Chapter 5

1. p. 358, line 24: Change "k_3x_3 " to "k_3x_2 "

2. p. 378, line 1: Add "Solve $\dot{\mathbf{x}} = A\mathbf{x}$ "

3. p. 452, line 15: Change "that is, Theorem 5.7 in Section 5.2 and Theorem 5.23. To " to

"that is, Theorem 5.7, in Section 5.2, and Theorem 5.23, to "

4. p. 453, line 3: Change "if, and only if, $h_1 + h_2 > 0$. " to

"only if $h_1 + h_2 > 0$. In fact, there is an example where, even though $h_1 = 2$ and $h_2 = -1.9$, the system is unstable. So, if $h_1 + h_2 > 0$ we cannot conclude that the system must be asymptotically stable. "

So, problem 5.8.6.8(b), as originally stated in the textbook, was incorrect.

Chapter 6

1. p. 462, line 16: Change ". and " to "and "

2. p. 462, line 35 through 39, and p. 461, lines 1 through 4: Changes to the instructions for problem 6.1.17: Specifically, change

> "(a) Explain why the particle's motion remains in the plane $\mathbf{r} = \mathbf{r}(0) + Span\{\mathbf{v}(0), \mathbf{a}(0)\}$, where $\mathbf{a}(0) \triangleq -\frac{q}{m}\,\mathbf{v}_0 \times \mathbf{B}_0$ is the particle's initial acceleration, as long as $\mathbf{a}(0) \neq \mathbf{0}$.
> (b) Explain why we can express $\mathbf{r}(t) = \mathbf{r}_0 + g(t)\mathbf{v}(0) + h(t)\mathbf{a}(0)$ for some unknown functions $g(t), h(t)$.
> (c) Explain why $g(t)$ and $h(t)$ both satisfy the scalar ODE of undamped harmonic motion, $\ddot{y} = -(||\mathbf{a}_0||^2/||\mathbf{v}_0||^2)\, y$.
> (d) Solve for $g(t), h(t)$ and thus find the motion of the particle. This is called **cyclotron motion**."

to

> "(a) Assume for the moment that we can express the solution in the form $\mathbf{r}(t) = \mathbf{r}_0 + g(t)\mathbf{v}(0) + h(t)\mathbf{a}(0)$ for some unknown functions $g(t), h(t)$. Substitute this into the ODE for $\mathbf{v}(t)$ and use the definition of $\mathbf{a}(0)$, assuming it is not the zero vector. Note that $\mathbf{v}(0)$ and $\mathbf{a}(0)$ are orthogonal. [Why?]
> (b) Using the result of part (a), take an inner product with $\mathbf{a}(0)$ and use the result of problem 6.8.4.15, namely the identity $\mathbf{A} \bullet (\mathbf{B} \times \mathbf{C}) = \mathbf{C} \bullet (\mathbf{A} \times \mathbf{B})$, to help conclude that (1) $\ddot{h}(t) = -\dot{g}(t)$.
> (c) Using the result of part (a), take an inner product with $\mathbf{v}(0)$ and use the result of problem 6.8.4.15 to help conclude that (2) $\dot{h}(t) = \big(||\mathbf{v}(0)||^2/||\mathbf{a}(0)||^2\big)\ddot{g}(t)$.
> (d) Solve (1) and (2) for $g(t), h(t)$ and thus find the motion of the particle. This is called **cyclotron motion**."

