}^{F\ell} = C_j^\ell \psi \left(\frac{x}{L_\ell}, \alpha_j \right)$

Pg. 558, eq. (9.2.3):

$$\left[K^\ell\right] = \begin{bmatrix} \left[K^\ell\right]^{FF} & \left[K^\ell\right]^{FC} \\ \left[K^\ell\right]^{CF} & \left[K^\ell\right]^{CC} \end{bmatrix}$$

Pg. 558, eq. (9.2.4), insert: $\left[K^\ell\right]^{CF} = \left[\left[K^\ell\right]^{FC}\right]^{\mathrm{T}}$

Pg. 558, 1st sentence after eq. (9.2.4) should be: In the special case where the fixed-interface modes are those of a bar that is immobilized at both ends, the off-diagonal partitions of $\left[K^\ell\right]$ are identically zero.

Pg. 558, last sentence of paragraph following eq. (9.2.4) should be: If $\psi_j^{F\ell}$ is defined to have zero displacement and rotation at interfaces, each work term will be zero.

Pg. 559, 4th line following eq. (9.2.6): eqs. (9.2.3). These matrices ...

Pg. 560, paragraph following equation for $\left(K^\ell\right)_{jn}^{CC}$, insert after second sentence: All $\left(K^\ell\right)_{jn}^{FC}$ should evaluate to zero according to the note on page 558.

Pg. 564, Exercise 9.23, change second sentence: Determine the constraint modes and Jacobian constraint matrix corresponding to using clamped-clamped flexural modes as the fixed interface modes for bar AB.

Pg. 564, Exercise 9.26, change 1st sentence: Select clamped-clamped flexural and fixed-free torsional modes as the fixed-interface ...

Pg. 572, 3rd line after 1st set of equations: eigenvalues to those derived from undamped modal analysis. Also, compare ...

Pg. 572, 3rd set of equations:

Mathcad:
$$\begin{aligned} &zero = identity\,(3) * 0 \\ &S := stack(augment(-K, zero), augment(zero, M)) \\ &R := -\,stack(augment(zero, K), augment(K, C)) \end{aligned}$$

Pg. 572, 4th set of equations, insert after "MATLAB": $lambda = diag(lambda);$

Pg. 572, 4th set of equations, 2nd line: $\ldots + 0.0001 * (imag\,(lambda\,(j)) < 0)\,;$

Pg. 592, Exercise 10.6, 2nd line, insert at end: ...to 16, and let Δf_j be a set of random numbers in the range $-0.05 < \Delta f_j < 0.05$.

Pg. 598, 1st line after eq. (11.1.11): When the quadratic coefficients of T actually ...

Pg. 598, eq. (11.1.12), insert term: $\cdots - \sum_{n=1}^{N} E_{jn} q_n + \dot{N}_j - J_j$

Pg. 599, 1st line after eq. (11.1.16): ...use eqs (11.1.12) and (11.1.15) to form ...

Pg. 599, eq. (11.1.17), insert term: $\cdots = \{Q\} - \left\{\dot{N}\right\} + \{J\} - \{F_0\}$

Pg. 600, eq. (11.1.19), 2nd line, insert term: $\cdots = \{Q\} - \left\{\dot{N}\right\} + \{J\} - \{F_0\}$

Pg. 600, eq. (11.1.21):

$$[S]\frac{d}{dt}\{x\} - [R]\{x\} = \left\{ \begin{array}{c} \{0\} \\ \{Q\} - \left\{\dot{N}\right\} + \{J\} - \{F_0\} \end{array} \right\}$$

Pg. 606, 1st line after eq. (11.2.1): ... into eq. (11.1.21) and ...

Pg. 607, 1st line after eq. (11.2.11): ... leads to $\{v\} = \lambda\{u\}$, which ...

