Errata: First Printing, Updated 7/24/98

Note: I'm including the TeX (LaTeX) form of the corrected equations here for people that might want to LaTeX them. I think they're understandable in this form but if you have a problem please e-mail me and I'll try to clarify. Also, if you'd like to simply get a postscript version of the errata then you can ftp errata.ps

Also, I'm putting down every typo that I can find. The vast majority aren't going to cause any problems to the reader (in fact they probably wouldn't even be noticed). I wanted to be complete though so please don't be put off by the number of entries.

Errata in the text

Chapter 1

page 9: Last sentence should have $t = \frac{2\pi}{\omega_n}$, not $\frac{2\pi}{\omega n}$.

page 11: Figure 1.11. What is shown in the plot as ϕ (the phase shift) is actually the shift in the origin of the time axis that corresponds to the phase shift. Eq. 1.2.33 can be re-written as $2\sin(3t) + 4\cos(3t) = 4.47\cos(3(t - .155)) = 4.47\cos(3(t - t_0))$ and the shift indicated in the plot is the t_0 term. Also, a period is missing after Figure 1.12.

page 13: Equation (1.2.39) should involve k_2, not k_1. In the last line (1.2) should be (1.2.41).

page 18: in (1.3.5) the $\frac{1}{3}$ in the sine expansion should be $\frac{1}{3!}$.

page 19: The double dots (time derivatives) in (1.3.12) should be centered over $(.05 + \eta)$ rather than between this and the factor ml^2.

page 20: End of second line before Example 1.4 should read "Thus the effect of the ..."

page 23: In the line before (1.4.11), $\frac{c}{m}$ should be written, not $\frac{c}{2m}$.

page 24: In (1.4.13), e^{ix} should appear, not e^x

page 25: In the third paragraph a ξ is used instead of ζ.

page 26: The solution to Example 1.5 should read $x(t) = (.01\cos(\ldots$. The left parenthesis was mistakenly written after .01 rather than before.

page 28: In Figure 1.27 the vertical force n_1 should be n and the t included in the $\vec{b_1}$, $\vec{b_2}$ coordinate frame illustration should be removed.

page 30: (1.5.8) should read $v_2 = \dot{x}\vec{n}_1 + l\dot{\theta}\vec{b}_1$.

page 31: (1.5.15) should end with $= 0$. Also, the $\dot{\theta}^2$ in the second term and in the next line should simply be $\dot{\theta}$.

page 33: (1.5.21) should simply be what's in (1.5.20) with $= Q_i$ in place of $= 0$. (The partial of the dissipation function and the entire partial with respect to q_i were omitted).

Chapter 2

page 61-62: Oops. Something slipped twixt the equation and the solution. (2.2.2) correctly reflects the physical system illustrated in Figure 2.3. The solution, however, is for $\ddot{x}+2\zeta\omega_n\dot{x}+\omega_n^2 x = \omega_n^2 y$. The $\dot{y}$ term isn't included. The problem was changed during the writing of the book and this wasn't caught - blame me for it. The affect of keeping the $\dot{y}$ term would be to change the system's initial condition on velocity, as is shown in Section 3.4. The solutions shown in Figure 2.5 are correct for the differential equation shown above.

The correct solution for (2.2.2) is given by

$$1 + e^{-\zeta\omega_n t}\left(\frac{\zeta\omega_n}{\omega_d}\sin(\omega_d t) - \cos(\omega_d t)\right).$$

The proper velocity initial condition is $\dot{x}(0) = 2\zeta\omega_n$, leading to $b = \frac{\zeta\omega_n}{\omega_d}$. Second line from the bottom of pg. 62, the word should be response, not reponse.

page 64: In Figure 2.6, τ_r is the time for the response to go from 10 percent to 90 percent of the steady-state value. The displacement itself is mistakenly labeled in the graph rather than the time needed.

page 69: in (2.2.22) the numerator should be $-\omega_n^2\Omega^2\bar{y}$

page 71: paragraph above Example 2.2 should read "from (2.3.7)) is plotted ..."