3. p. 545, line 17 : Change

> "hence, the angular velocity vector is $\boldsymbol{\omega} = \omega \sin\psi\, \hat{\boldsymbol{k}}$ "

to

> "hence, we may assume, without loss of generality concerning the directions $\hat{\boldsymbol{\imath}}$ and $\hat{\boldsymbol{\jmath}}$, that the angular velocity vector is $\boldsymbol{\omega} = \omega \cos\psi\, \hat{\boldsymbol{\jmath}} + \omega \sin\psi\, \hat{\boldsymbol{k}}$ "

Chapter 7

1. p. 570: Change "ω " to "w " in Figure 7.17

2. p. 570: Move "$\varphi = \alpha$ " to be near the pendulum bob in Figure 7.17

3. p. 591, line 21: Change "$\int_0^a$ " to "$\int_0^{2\pi}$ "

4. p. 592: In Figure 7.35(a), change "c_1 " to "$\mathcal{C}_1$ " and change "c_2 " to "$\mathcal{C}_2$ "

5. p. 607, line 4: Change "$|F|$ " to "$||\mathbf{F}||$ "

6. p. 607, line 12: Change "$3,396$ km " to "$3,376$ km " "

7. p. 621, line 12: Change "$\iint_{\mathcal{S}}$ " to "$\iint_{\mathcal{S}_+}$ "

8. p. 633, line 29: Change "$i = 1, 2$ " to "$i = 0, 1$ "

9. p. 645, lines 25, 26, and 27: Change "$e^{-u^2/2}$ " to "$e^{-u^2/2} du$ "

Chapter 8

1. p. 691, line 27: Change "x_1 " to "$Sign(x_1)$ "

2. p. 694, line 18: Add "Caution: $\mathsf{QRDecomposition[A]}$ has output $\{\mathsf{Q^T, R}\}$, not the $\{\mathsf{Q, R}\}$ used by the QR algorithm. "

3. p. 711, lines 5 and 6: Change "**Improved Euler's Method**, also known as another **Runge-Kutta Method of order two** given in (8.68)." to
"modified Euler's Method, also known as another **Runge-Kutta Method of order two**, given in problem 8.7.7.17."

4. p. 711, line 11: Change

$$\left\{ \begin{array}{l} y_0 = y(t_0) \\ y_{i+1} \triangleq y_i + \frac{1}{4}(k_1 + 3k_2), \text{ where} \\ k_1 \triangleq hf(t_i, y_i), \text{ and} \\ k_2 \triangleq hf(t_i + \frac{1}{3}\,h, y_i + \frac{1}{3}\,k_1) \end{array} \right\}. \tag{8.75}$$

to

$$\left\{ \begin{array}{l} y_0 = y(t_0) \\ y_{i+1} \triangleq y_i + \frac{1}{4}(k_1 + 3k_3), \text{ where} \\ k_1 \triangleq hf(t_i, y_i), \\ k_2 \triangleq hf(t_i + \frac{1}{3}\,h, y_i + \frac{1}{3}\,k_1), \text{ and} \\ k_2 \triangleq hf(t_i + \frac{2}{3}\,h, y_i + \frac{2}{3}\,k_2) \end{array} \right\}. \tag{8.75}$$

Chapter 9

1. p. 747, line 6: Delete "With $L = \pi$, "

2. p. 766, line 9: Change "$f\big(x + \frac{L}{2}\big) = f\big(x - \frac{L}{2}\big)$ " to "$f\big(\frac{L}{2} + x\big) = f\big(\frac{L}{2} - x\big)$ "

3. p. 785, line 5, in (9.43): Change "$a\,\mathcal{F}^{-1}[\,F(\omega)\,](x)$ " to "$a\,\mathcal{F}^{-1}[\,F(\omega)\,](ax)$ "

4. p. 787, in Table entry F.15: Change "$\sqrt{\dfrac{2}{\pi}}$ " to "$\sqrt{\dfrac{1}{2\pi}}$ "

5. p. 789, line 2: Add "You may find useful the result of Theorem 17.1 in Section 17.2. "

6. p. 789, line 4: Change "Theorem 9.8 " to "Theorem 9.8, and/or an entry in Table 9.2, "

7. p. 789, line 14: Change "Theorem 9.10 " to "Theorem 9.11 "

8. p. 804, bottom line: In Table 9.3, change "3.6 " to "3.5 " and
change the value $f(4.0)$ from "9" to be "8 "