Pg. 620, eq. (11.4.13):

$$\left\{\dot{\xi}\right\} - [\lambda]\{\xi\} = \left\{\tilde{\Psi}_n\right\}^{\mathrm{T}} \left\{ \begin{array}{c} \{0\} \\ \{Q\} \end{array} \right\}, \quad n = 1, ..., 2N$$

Pg. 621, eq. (11.4.17): Numerators should be $\left\{\tilde{\Psi}_n\right\}^{\mathrm{T}}\{F\}$ and $\left\{\tilde{\Psi}_n\right\}^{\mathrm{T}}\{F^*\}$

Pg. 622, 3rd equation from bottom: ... $-\,\omega^2 y_n - 2\omega\dot{z}_n$

Pg. 622, 2nd equation from bottom: ... $-\,\omega^2 z_n + 2\omega\dot{y}_n$

Pg. 623, 3rd set of equations from the bottom: 1st row of $[G']$ should be $0 \quad -\omega \quad 0 \quad 0$

Pg. 626, upper left graph: Delete the small circle at the top of the larger ellipse

Pg. 634, MATLAB program steps, 2nd and 3rd lines:

$$\begin{array}{l} eigval = eig\left(S\left(sig(j)\right), R\left(sig(j)\right)\right); \quad Re\_lam(:, j) = sort(real(eigval)); \\ Im\_lam(:, j) = sort(imag(eigval)); \quad end \end{array}$$

Pg. 634, Mathcad program steps, 1st line: ...$\lambda^{<j>} := genvals\left(R\left(\sigma_j\right), S\left(\sigma_j\right)\right)$

Pg. 635, 3rd paragraph, lines 4 and 5, and following equation: $\exp\left(\lambda_n \tau\right)$

Pg. 639, 4th equation:

$$f_{jn} = \left.\left(\frac{\partial \psi_n}{\partial x}\psi_j\right)\right|_{x=L}$$

Pg. 642, Exercise 11.4:

$$T = \frac{1}{2}mL^2\left[\frac{1}{3}\dot{\theta}^2 + \left(1 + \cos(\theta) + \frac{1}{3}\cos(\theta)^2\right)\omega^2\right] + \frac{1}{2}I_T\omega^2$$

Pg. 645, Exercise 11.23, 1st line: ... a height of $2\ell/3$ above ..

Pg. 646, Exercise 11.27, insert after 2nd sentence: The rotation rate is $\omega = 0.6\,(k/m)^{1/2}$.

Pg 6.57, eq. (12.3.1): right sides are $\varepsilon m\omega^2\cos(\omega t)$ and $\varepsilon m\omega^2\sin(\omega t)$

Pg. 665, last set of equations: $M'_{33} = M'_{44} = \kappa_y^2$, $G'_{34} = -G'_{43} = 2\kappa_x^2\Omega$

Pg. 670, eq. (12.5.6), 2nd line: ... $= \varepsilon m\omega^2\cos(\omega t)$

Pg. 670, eq. (12.5.6), 4th line: ... $= \varepsilon m \omega^2 \sin(\omega t)$

Pg. 672, 7th line: ... has a parametric instability. Typical ...

Pg. 672, 3rd and 2nd lines from bottom: ...condition $|\mathrm{Im}(\lambda)| = 0$ also approximates ...

Pg. 675, Exercise 12.11, part (c), delete last sentence, which begins with "Explain why ..."

Pg. 676, Exercise 12.15, insert after last sentence: The damping ratios are $\zeta_E = \zeta_I = 0.01$.

Pg. 685, Appendix B, entry for Free vibration: Insert plus sign at the beginning of the second line

Pg. 685, Appendix B, entry for Quadratic excitation, last line: insert close parentheses after ζ^3

Pg. 685, Appendix B, entry for Transient co-sinusoidal excitation, last line: fraction should be:

$$\frac{\zeta\omega_{\mathrm{nat}}\left(\omega_{\mathrm{nat}}^2 + \omega^2\right)}{\omega_{\mathrm{d}}}$$

Inside back cover, left page, first line: $\omega_n = \left(\frac{E}{\rho L^2}\right)^{1/2} \alpha_n$

Inside back cover, right page, entry for Clamped at $x = 0$, Clamped at $x = L$, 1st line:

$$\cos(\alpha)\cosh(\alpha) - 1 = 0$$