page 72: First line should read "Using (2.3.6) ..."

page 79: Second paragraph. Sentence should read "As ω approaches infinity, $\omega_n^2 - \omega^2$ becomes large, thus ...

page 80: In 2.15 (b) ϕ is plotted, not $-\phi$ (as labeled).

page 82: In (2.6.4) the second ω^2 should be ω_n^2

page 83: Equation 2.6.16 has a minus instead of a plus in the denominator. It should read $(...)^2 + (...)^2$

page 84: Figure 2.16. The label for the vector in the first quadrant was ommited. It should be labeled $f(t = 1)$.

page 85: The last paragraph discusses two values for ω. Only one is shown in the figure, namely an oscillation frequency greater than one. Therefore the magnitude of the velocity is greater then the displacement's magnitude (by a factor of ω) and the magnitude of the acceleration is greater than the velocity's magnitude by the same factor of ω.

page 86: The vector in Figure 2.18 for $\dot{x}$ is flipped - it should be rotated 180 degrees (into the upper left quadrant).

page 88: Last paragraph before Example 2.6 should read "be seen in Figure 2.19b, ..."

page 89: In 2.19 (b) and (c), ϕ is plotted, not $-\phi$ (as labeled).

page 90: (2.7.13) should read $g(.8) = 2.78$ and the last paragraph of solution should read "response has decreased by 22 percent ..."

page 91: An x, y coordinate frame should be included in Figure 2.21, the y direction pointing horizontally to the left.

page 92: Second to last paragraph. (... our previous $2m$) should be (... our previous $2m_2$)

page 94: In Figure 2.23a, x should be replaced by h.

page 95: First paragraph of Solution - should read "shown in Figure 2.23a." The x in (2.8.12) should be replaced by h. First line in Example 2.8 should read "in Example 2.7, ..."

page 102: The second line should read "Figure 2.27 shows ..."

page 104: In Figure 2.28, the value of friction force corresponding to negative relative motion should be labeled μW, not $-\mu W$.

page 107: In formulae 2.10.13, 2.10.14 and 2.10.17, $(i\omega t - \phi)$ is written when what should actually appear is $i(\omega t - \phi)$. Just after (2.10.13) should read "where $|g(\omega)|$ and ....

page 109: the dt was omitted from the integral of (2.10.27).

page 110 In Example 2.13 it should read "discussed in Example 2.12, determine ..."

Chapter 3

page 132: 3.2.12 should have a minus sign after the equals sign.

page 134: 3.2.23 should have a minus sign before the last integral.

page 139: There should be a t multiplying $\cos(n\omega_0 t)$ after the opening parenthesis. The last line should read "in Figure 3.7 for $\omega_n = 30$ rad/s and $a = 1$."

page 143: Two lines before (3.3.4), the denominator should be ϵ instead of δ.

page 144: First line of second to last paragraph should read "using a hammer to apply ..."

page 146: 3.3.13 should read $x(t) = e^{-\zeta\omega_n t}$ ... The line before 3.3.14 should read ...$= \frac{1}{m\omega_d}$.

(missing period) 3.3.14 should read $x(t) = \frac{1}{m\omega_d} e^{-\zeta\omega_n t}$ ...

page 147: Three lines after 3.3.21 should read ..., that is, near ...

page 149: End of first paragraph should be "and u as $e^{-\zeta\omega_n \tau}$." Immediately following the equals sign in (3.3.29) the fraction should read "$\frac{\bar{f}}{m\omega_d^2}$." 3.3.30 should read ... -$\frac{\zeta\omega_n \bar{f}}{m\omega_d^3} e^{-\zeta\omega_n t} \sin(\omega_d t) - ...$

page 151: 3.3.36 should read $x(t) = \frac{1}{m\omega_n} \int_0^t$ ... The last term in (3.3.39) should be $\tau \sin(\omega_n \tau) d\tau$.