9. p. 805, top line: In Table 9.4, change "3.6 " to "3.5 " and
change the value $f(4.0)$ from "0" to be "2 "

10. p. 811, line 16 : Change "$d_1 \cdot 0 + d_2 \cdot 1$ " to "$(d_1 \cdot 0 + d_2 \cdot 1)$ "

11. p. 815, last line: Add "Assume $a > 0$. "

12. p. 816, in problem 9.6.4.8: Change "$\displaystyle\int_a^b \psi(x)y(x) = 0.$ " to "$\displaystyle\int_a^b \psi(x)f(x) = 0.$ "

13. p. 824, in problem 9.7.1.7(d): Change "$X''''(0)$ " to "$X'''(0)$ "

14. p. 831, in problem 9.8.4.2: Change "odd " to "even "

Chapter 10

1. p. 879, line 5: Change "$\begin{bmatrix} x \\ -\nu\, y \\ -\nu\, z \end{bmatrix}$ " to "$\begin{bmatrix} X \\ -\nu\, Y \\ -\nu\, Z \end{bmatrix}$ "

2. p. 881, line 11: Change "why in " to "why "

3. p. 882, line 3: Change "$+\varrho(X)$ " to "$-\varrho(X)$ "

4. p. 891, line 3: Change "$\sin x$ " to "$6\pi \sin x$ "

5. p. 891, lines 7 and 10: Change "$1\, d\xi$ " to "$\sin\xi\, d\xi$ "

6. p. 900, line 22: Change "$\varrho_0 \left(\frac{\partial u}{\partial x}\right)^2$ " to "$T_0 \left(\frac{\partial u}{\partial x}\right)^2$ "

Chapter 12

1. p. 1006, line 9: Change “Problem 12.2.2.1 " to “Problem 12.2.2.2 "

2. p. 1007, line 6: Change “Problem 12.2.2.2 " to ““Problem 12.2.2.1 "

3. p. 1007, line 12: Change “Problem 12.2.2.2 " to ““Problem 12.2.2.1 "

4. p. 1016, line 16: Change “the wave speed $c > 0$ " to “$0 \leq \epsilon \leq 1$ "

5. p. 1017 line 17: Change “replacement " to “replacement equations "

6. p. 1017, line 29: Change “the wave speed $c > 0$ " to “$0 \leq \epsilon \leq 1$ "

Chapter 13

1. p. 1028, last line: Delete “convective", that is, change “convective heat loss" to “heat loss"

2. p. 1029, line 10: Delete “convective", that is, change “convective heat transfer" to “heat transfer"

3. p. 1029, line 13: Delete “by convection", that is, change “heat by convection" to “heat"

4. p. 1031, line 9: Change “length " to “height "

5. p. 1031, line 29: Delete “convective", that is, change “convective heat loss" to “heat loss"

6. p. 1041, line 23: Change “$w\ell\,\hat{\boldsymbol{w}} + h\ell\,\hat{\boldsymbol{h}}$" to “$h\ell\,\hat{\boldsymbol{w}} + w\ell\,\hat{\boldsymbol{h}}$"

7. p. 1047, line 15: Change “symmetric" to “real, symmetric"

8. p. 1073, line 2: Change “$S \triangleq \{\mathbf{x} : \ f(\mathbf{x}) \leq M\}$ " to “$S \triangleq \{\mathbf{x} \text{ is in } C : \ f(\mathbf{x}) \leq M\}$ "

9. p. 1073, line 3: Delete “(a) "

10. p. 1079, line 5: Change “2.9.2.3 and 2.9.2.4" to “2.9.2.4 and 2.9.2.3"

Chapter 14

1. p. 1091, line 17: Change “x term " to “an x term "

Chapter 15

1. p. 1156, line 11, in problem 15.3.3.10: Change “$u(x, y) = 3xy^2 - y^3 + 2xy - y$ " to
“$u(x, y) = 3x^2y - y^3 + 2xy + y$ "

