Errata and Suggested Updates for

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1. In many places "non-linear" appears that should be recast as "nonlinear." This is found on pages 248, 559, 559, 566, 566, 566.

2. p. 98: Sec. 2.6.3: In the analysis of Eqs. (2.346-2.348), several factors of 1/2 are missing; e.g. dx_1 should be replaced by $(dx_1)/2$ in Eq. (2.346).

3. p. 89, 91, 112, 113: We would be better to employ an opposite sign convention for torsion τ. This is more common in the literature. For example, the Frenet-Serret equations, Eqs. (2.259-2.261), p. 89, are better stated with the more common sign convection as

$$\begin{aligned} \frac{d\mathbf{t}}{ds} &= \kappa \mathbf{n}, \\ \frac{d\mathbf{n}}{ds} &= -\kappa \mathbf{t} + \tau \mathbf{b}, \\ \frac{d\mathbf{b}}{ds} &= -\tau \mathbf{n}. \end{aligned}$$

4. p. 98: Note: some sources define

$$\text{div } \mathbf{T} = \nabla \cdot \mathbf{T}^T = \frac{\partial T_{ji}}{\partial x_i}.$$

   As long as the analysis is internally consistent, as it is here, it is correct.

5. p. 111: Problem 4g is a repeat of Problem 1.

6. p. 113: Problem 22–The first equation in the problem may need to be

$$\mathbf{t}^T \cdot \frac{d^2\mathbf{t}}{ds^2} \times \frac{d\mathbf{t}}{ds} = \kappa^2 \tau$$

   This would change if we change the sign convention for τ.

7. p. 113: Problem 30 should have corners at $(0, 0, 0)$, $(0, 1, 0)$, $(1, 1, 0)$, and $(1, 0, 0)$.

8. p. 113: Problem 30 should have "For $\mathbf{f}(x, y, z)$ =...."

9. p. 114: Problem 38 should read "...one finds that the three principal..."

10. p. 114: Problem 38 should have $q_i = -k_{ij}\partial T/\partial x_j$....

11. p. 145: Problem 29: The problem is better stated as "...are possible when $b = 2.2617$, and find the corresponding frequency."

12. p. 156: Eq. (4.102) has a small error. The argument of the second term should be $-i\sqrt{14}\ln x$. So we should have

$$\begin{aligned}
y(x) &= \frac{1}{x}\left(C_1(\exp(\ln x))^{i\sqrt{14}} + C_2(\exp(\ln x))^{-i\sqrt{14}}\right), \\
&= \frac{1}{x}\left(C_1\exp(i\sqrt{14}\ln x) + C_2\exp(-i\sqrt{14}\ln x)\right), \\
&= \frac{1}{x}\left(\hat{C}_1\cos(\sqrt{14}\ln x) + \hat{C}_2\sin(\sqrt{14}\ln x)\right).
\end{aligned}$$

13. p. 214: Problem 29: We should have

$$P(u,v) = \sum_{k=1}^{n}\sum_{j=1}^{k}(-1)^{j-1}\frac{d^{k-j}u}{dx^{k-j}}\ \frac{d^{j-1}}{dx^{j-1}}(a_{n-k}v).$$

14. p. 216: Problem 4.52, should read "...to being connected as well as identical to mass 1..." and "...of the two masses and the potential energy of the three springs."

15. p. 217: Problem 4.53 needs an additional factor of "2" in the error function, so as to be consistent with the correct Eq. (A.103) on p. 594.

16. p. 230: Fig. 5.5's caption should be $dy/dx = -\sqrt{x}y$

17. p. 236: The second term in Eq. (5.146) be

$$2k\left(1 + x + \frac{1}{4}x^2 + ...\right)$$

instead of

$$2k\left(1 + x + \frac{1}{2}x^2 + ...\right)$$

18. p. 239: Eq. (5.179) should be

$$y = x + \frac{x^2}{2} + \frac{x^4}{12} + ...$$

19. p. 257: Eq. (5.319) should have

$$y(x) = y_0(x) + \epsilon y_1(x) + \epsilon^2 y_2(x)....$$

20. p. 269: Just before Eq. (5.429) we should find $\xi^2 + \eta^2 = r^2$ instead of $x^2 + y^2 = r^2$.