page 152: Line above (3.3.42) should read "what $x(t_0)$ and $\dot{x}(t_0)$ ..." and the left hand side of (3.3.42) should be "$x(t_0) \approx$..."

page 153: 5th line from bottom of page should read " ... sharp loadings of ..."

page 155: 4th line should be "...exists after t_1 and 5th line should read "... with a short duration t_1."

page 156: 3.4.5 should read $\sin(\omega_n t)$

page 157: In Figure 3.17 h should be replaced by x_h.

page 158: In Example 3.4 the mass of 1 kg should be changed to 10 kg.

page 161: In the second line of the third paragraph, the word ration should be ratio.

Chapter 4

page 181: The last l in the denominator of 4.3.24 should be squared.

page 187: Figures 4.15, 4.16 and 4.23 - The plotting routine joined the results from "plus infinity" to "minus infinity," leaving a vertical line that I erased from some, but not all plots.

page 189: Figure 4.17 shows the actual responses $x_1(t)$ and $x_2(t)$.

page 190: Figure 4.19 shows the actual responses $x_1(t)$ and $x_2(t)$.

page 194: 6th line: should read "... system: $k_2 - k_5$ and ..."

page 218: The dependent variables in 4.11.26 should be η_1 and η_2, not x_1 and x_2.

page 224: The a(4,4) entry in 4.11.52 is -.5

page 227: In 4.12.5 the $1 + 9i$ should be $1 + .9i$.

page 228: The first term on the right hand side should be $m_1 m_2$, not $m_1 + m_2$.

page 236: In Figure 4.39, the coordinate x_1 is the same as x.

page 244: 4.15.12 should read "... $= \frac{k_1+k_2}{k_1 k_2} f_2$

page 245: Last line of the page should read "$f_1 = (k_1 + k_2)x_1$.

Chapter 5

page 282: The signs of the moments m in Figure 5.11 should be flipped.

page 293: In (5.4.6) the $\phi_m(x)$ on the first term of the right hand side should be after the integral sign and before the left parenthesis. In (5.4.8) it should also follow the integral sign. Same for (5.4.9) for the first term on the right hand side.

page 314: last sentence, 3rd paragraph. Change "descrete systems" to "discrete systems"

page 330: In (6.3.39) and in Figure 6.11 the estimated frequency should be $\omega_1^2 + a_3^2(\omega_3^2 - \omega_1^2)$.

page 347: The first term in the final paragraph should be $EA\bar{\xi}\bar{\xi}_x|_0^l$

page 349: In (6.5.19) both ϕ terms in the integral should be differentiated with respect to x

page 351: In the 10th line of the Solution of Ex. 6.9, replace "with a spring" with "without a spring." Also, Eq. 6.5.29 should have $= 0$ added to it.

page 354: In (6.5.43), remove the a from the subscript of $\mathcal{M}$.

page 362: The right square bracket in (6.5.66) should follow $b_4 \cosh(\beta)$. Also, the matrix values in (6.5.69) are wrong. The (3,3) entry should be .36378. The (4,4) entry should be .5. The (4,5) entry should be .28294.

page 366: The first two terms on the right hand side of (6.6.4) should have dx appended. The $+$ in front of the third term should be $-$. The differentiation on the left hand side of (6.6.7) should be with respect to a, not x_1.

Chapter 7

page 376: In figure 7.1 the mass should be labeled m_1.

page 377: The text in the final paragraph was garbled. It should read "lumped mass isn't as large (relatively) as before, when compared to the mass of the bar."