2. p. 1170, line 15, in problem 15.4.6.11: Change “$(z^n)^{1/2}$ " to “$\sqrt{z^n}$, " and change “$z^{1/2}$ " to “$\sqrt{z}$ "

3. p. 1175, line 5, in problem 15.5.4.16: Change "$\sinh z = b$ " to "$\sinh z = ib$ "

4. p. 1220, line 25: Please delete problem 15.10.5.8, because it appears that we cannot use the method of Example 15.66 in Section 15.10. In particular, the use of an estimate similar to that of Lemma 15.1 in Section 15.10 does not work well, because it is not true that

$$\int_0^\pi \frac{R^2}{R^2-1}\,d\theta \to 0, \quad \text{as} \quad R \to \infty.$$

Chapter 16

1. p. 1230, line 3, in problem 16.1.5.6: Change "conformal " to "is conformal "

2. p. 1235, lines 19 and 20:

Change

$$M(\delta+i\gamma) = M(\delta+\gamma) \iff (\delta-\alpha)\gamma - \gamma^2 = \mp i\alpha\gamma.$$

which is impossible because δ, γ and α are real and $\alpha \neq 0$.

to

$$M(\delta+i\gamma) = M(\delta+\gamma) \iff \alpha = \beta \iff \alpha = \pm 1,$$

so hypothesis (16.10) guarantees that $M(\delta+i\gamma) \neq M(\delta+\gamma)$.

3. p. 1244, line 24, in problem 16.1.5.6: Change "$M_\pm(z)$ " to "$M(z) \triangleq \dfrac{z-\alpha}{z-\beta}$ "

4. p. 1244, line 32, in problem 16.2.5.22:

Change

$$M(\delta+i\gamma) = M(\delta+\gamma) \iff (\delta-\alpha)\gamma - \gamma^2 = \mp i\alpha\gamma.$$

to

$$M(\delta+i\gamma) = M(\delta+\gamma) \iff \alpha = \beta \iff \alpha = \pm 1$$

5. p. 1245, line 4, in problem 16.2.5.23: Change "$\dfrac{z_0}{|z_0|^2 - R^2}$ " to "$\dfrac{\overline{z_0}}{|z_0|^2 - R^2}$ "

6. p. 1252, line 21: Change "whole $z-$plane. " to

"whole $z-$plane, except for the finite interval $\{x + i0 : -a \le x \le a\}$ on the real axis. "

7. p. 1252, line 23: Change "is hyperbolas " to "are hyperbolas "

8. p. 1259, line 12: Change "$\phi(, y)$ " to "$\phi(x, y)$ "

9. p. 1260, line 9: Change "whole $z-$plane. " to

"whole $z-$plane, except for the finite interval $\{x + i0 : -a \le x \le a\}$ on the real axis. "

Chapter 17

1. p. 1267, line 13: Change “nonzero" to “positive"

2. p. 1267, line 15: Change “$a\,\mathcal{F}^{-1}[\,F(\omega)\,](x)$ " to “$a\,\mathcal{F}^{-1}[\,F(\omega)\,](ax)$ "

3. p. 1269, line 3, in problem 17.1.2.10: Change “$te^{-at}Step(t)$ " to “$\sqrt{2\pi}\,te^{-at}Step(t)$ "

4. p. 1275, line 10: Change “17.1 " to “17.2 "

5. p. 1280, next to last line, in problem 17.2.2.5: Change

“You may assume that $\mathcal{F}_{c,x}^{-1}\left[\,\dfrac{\cosh(a\omega)}{\cosh(b\omega)}\,\right] = \sqrt{2\pi}\,\dfrac{\cos\big(\pi a/(2b)\big)\cosh\big(\pi x/(2b)\big)}{b\big(\cosh(\pi x/b)+\cos(\pi a/b)\big)}$ "

to

“You may assume that $\mathcal{F}_{c,x}^{-1}\left[\,\dfrac{\sinh(a\omega)}{\sinh(b\omega)}\,\right] = \sqrt{\frac{\pi}{2}}\cdot\dfrac{\sin\big(\pi a/b\big)}{b\big(\cosh(\pi x/b)+\cos(\pi a/b)\big)}$, for $x>0$ "