21. p. 272: Problem 15 is identical to Example 5.11.
22. p. 276: Problem 55 repeats Problem 50.
23. p. 277: Problem 57 repeats Problem 18.
24. p. 296: The equation appearing just before Eq. (6.92) should receive a number.
25. p. 302: In Example 6.19, $||x||_2 = 3.873$ not 3.870.
26. p. 311: In Fig. 6.9, need more space in needed in the term "$-0.23\sin 4t$."
27. p. 316: Eq. (6.239) needs an approximate equals sign rather than an equals sign. So we should find

$$t^2 \approx \sum_{n=1}^{N} \alpha_n \varphi_n.$$

28. p. 327: Eq. (6.335) has a $\cdot$ between the matrix and the vector and should not. We should find

$$\begin{pmatrix} \xi^1 \\ \xi^2 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ 0 & 3 \end{pmatrix} \begin{pmatrix} x^1 \\ x^2 \end{pmatrix}$$

29. p. 363: Eq. (6.693) should have $\alpha\phi(t)$ instead of $c\phi(t)$.
30. pp. 364-5: In Eqs. (6.702), (6.703), one could replace $(t^5/4)^{2/5}$ by $t^{1/2}$. Additional simplification is possible that is easily achieved with computer algebra.
31. p. 371: Eq. (6.754) should have λt^3 instead of λt^2. So we should find

$$\begin{aligned} \int_0^1 \left(-(1-2t)^2 + \lambda t^3 (1-t)^2\right) dt &= 0, \\ -\frac{1}{3} + \frac{\lambda}{60} &= 0, \\ \lambda &= 20. \end{aligned}$$

32. p. 378: The y-axis of the rightmost graph of Fig. 6.28 is mis-labeled. It should be $y(t = 1)$.
33. p. 379: Problem 10 is too similar to Example 6.39.
34. p. 381: Problem 27: the inner product should be enclosed by angle brackets instead of parentheses. So we should have

$$\langle x, y \rangle = \int_a^b w(t)x(t)y(t)\ dt,$$

35. p. 381: Problem 30 is a repeat of Problem 18.

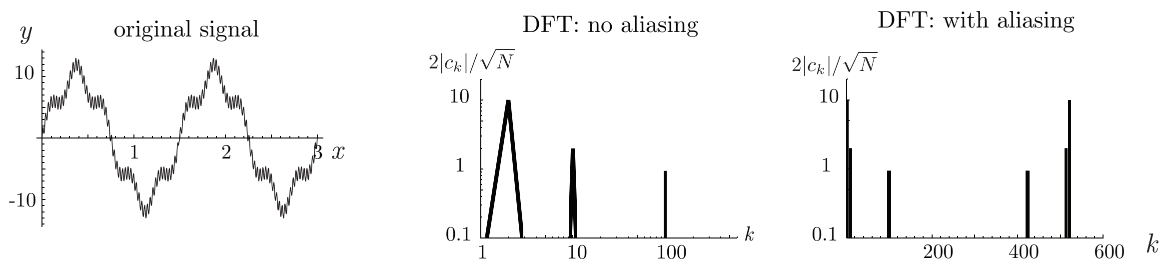

Figure 1: Modified Fig. 7.5.

36. p. 381: Problem 31 is a repeat of Problem 8.
37. p. 381: Problem 33 is a repeat of Problem 4.
38. p. 382: Problem 37 is a repeat of Problem 11.
39. p. 384: Problem 57 is a repeat of Problem 14.
40. p. 385: Problem 61 is a repeat of Problem 56.
41. p. 385: Problem 66 is a repeat of Problem 64.
42. p. 386: Problem 72 may benefit from changing the lower limit to $-\infty$.
43. p. 424: Eq. (7.229) should actually employ $\mathbf{u}\mathbf{u}^T$; it presently incorrectly uses $\mathbf{u}^T \cdot \mathbf{u}$, though Eq. (7.230) is correct. We should thus find

$$\begin{aligned}
\mathbf{H} &= \mathbf{I} - 2\mathbf{u}\mathbf{u}^T, \\
&= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - 2 \begin{pmatrix} -\frac{1}{\sqrt{10}} \\ \frac{3}{\sqrt{10}} \end{pmatrix} \begin{pmatrix} -\frac{1}{\sqrt{10}} & \frac{3}{\sqrt{10}} \end{pmatrix}, \\
&= \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} - 2 \begin{pmatrix} \frac{1}{10} & \frac{-3}{10} \\ \frac{-3}{10} & \frac{9}{10} \end{pmatrix}, \\
&= \begin{pmatrix} \frac{4}{5} & \frac{3}{5} \\ \frac{3}{5} & \frac{-4}{5} \end{pmatrix}.
\end{aligned}$$