Chapter 8

page 405: (8.2.5) should read $\text{var}(y) = E[y - E(y)]^2$. Also, the integral in (8.2.7) should have a dt added.

page 407: Second line from top: "... our summation mutates ..." would be clearer as "...our summations in (8.3.1) mutate into ..."

page 408: In (8.3.12) the exponential term after the integral should be $e^{-i\omega t}$. The fraction following the = sign in (8.3.13) should be $\frac{1}{2\pi\omega}$

page 411: Second line after (8.4.10) should read "use the infinite limits of integration, we'd ..."

page 413: The left hand side of (8.4.17) should be $g(\omega)$, not $g(t)$.

page 414: Third line from the bottom of first paragraph should be (8.4.20), not (8.4.15).

page 418: The differentials in the integrals of (8.5.3) and (8.5.4) should be $d\omega$, not $d\tau$.

Errata in the problems

Chapter 1

Problem 12: "$m_1 = 1$ kg" should read "$m = 1$ kg."

Problem 15: The illustration shows 50 m between the top of the rope and the plane. It should be 48 m (so that the distance of fall was 50 m at grab time.

Problem 16: The parametric values for case a) and b) were omitted from the problem. The correct values to use are

a) $k_1 = 5$ N/m, $k_2 = 5$ N/m, $k_3 = 100$ N/m and $m = 100$ kg

b) $k_1 = 50$ N/m, $k_2 = 50$ N/m, $k_3 = 10$ N/m and $m = 100$ kg.

Problem 17: The solution should be $y(t) = .1(1 - \cos(7.91t)$.

Problem 33: Not really an errata but in the figure the $t = -2$, $t = -1$, $t = 0$ is simply there to give a sense of time passing. The -2, -1 don't correspond to seconds.

Problem 41: In the top view the y coordinate is mistakenly labeled z.

Problem 42: This problem was meant to allow the student to obtain an equilibrium that wasn't just zero or $\frac{\pi}{2}$. Unfortunately, what was originally a linear torsional spring was replaced for "clarity" by a linear spring (k_1) and the trigonometric characteristic that should go with the linear spring was ignored. Thus the solution indicates a restoring force proportional to θ rather than $\sin(\theta)$. When revised, this problem will have the torsional spring restored since with the current setup the equilibrium is still going to be $\theta = 0$. For the solution in the solutions manual to hold, the k_1 spring should be replaced by a torsional spring for which the restoring moment is equal to $k_1 l_2^2 \theta$.

Problem 44: Add "The rotational spring constant is equal to k_θ."

Problem 49: The left arrowhead for the 2 m measurement should end at the left end of the bar, not at the base of the pivot.

Problem 59. For this problem $m_1 = 1$ kg, $m_2 = 2$ kg, $l_1 = 1$ m and $l_2 = 3$ m.

Problem 76. The illustration shows the possibility of base motion but the solution doesn't include any. If base motion is allowed the solution should be given by

$$k_e = \frac{1}{2} m \dot{x}^2$$

$$p_e = \frac{1}{2} k_1 (x - y)^2 + \frac{1}{2} k_2 x^2$$

$$r_d = \frac{1}{2}c\dot{x}^2$$

$$L = k_e - p_e$$

$$L = \frac{d}{dt}\frac{\partial L}{\partial \dot{x}} - \frac{\partial L}{\partial x} + \frac{\partial r_d}{\partial \dot{x}} = 0$$

$$m\ddot{x} + c\dot{x} + (k_1 + k_2)x = k_1 y$$

Problem 84: In the figure, a should measure from the top of the pivoted bar to the place that k_2 attaches to the bar.

Chapter 2

Problem 4: "occur around $\omega = 1.2$ ..." should actually read "occur around $\omega = 3$ rad/s ..." This matches the following expression for y. In the solution itself there is a typo in the last equation. The denominator should be 36-9(18), not 36-9(36). The final result is correct.

Problem 13: The -3 on the figure should line up with the horizontal dotted line. There should be a minus sign after the equals sign in the third from final equation of the solution.

Problem 17: The figure has an error. The parameter a should be given by $\frac{h_1-h_2}{2}$. x was left off the figure; it is zero at the cam center and increases in the direction of the mass. Finally, there's really no need to include x_c. Simply view the spring as being compressed by an amount $x(t)$ with $x(t)$ as given in the problem statement and set x_c equal to zero in the solution. If you want to keep x_c as shown in the solution then the last sentence should read " ... deflection is equal to $x_c + x(t)$.