6. p. 1282, line 15, in (17.38): Change an α to an a, so that we change “$\frac{\sin\omega x}{\omega}\,e^{-\alpha\omega^2}$ " to “$\frac{\sin\omega x}{\omega}\,e^{-a\omega^2}$ "

7. p. 1288, line 7: Change “theorem (15.27) in Section 15.7 " to “theorem, that is, Theorem 15.27 in Section 15.7, "

8. p. 1291, line 17: Change “pp. 302-302 " to “pp. 347-348 "

9. p. 1294, line 12, in problem 17.3.2.11: Add “Also, assume ICs $u(x,0)=v(x,0)=0$ for $0<x<\infty$. "

10. p. 1294, line 14, in problem 17.3.2.12: Change “Corollary 4.1, " to “Corollary 4.1 in Section 4.5, "

11. p. 1299, line 17, in problem 17.4.1.3: Change “$tialr$ " to “∂r "

12. p. 1299, lines 19 and 20, in problem 17.4.1.4: Change
“You will explain why the diffusion problem for $0<r<\infty$, $0<z<\infty$, $0<t<\infty$ given by "
to
“Solve the diffusion problem for $0<r<\infty$, $0<z<\infty$, $0<t<\infty$ given by "

13. p. 1300, line 2, in problem 17.4.1.4: Change

$$c(r,z,t) = \int_0^\infty J_0(kr)\,\Big(1-e^{-Dk^2t}\Big)\sinh(kz)\,F(k)\,k\,dk\,. \tag{17.61}$$

to

$$c(r,z,t) = \int_0^\infty\!\!\left(-\sqrt{\frac{\pi}{2}}\,e^{-kz} + \frac{1}{4}\sqrt{\frac{\pi}{Dt}}\cdot e^{-Dk^2t}\int_0^\infty\!\Big(e^{-(z-\xi)^2/(4Dt)} - e^{-(z+\xi)^2/(4Dt)}\Big)\,e^{-k\xi}\,d\xi\right)\!F(k)J_0(rk)k\,dk. \tag{17.61}$$

14. p. 1300, line 6, in problem 17.4.1.4(a): Change “$\omega\cdot F(k)$ " to “$\omega D\cdot F(k)$ "

15. p. 1300, lines 11 through 17, in problem 17.4.1.4(c) and (d): Change

"(c) Use residues to evaluate

$$\mathcal{F}_s^{-1}\left[\frac{\omega}{\omega^2+k^2}\cdot\left(e^{-D(\omega^2+k^2)t}-1\right)\right]=\sqrt{\frac{2}{\pi}}\int_0^\infty \frac{\omega}{\omega^2+k^2}\cdot\left(e^{-D(\omega^2+k^2)t}-1\right)\sin\omega z\,d\omega\,.$$

Note that the integrand is an even function so we can replace $\int_0^\infty ...\,d\omega$ by $\frac{1}{2}\int_{-\infty}^\infty ...\,d\omega$.

(d) Finally, take the inverse Hankel transform of $\mathcal{F}_s^{-1}\left[\,C(k,\omega,t)\,\right]$ to find that

$$c(r,z,t)=\mathcal{H}_0^{-1}\left[\,\mathcal{F}_s^{-1}\left[\,c(r,z,t)\,\right]\right]\,.$$

satisfies (17.61). "

to

"(c) Assume that $\mathcal{F}^{-1}\left[\frac{\omega}{\omega^2+k^2}\right]=-\sqrt{\frac{\pi}{2}}\,e^{-kx}$. To evaluate the inverse Fourier sine transform $\mathcal{F}_s^{-1}\left[\,C(k,\omega,t)\,\right]$, separately study $\mathcal{F}_s^{-1}\left[\frac{\omega}{\omega^2+k^2}\right]$ and $\mathcal{F}_s^{-1}\left[-e^{-D(\omega^2+k^2)t}\cdot\frac{\omega}{\omega^2+k^2}\right]$.