44. p. 426: Eq. (7.240) should read $\mathbf{I} - 2\mathbf{u}\mathbf{u}^T$. The actual numerical values are correct.
45. p. 431: Figs. 7.5 and 7.6 would be more effective if it plotted $2|c_k|/\sqrt{N}$ vs. k. When so done, it returns the actual amplitude of the mode for modes that are sufficiently resolved. It would be useful to present the analysis to show this. Figure 1 gives an example of how this could be fixed.
46. p. 440: Eq. (7.337) has an unneeded dot in the matrix product.

47. p. 441: It would be useful in Section 7.9.5 to have more discussion of algebraic and geometric multiplicity of the eigenspace.

48. p. 450: Columns of $\mathbf{Q}$ should be the normalized eigenvectors, not just the eigenvectors.

49. p. 457: More nuance may be needed for the projection matrix $\mathbf{P}$. The matrix $\mathbf{P}$ as defined by Eq. (7.477) is guaranteed symmetric with spectral norm of 1. And it guarantees $\mathbf{P} \cdot \mathbf{x} = \mathbf{P} \cdot \mathbf{P} \cdot \mathbf{x}$, as required. However if

$$\mathbf{B} = \begin{pmatrix} 1 & 0 \\ 1 & 0 \end{pmatrix},$$

we find a) $\mathbf{B} \cdot \mathbf{x} = \mathbf{B} \cdot \mathbf{B} \cdot \mathbf{x}$, b) the eigenvalues of $\mathbf{B}$ are 1 and 0; c) $\mathbf{B}$ is asymmetric, d) the spectral norm of $\mathbf{B}$ is $||\mathbf{B}|| = \sqrt{2}$, thus $\mathbf{B}$ can stretch vectors of certain orientation, e.g. if $\mathbf{x} = (1, 0)^T, \mathbf{B} \cdot \mathbf{x} = (1, 1)^T$. So we do not consider $\mathbf{B}$ to be a projection because it could stretch $\mathbf{x}$, though some authors might allow it to be considered a projection.

50. p. 460: Eq. (7.497) needs another "dot" within its matrix multiplication. So we should find

$$\mathbf{a} = \left((\mathbf{W} \cdot \mathbf{A})^T \cdot \mathbf{W} \cdot \mathbf{A} \right)^{-1} \cdot (\mathbf{W} \cdot \mathbf{A})^T \cdot \mathbf{W} \cdot \mathbf{b}.$$

51. p. 469: In Eq. (7.593), we should have $q_{11} = 1/\sqrt{10}$.

52. p. 475: Problem 32 has no Cholesky decomposition as the matrix is not positive definite.

53. p. 486: Figure 8.2 needs negative signs on some numbers on the y axis.

54. p. 491: Some confusion exists here. The ϕ_i of Eq. (8.72) is orthonormal. The ϕ_i of Eq. (8.73) is not. It is written carefully, but it is confusing. It could and should be reformulated for more clarity.

55. p. 518: Just after Eq. (9.159), should read "...eigenvectors $\mathbf{e}_k, k = 1, 2, ..., K$, as possible."

56. p. 553: In the caption of Fig. 9.13, one should replace dx/dx by dx/dt.

57. p. 562: Eq. (9.494) should have an 8 in the numerator of both terms, not $4\sqrt{2}$. So we should find

$$T(x,t) \approx \frac{8}{\pi^3} e^{-\pi^2 t} \sin(\pi x) + \frac{8}{27\pi^3} e^{-9\pi^2 t} \sin(3\pi x).$$

58. p. 562: Eq. (9.495) should have additional $\sqrt{2}$ on both terms because this is part of the basis function. Thus, we should find

$$T(x,t) \approx \alpha_1(t)\sqrt{2}\sin(\pi x) + \alpha_2(t)\sqrt{2}\sin(3\pi x),$$