Problem 43: Note that the damping factor in the figure is exact; it is equal to .10

Problem 48: No particular errata but I've got a "nicer" solution for this problem that obviates the need for determining the first Fourier Series coefficient. e-mail me and I'll send it to you.

Problem 57: The solutions should say "from Problem 55" not "from Problem g52".

Chapter 3

Problem 2: The maximum response for $g(t)$ is B. This was left off the plot

Problem 3: Should read "amplitude $A = 2$ cm and ..."

Chapter 4

Problem 2: In the solutions manual, replace C1 with 4.1.

Problem 6: Should read "A nonuniform bar ..." "spring constant equal to k (see Figure 4.38)"

Problem 13: Ignore the accompanying figure. Just assume the system has 3 degrees of freedom and that the $[M]$ and $[K]$ matrices match the given conditions.

Problem 19: Second line should read "If k_1 goes to infinity ..."

Problem 31: The θ was left off from the figure - it measures the angular deviation of the pivoted bar from vertical.

Problem 34: In the solutions manual replace C5 with 4.33.

Problem 35: In the solutions manual replace C5 with 4.33.

Problem 39: f_2 should be centered about zero (change -2 to -1).

Problem 41: In the solutions manual the solution ignores any equilibrium displacement of the two masses under the influence of gravity. The question in the book was supposed to direct the student to do this so as to simplify the analysis. Since I left those directions out, I've left a modified solution in the file solutions.vib, at the same ftp site as everything else for the book, that deals with these additional (and small) terms.

Problem 44: In the solutions manual there are some typos. The first line has $\cos(1.2t)$ rather than $10\cos(1.2t)$. The illustrated solution assumes $f_1^T = 0\ 1\ 0$ and $f_2^T = 0\ 0\ 1$. The final answer for $x_1(t)$ is correct for these f_i. The final result, however, requires that the $\cos(1.2t)$ term be multiplied by 10 and the $\sin(5.45t)$ term be multiplied by 30. The plot shows the correct final result.

Problem 49: The second occurrence of k_1 in the problem statement should be k_2.

Problem 56: The coordinate associated with m_2 (shown in figure) is x_2, not x_1.

Problem 57: The solution assumes a length of $2l$ while the figure in the book shows a length of l. The numbers are all correct but to make the solution manual match the book you should change the l to $2l$ in the book's figure and take l to be .5m. Also, "... let's look at the undamped system:" should read "... let's look at the unforced system:"

Problem 72: This problem doesn't, repeat doesn't, actually refer to problem 30. Problems were switched somewhere along the line and what should be looked at for this problem is a serial chain of spring-mass elements with five masses and six springs. The values (from left to right) are $m_1 = 1$ kg, $m_2 = 10$ kg, $m_3 = 50$ kg, $m_4 = 1$ kg, $m_5 = 200$ kg, $k_0 = 1000$ N/m, $k_1 = 10$ N/m, $k_2 = 125$ N/m, $k_3 = 2000$ N/m and $k_4 = 2000$ N/m. Finally, there's an additional spring (k_5) that goes from m_3 and m_5 with a spring constant of 1 N/m.

Problem 76: See Problem 72 - same correction to system.

Problem 78: Should read $k_2 = 100$ N/m, $k_3 = 200$ N/m and $k_4 = 400$ N/m.

Problem 81: The last k should be $k_5 = 3$ N/m

Chapter 7

Problem 12: In solutions manual, "which from 35.8" should read "which drops from 35.8"

Problem 13: In the solutions manual, "the bar is essentially ..." should read "beams 1 and 3 are essentially ..."

Problem 15: Should read "Shown below is a uniform, rigid, bar ..."

Problem 16: Should read "Shown below is a uniform, rigid, bar ..."

Chapter 8

Problem 8.9: In the solutions, replace "problem P13" with "problem 8.8"

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