(d) Finally, take the inverse Hankel transform of $\mathcal{H}_0^{-1}\left[\,\mathcal{F}_s^{-1}\big[\,C(k,\omega,t)\,\big]\,\right]$ to find that $c(r,z,t)$ satisfies (17.61)."

Chapter 18

1. p. 1320, line 15, in problem 18.2.3.11: Add "Assume that $\omega>0$ and $b\geq 0$ are constants. "

2. p. 1320, line 22, in problem 18.2.3.13: Change "the" to "for the"

3. p. 1330, line 12: Change "b. " to "$b\geq 0$. "

4. p. 1332, line 9: Change "ball punctured " to "punctured ball "

5. p. 1340, line 6, in problem 18.4.5.13: Change "$\begin{bmatrix} -x+y^3 \\ x^2+y \end{bmatrix}$" to "$\begin{bmatrix} -x+y^2 \\ xy+y \end{bmatrix}$"

6. p. 1340, line 8, in problem 18.4.5.14: Add "Hint: $e^{tA^T}(A^T+A)e^{tA}=\dfrac{d}{dt}\big[\,e^{tA^T}e^{tA}\,\big]$. "

7. p. 1340, line 26, in problem 18.4.5.19: Change "$\begin{bmatrix} 3x+\alpha x(x^2+y^2) \\ -3y+\alpha y(x^2+y^2) \end{bmatrix}$" to "$\begin{bmatrix} 3y+\alpha x(x^2+y^2) \\ -3x+\alpha y(x^2+y^2) \end{bmatrix}$"

8. p. 1343, line 24, in problem 18.5.2.4: Change "definite." to "definite and has $g(0)=0$."

9. p. 1344, line 4, in problem 18.5.2.6: Change "k is an unspecified positive constant." to "k and b are unspecified positive constants."

10. p. 1353, in problem 18.6.5.5: Change "$\dot{h}(t)>0$ at all t unless $\boldsymbol{\nabla} f\big(x(t),y(t)\big)\equiv\mathbf{0}$" to "$\dot{h}(t)>0$ unless $\boldsymbol{\nabla} f\big(x(t),y(t)\big)\equiv\mathbf{0}$"

11. p. 1354, in problem 18.6.5.9: Change "$0.01x$" to "x"

12. p. 1354, lines 14 and 17, in problem 18.6.5.10: Change "$\overline{\mathcal{D}}$ " to "$\widetilde{\mathcal{D}}$ "

13. p. 1354, in problem 18.6.5.14: Change "b varies. " to "b varies, where $-\infty < b < \infty$. "

14. p. 1361, line 4: Change "$x(t; t_1, \mathbf{x}_1)$ " to "$\mathbf{x}(t; t_1, \mathbf{x}_1)$ "

15. p. 1361, line 5: Change "$< \delta$. " to "$< \delta$, along with the IC $Y(t_1) = I$. "

16. p. 1363, bottom line, in problem 18.7.2.8: Change "A " to "$A(t)$ "

17. p. 1364, line 4, in problem 18.7.2.9: Change "IVP $\mathbf{x}$ " to "IVP $\dot{\mathbf{x}}$ "
and change "$\begin{bmatrix} 0 & 1 \\ -\lambda & 1 \end{bmatrix}$ " to "$\begin{bmatrix} 0 & 1 \\ -\lambda & 0 \end{bmatrix}$ "

18. p. 1364, line 12, in problem 18.7.2.10: Change "$\mathbf{z}$ " to "z "

Index

1. p. 1411, in "Exactness Criterion" reference: Change "492 " to "493 "